EDE009-b

Neuroradiology Case of the Day

Education Exhibits

Location: NA

Participants

Moderator
Thiru A.P. Sudarshan DMRD, FRCR Nothing to Disclose
Avinash K. Kanodia MD : Nothing to Disclose
Matthew John Budak MD, FRCR : Nothing to Disclose
Jonathan Weir-McCall MBBCh, FRCR : Nothing to Disclose

EDE100

Image Interpretation Exhibit in Digital Format

Education Exhibits

Location: NA

Participants

Jeffrey C. Weinreb MD : Nothing to Disclose

TEACHING POINTS

This is the companion electronic exhibit to the Image Interpretation Session, scheduled for Sunday, November 30, 4:00 - 5:45 pm, in Arie Crown Theater. Several of the case histories to be discussed in the Sunday session will be on display electronically beginning Sunday at 8:00 am. After the session concludes, the accompanying discussion for each case will be revealed. The exhibit will remain on display for self-study until 12:30 pm, Friday, December 5.

The learning objectives for this presentation are: 1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.

MSE003-b

The Great Pretender—How Sarcoidosis Gained Its Reputation as the Mimic of Other Pathology

Education Exhibits

Location: MS Community, Learning Center

Participants

Thomas Robert Semple MBBS, BSC (Presenter): Nothing to Disclose
Susan Jane Buckingham MBChB : Nothing to Disclose

TEACHING POINTS

The aim of this exhibit is to
1. Review the pathophysiology of sarcoidosis
2. Demonstrate the typical radiological features of sarcoid within the chest, abdomen and central nervous system
3. Share some particularly good cases of sarcoid mimicking other conditions and the key features that suggest sarcoid could be the underlying cause

TABLE OF CONTENTS/OUTLINE

The Pathophysiology of Sarcoidosis

Typical Radiological Features (radiography, CT, MRI)
- Chest
- Abdomen
- Central Nervous System

Sarcoid as mimic of other pathology - illustrative cases and tell tale signs all is not what it seems
(Including, amongst others, cases of sarcoid masquerading as metastatic bowel cancer (granulomatous colitis with necrotic lymphadenopathy and multiple pulmonary lesions) and mimicking high grade lymphoma with extensive bone marrow involvement (lymphadenopathy and diffuse bone FDG avidity on PET-CT). All cases presented were subsequently biopsy proven to represent sarcoidosis)

Summary

NRE001-b
Bright Tongue Sign: A Potentially Intriguing "Neural Health" Biomarker in Neurodegenerative Disease

Education Exhibits
Location: NR Community, Learning Center

Participants
Karen Lynch : Nothing to Disclose
Peter G. Hildenbrand MD : Nothing to Disclose
James Russell DO : Nothing to Disclose
Adam Fang MD (Presenter): Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To bring to radiologists' attention the pathological changes of midline fatty infiltration of the tongue due to amyotrophic lateral sclerosis (ALS) that create the imaging appearances on T1-weighted MR imaging. 2. To demonstrate how the "bright tongue sign" and tongue metrics may assist in the diagnosis of neurodegenerative disease.

TABLE OF CONTENTS/OUTLINE
Anatomy of the tongue - Muscles - Nerve innervation Pathologic changes in the tongue in patients with Amyotrophic Lateral Sclerosis (ALS) - Denervation - Muscle atrophy of the tongue Appearance of the tongue in patients with ALS - Bright tongue - Tongue atrophy, dental gap Clinical Significance - The tongue is a large muscle frequently seen on MR imaging of the brain and cervical spine. - May indirectly aid in confirming the diagnosis of ALS.

Status Epilepticus and Periictal MRI Imaging

Education Exhibits
Location: NR Community, Learning Center

Participants
Hana Malikova MD (Presenter): Nothing to Disclose
Jiri Weichet MD : Nothing to Disclose

TEACHING POINTS
Status epilepticus (SE) is a seizure that persists for a sufficient length of time or is repeated frequently enough that recovery between attacks does not occur. It represents persistent neuronal firing and the release of excess glutamate, which activates postsynaptic NMDA receptors and triggers receptor-mediated calcium influx and initiates the vicious cycle of self-sustained seizure, which may result in cell death. Mortality of SE is up to 5-10%. SE might occur as a consequence of chronic known epilepsy (1/3); as a new onset of epilepsy (1/3) and as a complication of acute encephalopathy (1/3). MRI provides new opportunities for identifying early seizure neuronal damage (cytotoxic and vasogenic edema) often in typical localization (mesial temporal structures, thalamus and cerebral cortex) and if is a useful imaging technique to find out causes of SE.

TABLE OF CONTENTS/OUTLINE
1. Etiology and pathophysiology of SE 2. Examples of MRI periictal reversible and irreversible damage in non-lethal and lethal cases 3. Mixed MRI detectable pathology - periictal damages and imaging of causes of SE 4. Irreversible late changes after SE in surviving cases on MRI 5. Conclusion: MRI plays an important role not only in diagnosis of periictal neuronal damage, but also in identifying of causes of SE especially potentially treatable ones

Acquired Toxic and Metabolic Encephalopathies: Imaging Findings and Clinical Correlation

Education Exhibits
Location: NR Community, Learning Center

Participants
Seul Kee Kim (Presenter): Nothing to Disclose
Woong Yoon MD : Nothing to Disclose
Heoung-Keun Kang MD : Nothing to Disclose
Tae Wook Heo : Nothing to Disclose

TEACHING POINTS
1. To overview radiologic findings of toxic and metabolic encephalopathies 2. To explain the anatomy and physiology of the basal ganglia and thalami 3. To explain the utility of correlation between radiologic findings with clinical features, which will help in correctly indentifying the cause of encephalopathy

TABLE OF CONTENTS/OUTLINE
Anatomy and physiology of the basal ganglia and thalami Review of imaging findings and clinical correlation - Metabolic encephalopathy - Toxic encephalopathy Differential diagnosis of basal ganglia and thalami lesions Summary

Transcranial Ultrasound in Parkinson’s Disease: A Practical “How to” and “What to Do about It” Guide

Education Exhibits
Location: NR Community, Learning Center

Participants
TEACHING POINTS

1. To review the indications for Transcranial Ultrasound in Parkinson's Disease (PD). 2. To describe the technique and imaging protocol of Transcranial ultrasound. 3. To illustrate the imaging findings in PD that support diagnosis and helps differentiating from other movement disorders.

TABLE OF CONTENTS/OUTLINE


NRE005-b

Focal Cortical Dysplasia in Pharmacoresistant Pediatric Epilepsy: A Review of Advanced Imaging Techniques within a Multimodality Approach

Education Exhibits
Location: NR Community, Learning Center

Participants
Andrew Kenneth Nash MD (Presenter): Nothing to Disclose

TEACHING POINTS

The exhibit’s purposes are: 1. To review imaging findings of focal cortical dysplasia, with emphasis on subtle or MRI-occult cases in children. 2. To review best practices in working up pediatric epilepsy from an imaging standpoint. This includes emphasizing the importance of working closely with clinical colleagues to appropriately correlate imaging findings. 3. To review available advanced imaging techniques; examining when and how to use these tools properly. 4. To identify current treatment options and related imaging findings.

TABLE OF CONTENTS/OUTLINE

Imaging Findings Cortical symmetry, thickness, signal Transmantle sign Best Practices Correlating semiology, EEG; communicating with clinicians MRI-equipment, sequence protocols Advanced Imaging Techniques When and how to employ MEG, fMRI, PET/MR, SPECT, ASL, DTI Treatment Resective and palliative surgery Minimally invasive techniques, e.g. MRI guided laser ablation therapy

NRE006-b

Scan Reading Assisted by a 3D Atlas of the Brain, Head and Neck

Education Exhibits
Location: NR Community, Learning Center

Participants

Wieslaw Lucjan Nowinski PhD (Presenter): Nothing to Disclose
Beng Choon Chua : Nothing to Disclose
Vincent Wing Seng Ngai : Nothing to Disclose
Su Hnin Wut Yi : Nothing to Disclose
Than Shoon Let Thaung : Nothing to Disclose
Yili Yang : Nothing to Disclose
Andrzej Urbanik MD : Nothing to Disclose
Patrick James Peller MD : Speakers Bureau, General Electric Company

TEACHING POINTS

To demonstrate the use of a brain, head and neck atlas in scan reading for structure localization and naming. To identify structures not visible in typical scans, such as deep and brainstem nuclei, tracts, vessels and cranial nerves. To provide 2D-3D relationships. To understand the brain, head and neck anatomy in 3D.

TABLE OF CONTENTS/OUTLINE

Despite tremendous advancements in diagnostic imaging, scan reading remains challenging because of data explosion and insufficient details in typical scans. To deal with these problems, we created an atlas with a virtual brain, head and neck parcellated into about 3,000 components. The virtual brain contains the cerebrum (with the cortex subdivided into lobes, gyri and sulci), cerebellum, brainstem, spinal cord, gray matter nuclei, ventricular system, white matter, arterial system, venous system, white matter tracts, cranial nerves with nuclei, and visual system. The virtual head comprises head muscles, glands, skull, extracranial vessels and skin. The virtual neck contains cervical vertebrae, neck vessels and pharyngeal muscles. An application is developed mapping the atlas on a scan, and providing functions for image interpretation as well as 3D display and exploration. The atlas is presented in 4 views: 3D with scan triplanar, and axial, coronal and sagittal views with the atlas superimposed as contours.

NRE007-b

High SI on DWI, Is It Really Acute Infarction?; High DWI Lesion, Mimicking Acute Cerebral Infarction (ACI)
**TEACHING POINTS**

1. Diffusion-weighted imaging (DWI) has been used as a rapid and useful diagnostic tool for detection of acute cerebral infarction (ACI) which shows high signal intensity (SI). 2. But in some cases, high signal intensity on DWI does not always indicate the ACI. We will present many diseases that show high SI on DWI, mimics ACI and suggesting differential clues.

**TABLE OF CONTENTS/OUTLINE**


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**Ocular Movements: More than Meets the Eye**

**TEACHING POINTS**

1. Revisit the functional pathways that control eye movements 2. Identify them on cross-sectional brain MR images 3. Discuss effects of lesion location, laterality and hemispheric dominance on deficits and recoverability

**TABLE OF CONTENTS/OUTLINE**

The precise, symmetric and synchronous movements of the eyes is accomplished by perfect coordination of six sets of extracocular muscles controlled by three pairs of cranial nerves. Voluntary focusing of the eye to search the environment and maintain clear view of stationary or moving objects, near or far, is meticulously controlled by centers in the frontal and parietal lobes, brainstem, cerebellum, and upper spinal cord. Maintenance of clear images during head movement brings about vestibular influences and oculoc reflex pathways as well. The extent to which injury to nuclear and supranuclear structures can impair eye movements depends on lesion location, laterality, and hemispheric dominance. Knowledge of these substrates and their location on cross-sectional imaging can be useful in guiding search patterns and in clinico-radiological correlation. In this exhibit, functional pathways which control eye movements are identified on cross-sectional MRI and correlated with function, deficits, and recoverability.

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**Pathology Enhanced MRI: Unveiling the Hidden Cranial Nerves**

**TEACHING POINTS**

1. Cranial nerve anatomy is complex. Proper evaluation of patients with cranial neuropathies requires good knowledge of the course of these small frequently indistinct structures 2. Etiologies of cranial neuropathies are diverse, and pathology often cause enhanced depiction of cranial nerve course on MRI 3. Cranial nerves can serve as tumoral dissemination routes (leukemia, metastatic disease) 4. Common primary malignancies of peripheral nerves include nerve sheath tumors, glomus jugulare tumors and meningiomas 5. Inflammatory/autoimmune/infectious processes involving cranial nerves include sarcoidosis, herpes simplex and multiple sclerosis

**TABLE OF CONTENTS/OUTLINE**

1. To review the course of cranial nerves using pathology to enhance depiction of their complex courses on MRI 2. To review multiple etiologies of cranial neuropathies a. Their MRI features b. Their management and follow up 3. To present a checklist of specific segments that must be scrutinized in the evaluation of each cranial nerve.
NRE010-b
Common and Uncommon MR Imaging Spectrum in Craniopharyngioma: Radiopathologic Correlation

Education Exhibits
Location: NR Community, Learning Center

Participants
Nidhin Hafeez MBBS (Presenter): Nothing to Disclose
Kanchan Gupta MD : Nothing to Disclose
Sunita P Kumaran MBBS, MD : Nothing to Disclose
Sanjaya Viswamitra MD : Nothing to Disclose
Nandita Ghosal MD : Nothing to Disclose

TEACHING POINTS
• MRI - non-invasive, accurate modality to diagnose and assess craniopharyngioma - differentiates histological subtypes of craniopharyngioma • Helps in deciding surgical approach • Preferred modality for post-op follow up

TABLE OF CONTENTS/OUTLINE
Retrospective study of MRI of 102 histologically proven craniopharyngiomas [Feb'10-Mar'12] revealed spectrum of imaging and histopathological findings, 89 adamantinomatous, 12 papillary and 1 melanotic - rare variant noted. Aged 4-60yrs: Mean±SD: 25±18. Adamantinomatous were large, lobulated, predominantly cystic with solid components, calcification, infiltrative, hyperintense T1,T2, FLAIR, peripheral/hetero/nodular enhancement, ADC (1.1-3.4x10^-3mm/s), peripheral, mixed enhancing with ADC (1.1-3.4x10^-3mm/s), no recurrence and good prognosis. This exhibit illustrates spectrum of MRI features of craniopharyngioma which helps in correct radiological diagnosis of histological subtypes. Knowledge of clinical, MR imaging and histopathologic spectrum aids in differentiation of this neoplasm since prognosis and therapeutic options differ.

NRE011-b
Unusual Meningeal Masses; MR and Pathologic Correlation

Education Exhibits
Location: NR Community, Learning Center

Participants
Sunghwan Cho (Presenter): Nothing to Disclose
In Kyu Yu : Nothing to Disclose
Youn Joo Lee MD : Nothing to Disclose
Hee Kyung Kim : Nothing to Disclose

TEACHING POINTS
Sometimes there are intraaxial-looking masses, which are turned out to be meningeal mass, whereas there are conventional meningeoma-looking masses, which are turned out to be unusual meningeal lesions. To discuss MR and pathological features of these intraaxial-looking meningeal masses and conventional meningeoma-looking unusual meningeal lesions. Unusual meningeal masses are often misdiagnosed as being malignant intraaxial masses or conventional meningeoma or even extracerebral hematoma because of their various mimicking features. To understand the clinical, MR and pathological features of them help the accurate diagnosis and the appropriate treatment.

TABLE OF CONTENTS/OUTLINE

NRE012-b
Venous Anatomy of the Skull Base: What the Surgeon Needs to Know

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics

Participants
Pattana Wangaryattawanich MD (Presenter): Nothing to Disclose
Lakshmi Chavali BS : Nothing to Disclose
Ashok J. Kumar MD : Nothing to Disclose
Jill Vanessa Hunter MD : Author with royalties, UpToDate, Inc
L. Anne Hayman MD : Founder, Anatom-e XRT Information Systems, Ltd

TEACHING POINTS
Skull base surgery which sacrifices a major venous pathway can result in postoperative venous infarction of the inferior temporal lobe and/or cerebellum. Preoperative planning can identify the venous structures at risk and prompt the surgeon to modify his approach.

TABLE OF CONTENTS/OUTLINE
A deformable anatomic template (DAT) of the venous pathways has been developed which can be embedded into the patient's preoperative thin section contrast images. It provides the expected normal location of the venous pathways. Each venous...
structure label can be activated to show text concerning the anatomic variations of all of the veins in the skull base region. If needed, the DAT can be deformed in 3 dimensions to simulate displacement by tumor. All of this information is available in standard axial planes and in conformal reconstructed views. Since the patient's images are labeled, it is possible to evaluate the tumor and the venous drainage in one data set. The relevant literature is summarized for each specific skull base surgery.

**NRE013-b**

**Predicting the Spread of Glial Tumors: Insights from the Prefrontal Cortex (BA 10)**

*Education Exhibits*

*Location: NR Community, Learning Center*

*Certificate of Merit*

**Participants**

- Lakshmi Chavali BS (Presenter): Nothing to Disclose
- Pattana Wangaryattawanich MD: Nothing to Disclose
- Mohammed R. Kaleel MD: Nothing to Disclose
- Sujit Prabhu MD: Nothing to Disclose
- Ashok J. Kumar MD: Nothing to Disclose
- L. Anne Hayman MD: Founder, Anatom-e XRT Information Systems, Ltd

**TEACHING POINTS**

To describe the common spread pattern behavior of gliomas of the anterior prefrontal cortex using confocal reconstructions of MR images and Brodmann nomenclature.

**TABLE OF CONTENTS/OUTLINE**

- Eighteen diffuse gliomas cases (Brodmann area [BA] 10) involving the prefrontal cortex and 4 cases involving the sub-genual cortex (BA 25) were retrospectively analyzed. The anterior prefrontal cortex spread pattern follows the white matter pathways. Also noted in latter, 5 cases presented with growth of a callosal tumor which caused herniation through the weak callosal isthmus. Prefrontal cortex can be reached by the spread from orbitiofrontal, sub-genual, and through the septal veins causing a late tumor spread posterior into the ventricle. Each of these functional and neurosurgical importance will be discussed. In summary, anterior prefrontal cortex gliomas spread via white matter tracts in predictable patterns with clinical ramifications.

**NRE014-b**

**MRI Findings of Secondary Neuronal Degeneration**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Bo Young Jeong (Presenter): Nothing to Disclose
- Eun Ja Lee: Nothing to Disclose
- Eun Kyoung Lee: Nothing to Disclose
- Dae Bong Kim MD: Nothing to Disclose

**TEACHING POINTS**

1. To review classification of secondary neuronal degeneration
2. To review diagrams of neuronal pathway
3. To explain the utility of MRI and particularly diffusion-weighted imaging (DWI) in the diagnosis

**TABLE OF CONTENTS/OUTLINE**

1. General overview and classification of secondary neuronal degeneration
2. Review of neuronal pathway diagrams and MRI findings
   - Corticospinal tract
   - Corticopontocerebellar tract
   - Limbic system
   - Dento-rubro-olivary pathway (Guillain-Mollaret triangle)
   - Corticothalamic connection
   - Corpus callosum
3. Summary and conclusion

**NRE015-b**

**Workup of Thyroid Nodules: A Practical Algorithm and Review of Guidelines**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Adam Andrew Dmytriw MD, MSc (Presenter): Nothing to Disclose
- Eugene Yu MD, FRCPC: Nothing to Disclose
- Reza Forghani MD, PhD: Nothing to Disclose
- Colin S. Poon MD, PhD: Nothing to Disclose
TEACHING POINTS

The purpose of the exhibit is:
1. To review imaging features of thyroid nodules on different imaging modalities, with correlation to their predictive values for benignity and malignancy.
2. To review current evidence-based guidelines for initial workup and follow-up of thyroid nodules.
3. To present a practical diagnostic algorithm that summarizes the current guidelines from various organizations.

TABLE OF CONTENTS/OUTLINE

- Relevance of Clinical History and Endocrine Profile for Thyroid Nodule Workup
- Key Features of Benign Nodules
- Key Features of Malignant Nodules
- Predictive Values of Imaging Characteristics
- Algorithm for Radiological Management of Thyroid Nodules, Including Follow-Up and Fine Needle Aspiration and Decision Flow Chart Based on Summary of Recommendations from Various Guidelines

NRE017-b

Imaging Evaluation of Sensorineural Hearing Loss: Critical Aspects That Radiologists Should Know

Education Exhibits
Location: NR Community, Learning Center

Participants
Sun Huh MD (Presenter): Nothing to Disclose
Hyun-Sook Hong MD, PhD : Nothing to Disclose
Ji Sang Park : Nothing to Disclose
Sun Hye Jeong MD : Nothing to Disclose
Jae Myeong Lee : Nothing to Disclose
Heon Lee : Nothing to Disclose

TEACHING POINTS

- Review the embryology of the inner ear and understand the components of the auditory neural pathway.
- Review the imaging and clinical evaluation of children with sensorineural hearing loss (SNHL) with an emphasis on critical aspects that radiologists should know.
- Discuss the classification of congenital inner ear malformation and non-syndromic or syndromic causes of congenital SNHL, and acquired causes of SNHL.

TABLE OF CONTENTS/OUTLINE

Each topic below will be discussed and illustrated: 1. Introduction 2. Embryology of the inner ear and components of auditory neural pathways 3. Anomalies of the inner ear, IAC, and cochlear foramen A. Differentiation of the inner ear from the otic placode B. Large endolymphatic sac anomaly: enlarged vestibular aqueduct syndrome C. Vestibular dysplasia D. Semicircular canal dysplasia E. Small internal auditory canal F. Stenosis of cochlear aperture 4. Syndromic sensorineural hearing loss A. Pendred syndrome B. Brachio-oto-renal (BOR) syndrome C. Waardenburg syndrome D. X-linked deafness with stapes gusher E. CHARGE syndrome 5. Acquired SNHL A. Infectious labyrinthitis B. Autoimmune labyrinthitis C. Trauma

NRE018-b

Diagnostic Value of Contrast-Enhanced Fluid Attenuated Inversion Recovery Imaging

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Eun Ja Lee (Presenter): Nothing to Disclose
Bo Young Jeong : Nothing to Disclose
Eun Kyoung Lee : Nothing to Disclose
Dae Bong Kim MD : Nothing to Disclose

TEACHING POINTS

To describe the normally enhancing structures on contrast-enhanced fluid attenuated inversion recovery imaging (CE-FLAIR). To investigate the clinical utility of CE-FLAIR in various pathologic conditions of the intra and extracerebral compartment. To show distinct advantages of CE-FLAIR over CE-T1 weighted imaging (WI).

TABLE OF CONTENTS/OUTLINE


NRE019-b

MRI of Myelin Water: Principles and Applications of an Emerging Technique

Education Exhibits
Location: NR Community, Learning Center

Participants
Cornelia Laule PhD (Presenter): Nothing to Disclose
Irene M. Vavasour PhD : Nothing to Disclose
**NRE022-b**

**DWI and DTI in Spinal Cord Imaging: Technical Challenges and Developed Recent Methods**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Jin Hwa Lee MD (Presenter): Nothing to Disclose
- Dong Ho Ha: Nothing to Disclose
- Sunseob Choi MD, PhD: Nothing to Disclose

**TEACHING POINTS**

The educational objectives of this article are to describe the technical challenges and recent developed methods of DWI and DTI in spinal cord imaging.

**TABLE OF CONTENTS/OUTLINE**

1. To illustrate of technical challenging of DWI in spinal cord and vertebrae; sensitivity to magnetic field inhomogeneity, small diameter of spinal cord and lesion, lack of discernible pattern, partial volume averaging, bulk physiologic motion about the spinal cord.
2. To illustrate technical consideration: proper image acquisition without distortion, high SNR, available scanning time, proper b-value, orientation of diffusion encoding directions, etc.
3. To describe advanced EPI based technique to overcome geometric distortion; multishot EPI, parallel imaging, reduced FOV method.

**NRE021-b**

**Got Calcium? Advances in Imaging of the Parathyroid Glands—A Pictorial Review**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Jonathan D. Kirsch MD (Presenter): Nothing to Disclose
- Mahan Mathur MD: Nothing to Disclose
- Thomas McCann MD: Nothing to Disclose

**TEACHING POINTS**

After viewing this presentation the learner should be able to: 1) Understand the embryology, anatomy, and physiology of the parathyroid glands. 2) Recognize the common pathologies involving the parathyroid glands (parathyroid adenomas, parathyroid hyperplasia, cystic parathyroid adenomas, parathyroid carcinoma, and expected findings in hyperparathyroidism and MEN syndromes). 3) Become familiar with the latest techniques used for parathyroid imaging and their interpretation: High-resolution US, 4D-CT, and Nuclear Medicine sestamibi scanning. 4) Understand the importance of preoperative imaging for hyperparathyroidism and other parathyroid disease and how it aids in the performance of minimally invasive parathyroidectomies.

**TABLE OF CONTENTS/OUTLINE**

1. Anatomy and embryology of the parathyroid glands
2. Pathophysiology of hyperparathyroidism (primary, secondary, tertiary)
3. Imaging of the parathyroid glands including techniques and pearls (Ultrasound, 4D CT, Nuc. Med)
4. Sample cases of pathology involving the parathyroid glands- what to look for and how to interpret the studies
5. Pitfalls and mimics in imaging

**NRE022-b**

**Primary Hyperparathyroidism**

*Teaching Points*

- Importance of imaging in preoperative planning, especially in relation to minimally invasive parathyroidectomies performed for primary hyperparathyroidism.
A Brief Review of Parenchymal Hematoma MRI Imaging, Physics Included!

Education Exhibits
Location: NR Community, Learning Center

Participants
Ernest John Laney MD (Presenter): Nothing to Disclose
Arthur Thomas Maydell MD : Nothing to Disclose

TEACHING POINTS
1) Multi-sequence (including SWI and component magnitude and phase) MRI based illustration of the temporal evolution of parenchymal hematoma with a simultaneous description of the related MRI physics of hematoma evolution. A quick easy to remember reference algorithm aimed for use by the "on-call" radiologist will be detailed. 2) Illustrate differences between evolving hematoma on T2 FLAIR and standard T2 sequences (including a description of the underlying physics). Historically, textbooks teach only the standard T2 appearance of parenchymal hematoma yet many institutions current stroke protocol (including the stroke protocol at Rush) utilize T2 FLAIR as opposed to standard T2. 3) A pictoral and written description of the evolutionary changes of parenchymal hematoma including the underlying MRI physics as seen on SWI and its component phase and magnitude images.

TABLE OF CONTENTS/OUTLINE
Review of imaging findings T1 T2 FLAIR SWI magnitude and phase images Supplemental CT images MRI physics review of each phase of hematoma evolution QR codes (online links) provided for key animations Discussion of T2 versus T2 FLAIR SWI with magnitude and phase components Imaging features at differing field strengths Discussion of current stroke MRI imaging protocols Unanswered questions and future research ideas

NRE023-b
Can You Hear Me Now? Congenital Aural Atresias and the CT Predictors of Surgical Success

Education Exhibits
Location: NR Community, Learning Center

Participants
Jerome Li-Yong Kao MD (Presenter): Nothing to Disclose
Matthew Buzzeo MD : Nothing to Disclose
Paul Dennis Campbell MD : Nothing to Disclose

TEACHING POINTS
1. To understand the spectrum and diagnostic workup of congenital aural atresias.
2. To appreciate temporal bone CT anatomy as it pertains to aural atresias and conductive hearing loss.
3. To recognize the importance of precise CT description of aural atresias for operative planning and prediction of surgical success, specifically emphasizing the Jahrsdoerfer predictive scoring system.
4. To briefly review the treatment options available for congenital aural atresias.

TABLE OF CONTENTS/OUTLINE
• Introduction to congenital aural atresias, including background and diagnostic workup • Review of pertinent external and middle ear anatomy • Description of the Jahrsdoerfer system and its ability to predict surgical success based on specific temporal bone CT findings • Demonstration of representative CT findings from sample patient cases • Brief review of treatment options, including external/middle ear reconstruction and Bone Anchored Hearing Aid implants (BAHA)

NRE024-b
Clinical Applications of Dual Energy CT in Head and Neck Imaging

Education Exhibits
Location: NR Community, Learning Center

Participants
Laleh Daftaribesheli MD (Presenter): Nothing to Disclose
Michael Steven Mayich MD, FRCPC : Nothing to Disclose
Daniel Thomas Ginat MD : Nothing to Disclose
Rajiv Gupta PhD, MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: ? To review the physical basis of dual energy CT scan ? To discuss the clinical applications of dual energy CT for the head and neck imaging ? To explain the image quality and dose considerations of the dual energy CT for the head and neck imaging

TABLE OF CONTENTS/OUTLINE
Physical basis of dual energy CT scan (DECT) Clinical application of DECT scan for the head and neck imaging Application of DECT for metal artifact reduction Head and neck vascular assessment Tumor imaging Parathyroid lesions Paranasal sinus ventilation Image quality and dose considerations Conclusion and future prospective

NRE025-b
Benign Neck Masses Showing Restricted Diffusion: What Are We Missing Out?

Education Exhibits
Location: NR Community, Learning Center

Participants
TEACHING POINTS

1. To briefly review the basic principles of diffusion weighted imaging (DWI).
2. To illustrate the conventional magnetic resonance imaging (MRI) and DWI of benign neck masses showing restricted diffusion.
3. To understand the implication of tumour histology on DWI.
4. To create awareness about these outlier entities to avoid possible errors in diagnosis.

TABLE OF CONTENTS/OUTLINE

1. Brief overview of DWI.
2. Imaging spectrum of benign neck masses showing restricted diffusion: conventional MRI and DWI.
3. Entities to be discussed:
   - Benign nerve sheath tumour
   - Paraganglioma
   - Warthin tumour
   - Meningioma
   - Solitary fibrous tumour
4. Histopathological correlation
5. Conclusion

NRE026-b
Clinicoradiological Correlation of Extraocular Eye Movement Disorders: Seeing Beneath the Surface

Education Exhibits
Location: NR Community, Learning Center
🔗 Selected for RadioGraphics

Participants
Keegan Kristin Hovis BS (Presenter): Nothing to Disclose
Yu-Ring Chang MD, PhD: Nothing to Disclose
Joshua P. Thatcher MD: Nothing to Disclose
Rachel Sobel MD: Nothing to Disclose
Akifumi Fujita MD: Nothing to Disclose
Osamu Sakai MD, PhD: Speaker, Bracco Group Speaker, KYORIN Holdings, Inc Speaker, Eisai Co, Ltd

TEACHING POINTS

Eye movement disorders may result from a broad range of etiologies involving the brain, peripheral nerves, and orbit. Thus, radiologists should be aware of patterns of eye movement restriction that may indicate a specific etiology or imaging findings so that essential diagnoses are not missed. The purpose of this exhibit is to: 1. Review the anatomy of the oculomotor system and the physiology of eye movement 2. Review various pathologies that cause oculomotor dysfunction 3. Provide a clinical correlation between imaging and patient presentation of various eye movement disorders

TABLE OF CONTENTS/OUTLINE

1. Anatomy and normal physiology of eye movement
2. Eye movement disorders
   a. Mechanical restriction: i. Trauma

NRE027-b
Imaging Considerations for Robotic Thyroidectomy: What the Thyroid Surgeon Wants to Know

Education Exhibits
Location: NR Community, Learning Center
_certificate of Merit

Participants
Semin Chong MD (Presenter): Nothing to Disclose
Kyungho Kang: Nothing to Disclose
Soo Jin Kim MD: Nothing to Disclose
Jae Seung Seo: Nothing to Disclose
Yang Soo Kim MD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the difference between conventional and robotic thyroidectomy 2. To suggest and discuss the imaging considerations which the thyroid surgeon wants to know before robotic thyroidectomy

TABLE OF CONTENTS/OUTLINE

What’s robotic thyroidectomy - The difference from conventional thyroidectomy New imaging considerations before robotic thyroidectomy - What the thyroid surgeon wants to know - General considerations 3D imaging view: thyroid (including common carotid artery, superior and inferior thyroid artery, thyroid veins) 3D volume measurement of thyroid gland and tumor: adding to 2D measurement Presence or absence of local invasion and central/lateral metastatic lymphadenopathy - Special considerations The relationship of larynx and trachea to thyroid gland The possibility of non-recurrent laryngeal nerve: aberrant right subclavian artery (arteria lusoria) The distance between Berry ligament and thyroid tumor Localization of parathyroid gland Course of thyroid artery Simulation imaging views corresponding to FOV of robotic thyroidectomy Future directions and summary

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

Mariam Hanna MD (Presenter): Nothing to Disclose  
Yang Tang MD, PhD: Nothing to Disclose

**TEACHING POINTS**

This pictorial essay presents an approach to the differential diagnosis of spinal cord lesions identified on MR imaging. We will discuss differential causes for intramedullary cord abnormalities. Topics that will be covered in the following essay include vascular supply of the spinal cord and consequences of arterial and venous compromise, vascular malformations and vascular tumors.

**TABLE OF CONTENTS/OUTLINE**

This pictorial essay presents an approach to the differential diagnosis of spinal cord lesions identified on MR imaging. The purpose of this exhibit is: To review the anatomy and pathophysiology of spinal cord arterial and venous blood supply. To discuss various etiologies of cord pathology and imaging features. Table of Contents/Outline: Anatomy and pathophysiology of cord vasculature Spinal Cord Infarction- Arteriovenous Fistula (AVF)- Arteriovenous Malformation- Discuss pathology, etiology, imaging features and example MRI cases of each. Vascular tumors- Discuss pathology, etiology, imaging features and example MRI cases for each: Hemangioblastoma, Astrocytoma, Ependymomas, and Metastatic Renal Cell Carcinoma. The major teaching points of this exhibit are: Review of vascular anatomy and how it relates to cord pathology. Key imaging features of non-traumatic spinal cord pathology. Common imaging pitfalls.

Where's the Blood? A Pictorial Review of Spinal Hemorrhage on MRI

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

Jennifer Koay MD (Presenter): Nothing to Disclose  
Jeffery Hogg MD: Nothing to Disclose

**TEACHING POINTS**

1. Review the anatomy and imaging features defining the intramedullary, epidural, subdural, and subarachnoid spaces and delineate landmarks which define these different locations.
2. Discuss the various etiologies and clinical contexts of spinal hemorrhages including trauma, postoperative complication, coagulopathy, vascular malformation, and secondary complications of hemorrhage.
3. Demonstrate the complementary nature of different imaging modalities and sequences used to analyze various spinal hemorrhages.

**TABLE OF CONTENTS/OUTLINE**

1. Anatomy: Review intramedullary, epidural, subdural, and subarachnoid anatomy. 2. Imaging and Clinical Context: Discuss and illustrate the various causes and clinical features of spinal hemorrhage including trauma, postoperative complication, coagulopathy, vascular malformation, and secondary complications of hemorrhage using CT and MR images. 3. Conclusion: The learner interacting with this educational exhibit will gain an understanding of the anatomic features which distinguish the compartmental locations of spinal hemorrhages. A solid understanding of spinal anatomy and imaging characteristics along with clinical history will help to narrow differential diagnoses, inform clinical management, and optimize patient outcomes.

Manifestations of Spine Injuries in Firefighters on MRI

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

Vetana Sein MD: Nothing to Disclose  
Susan Catherine Lee MD (Presenter): Nothing to Disclose  
Kevin R. Math MD: Nothing to Disclose  
James Eric Silberzweig MD: Nothing to Disclose

**TEACHING POINTS**

To demonstrate and characterize most common abnormalities of the spine in firefighters using primarily MRI examinations. To review the spectrum of imaging features and mechanisms of injuries sustained by urban firefighters.

**TABLE OF CONTENTS/OUTLINE**

We retrospectively evaluated 138 spine MRI examinations of urban firefighters who were referred for back pain, over the course of one year. The various injuries were tabulated. A total of 39.9% cervical, 5.0% thoracic, and 55.1% lumbar spine MRIs of firefighters from the ages of 29-65 (mean age 46.1 years) were reviewed. Of the 138 spine MRI examinations performed 95.6% demonstrated abnormalities. The most commonly seen spinal abnormalities included degenerative disc disease( disc herniation / bulge/ protrusion) in 94.2%, degenerative joint disease of the facet joints and uncovertebral joints 19.6%, and degenerative spondylolisthesis 10.1%. Degenerative changes were seen in firefighters as young as 30 and at least 9 individuals from the sample population had surgery for their symptoms. Reported mechanisms of injuries were related to carrying victims, lifting heavy fire-hoses and ladders, and occupational falls. Knowledge of early onset of degenerative change and spinal injuries in firefighters will aid in diagnosis and can offer information for management and prevention of injury in this high-risk population.
NRE031-b
Is This Cord Tumor or Non-tumorous Myelopathy?: Spinal Cord Tumor Mimicking Non-tumorous Myelopathy

Education Exhibits
Location: NR Community, Learning Center

Participants
Hee Kyung Kim (Presenter): Nothing to Disclose
In Kyu Yu: Nothing to Disclose
Youn Joo Lee MD: Nothing to Disclose
Sung Bum Cho MD: Nothing to Disclose

TEACHING POINTS

1. We occasionally encounter enhancing spinal cord lesions with difficulty for differentiation between tumorous or non-tumorous myelopathy. There are some imaging clues that can be helpful for differential diagnosis. Tumorous myelopathy usually show more cord expansion, syrinx formation, and more dense patchy enhancement, while non-tumorous myelopathy show as less cord expansion, multisegmental with skipped lesions, and usually vary or disappears on follow up MRI. With these points we may differentiate non-tumorous spinal cord lesions without invasive diagnostic biopsy.

2. In this exhibit, we will present various non-tumorous myelopathy, confirmed by clinical or surgical biopsy and suggest imaging clues, useful for differentiation from tumorous myelopathy

TABLE OF CONTENTS/OUTLINE


NRE032-b
The Use of Dual Energy CT Neck in Localizing Parathyroid Adenomas: Initial Experience

Education Exhibits
Location: NR Community, Learning Center

Participants
Ciaran F. Healy MD (Presenter): Nothing to Disclose
Cameron John Hague MD: Nothing to Disclose
Patrick Martin Vos MD: Nothing to Disclose
Pari Tiwari FRCR, FRCP: Nothing to Disclose

TEACHING POINTS

1. Review the current imaging findings in investigations of primary hyperparathyroidism caused by a parathyroid adenoma (ultrasound, MIBI and SPECT MIBI) 2. Review the enhancement and attenuation characteristics of parathyroid adenomas using IV enhanced dual energy CT Neck. 3. Review the physics behind Dual Energy CT and it’s applications in parathyroid imaging. 4. Illustrate the attenuation characteristics of pathology proven parathyroid adenoma at multiple different KeVs, and compare these differences with thyroid tissue, thyroid nodules and lymph nodes.

TABLE OF CONTENTS/OUTLINE

Background on the radiological work-up for patients being investigated for primary hyperparathyroidism including pictorial examples of ultrasound findings and more advanced nuclear medicine imaging including MIBI studies and combined MIBI SPECT images CT contrast enhanced neck in parathyroid localisation - enhancement and attenuation patterns of adenomas and how they differ from thyroid tissue, thyroid nodules and lymph node Background on Dual Energy CT, it’s physics, it’s utility and application in parathyroid imaging The utility of Dual Energy CT neck in localizing parathyroid adenomas and where it may play a future role in localizing adenomas at acceptable or even reduced radiation dose.

NRE033-b
Parry-Romberg Syndrome – Six Cases of Progressive Facial Hemiatrophy

Education Exhibits
Location: NR Community, Learning Center

Participants
Michael Wong MD (Presenter): Nothing to Disclose
C. Douglas Phillips MD: Stockholder, MedSolutions, Inc Consultant, Guerbet SA
Deborah Rachelle Shatzkes MD: Nothing to Disclose

TEACHING POINTS

To present the current understanding of etiology, pathophysiology and clinical presentation of Parry Romberg Syndrome (PRS). To familiarize the viewer with the highly variable extracranial and intracranial imaging findings in PRS.

TABLE OF CONTENTS/OUTLINE

Background Spectrum of clinical presentations Theories of underlying pathophysiology Reported extracranial and intracranial imaging findings Presentation of cross-sectional imaging findings in 6 cases
Ophthalmoplegia, Various MR Imaging Features in Brainstem and Cavernous Sinus Levels

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

Hee Kyung Kim (Presenter): Nothing to Disclose  
In Kyu Yu: Nothing to Disclose  
Youn Joo Lee MD: Nothing to Disclose  
Sung Bum Cho MD: Nothing to Disclose

**TEACHING POINTS**

1. Ophthalmoplegia is a paralysis or weakness of one or more extraocular muscles which are responsible eye movement. It may be neurogenic in brainstem, cavernous sinus levels.
2. In this exhibit, we will classify and present various cases with ophthalmoplegia at cavernous sinus and brainstem level

**TABLE OF CONTENTS/OUTLINE**

1. Brainstem level  
   a. Ischemic lesion - interneuclear ophthalmoplegia  
   b. Aneurysm - SCA aneurysm, PCA dissecting aneurysm  
   c. Metabolic lesion - Wernicke encephalopathy  
   d. Demyelinating disease  
   e. Tumor - pineal tumor - parinaud’s syndrome
2. Cavernous sinus level  

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Obstructive Sleep Apnea/Hypopnea. Imaging Evaluation with CT Measurements. Are Cephalometric and Neck Measurements Useful or Useless?

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

Jimena Ortiz MD: Nothing to Disclose  
Camilo Andres Barragan Leal MD (Presenter): Nothing to Disclose  
Julian Guevara MD, RT: Nothing to Disclose  
Sonia Bermudez MD: Nothing to Disclose  
Anibal Jose Morillo Zarate: Nothing to Disclose  
Juan Nicolas Useche MD: Nothing to Disclose

**TEACHING POINTS**

- To know the most common imaging identifiable abnormalities in the upper airway in Obstructive Sleep Apnea/Hypopnea (OSA/H).  
- To know the different measurements in the upper airway CT for the evaluation of (OSA/H).  
- To compare these measurements between patients referred for sleep apnea evaluation and asymptomatic subjects in Colombian population.

**TABLE OF CONTENTS/OUTLINE**

1. OSA/H Definition  
2. Causes  
3. CT findings  
   a. Cephalometric and neck measurements  
   b. Measurement differences between patients with OSA/H and asymptomatic subjects in our institution  
4. Results  
5. Conclusions

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4D Brain CT Perfusion Illustration of Early Spontaneous Thrombolysis and Recanalization of Complete Acute Internal Carotid Artery and Middle Cerebral Artery Occlusion: More than Just a Clinical Reminder

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

Gary Xin Gong MD, PhD (Presenter): Nothing to Disclose  
Haiyan Wang MD: Nothing to Disclose  
Martin Austr MD: Nothing to Disclose

**TEACHING POINTS**

1. Spontaneous recanalization of thromboembolic vascular occlusions is common in stroke patients. The rate of spontaneous recanalization is 5%-30% with most of the reports of intracranial vascular occlusion. Spontaneous thrombolysis after occlusion of the extracranial carotid may occur just as frequently. 4D CT perfusion exam offers fast and accurate hemodynamic evaluations of the vascular anatomy and possibly associated brain infarction or ischemic penumbra. This review adds help in recognizing this entity. Little is known about the mechanism, natural course, and the long-term clinical outcome of the observed spontaneous recanalization of internal carotid artery occlusion. Such background literatures were reviewed through this case exhibit which can spike future interest in collecting and analyzing those cases for better stroke management. 3. This review illustrates the importance of routine imaging follow ups after the diagnosis of complete occlusion of internal carotid artery by using noninvasive carotid Doppler ultrasound or CTA, even after the spontaneous recanalization.

**TABLE OF CONTENTS/OUTLINE**

Pathophysiology of therapeutic and spontaneous thrombolysis. Review of imaging findings, diagnostic pitfalls, and 4D CT brain perfusion techniques. Literature review and proposed mechanism Future directions and summary

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The Vertebral Arteries: A Review of Embryology and Variant Anatomy
The Vertebral Arteries: A Review of Embryology and Variant Anatomy

Education Exhibits
Location: NR Community, Learning Center

Participants
David Chiao MD, MPH (Presenter): Nothing to Disclose
Max Wintermark MD: Research Grant, General Electric Company Research Grant, Koninklijke Philips NV

TEACHING POINTS
After reviewing this educational exhibit, the learner will:
1. Have a basic knowledge of the embryology of the vertebral arteries
2. Understand the embryologic basis of variant anatomy
3. Recognize the imaging appearance of common anatomic variants as well as their clinical significance

TABLE OF CONTENTS/OUTLINE
Introduction
Embryology
Epidemiology of Variant Anatomy
Imaging Findings of Common Variants
- Persistent Trigeminal Artery
- Persistent Otic Artery
- Persistent Hypoglossal Artery
- Proatlantal Intersegmental Artery
- Vertebral Artery Fenestration

Conclusion

NRE038-b
The Cavernous Sinus and Its Tributaries: Demonstration of Imaging Anatomy and Clinical Implication for Endovascular Treatment

Education Exhibits
Location: NR Community, Learning Center

Participants
Shuichi Tanoue MD (Presenter): Nothing to Disclose
Hiro Kiyosue MD: Nothing to Disclose
Yuzo Hori MD: Nothing to Disclose
Mika Okahara MD: Nothing to Disclose
Yoshiko Sagara MD: Nothing to Disclose
Hiromu Mori MD: Nothing to Disclose

TEACHING POINTS
The teaching points of this exhibit are:
1. The functional and imaging anatomy of cavernous sinus and its tributaries
2. The angiographic findings of vascular lesions involving cavernous sinus
3. The endovascular treatments for vascular lesions involving cavernous sinus and its tributaries

TABLE OF CONTENTS/OUTLINE
Contents
A. Functional anatomy of cavernous sinus (CS) and its tributaries including superficial middle cerebral vein, uncal vein and preptontine bridging vein Normal anatomy and variations Embryology in reference to the anatomical variations B. Imaging appearance of CS and its tributaries in normal and pathologic conditions Normal angioarchitectures and variations in CT, MRI and angiography Imaging findings of pathological conditions C. Endovascular treatment Endovascular treatment for CS dural arterovenous fistula or other arterovenous fistula involving the tributaries of CS with focusing on the angioarchitectures

NRE040-b
Imaging of Strangulation in Forensic Cases

Education Exhibits
Location: NR Community, Learning Center

Participants
Dominic Gascho (Presenter): Nothing to Disclose
Sabine Franckenberg MD: Nothing to Disclose
Steffen Ross MD: Nothing to Disclose
Lukas Ebner MD: Nothing to Disclose
Garyfalla Ampanozi MD: Nothing to Disclose
Thomas D. Ruder MD: Nothing to Disclose
Wolf Schweitzer MD: Nothing to Disclose
Patrick Laberke: Nothing to Disclose
Michael J. Thali MD: Nothing to Disclose
Patricia Mildred Flach MD: Nothing to Disclose
TEACHING POINTS

Teaching points: • Optimal magnetic resonance (MR) protocol for postmortem strangulation cases • The audience will learn about typical findings on computed tomography (CT) and MR in strangulation • Forensic aspects of strangulation will be elaborated • Pitfalls and pearls in imaging of strangulation cases

TABLE OF CONTENTS/OUTLINE

Table of content: • Introduction on postmortem imaging and state-of-the-art in forensic radiology • Review of literature on CT and MR in surviving victims and postmortem cases • Review of typical findings in younger and elderly deceased cases in strangulation • Methods - Potential postmortem neck MR protocol and CT imaging • Educational image based display of the pitfalls and pearls in strangulation cases • Discussion of the forensic relevance and implication for surviving victims and clinical imaging in assault victims • Case-based review of postmortem cases (scanned on a 3 T) displaying the above reviewed imaging features in correlation to autopsy with macroscopic specimen

NRE041-b

Contribution of F18-FDG-PET/CT and MRI to the Diagnosis of Perineural Extension in Head and Neck Malignancies

Education Exhibits
Location: NR Community, Learning Center

Participants
Samy Ammari (Presenter): Nothing to Disclose
Laurent Dercle MD : Nothing to Disclose
Stephane Temam : Nothing to Disclose
Pierre Blanchard : Nothing to Disclose
Martin Schlumberger : Nothing to Disclose
Clarisse Dromain MD : Nothing to Disclose
Jean Lumbrasco MD : Nothing to Disclose
Francois Bidault : Nothing to Disclose

TEACHING POINTS

• Perineural spread is frequent • An optimal protocol is required

TABLE OF CONTENTS/OUTLINE

Introduction Head and neck cancer frequently spread along peripheral nerves. It most commonly involves the trigeminal (V) and the facial (VII) nerves, the rotondum (V2) and ovale (V3) foramen. Its frequency is variable (depending on tumor histologic type and location). Its diagnosis is crucial because it bears a poor prognosis (survival, local recurrence and metastasis) and warrants treatment adaptation. Teaching points The radiologic signs are an enlargement of the foramen or of cranial nerves associated with either a contrast enhancement asymmetry (MRI and CT-scan) or a hypermetabolism (FDG-PET/CT). Imaging and analysis must systematically include a coronal reconstruction (V2 and V3) and the imaging of the cavernous sinus. On MRI, a T1-weighted sequence with gadolinium chelate injection and suppression of fat signal is required. The primary advantage of a dedicated Head and Neck PET/CT protocol over the whole body acquisition is in the detection of small lymph node metastases. A baseline imaging after surgery and/or radiotherapy is particularly useful for the follow-up. Conclusions In head and neck cancer, the presence or absence of « extra-cranial » perineural extension should always be reported and an optimal protocol is required.

NRE100

“Dual Energy CT” - A Boon to Clinical Advances in Neuroimaging

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Vrushali Dinesh Bachhav MBBS (Presenter): Nothing to Disclose
Abhijit Ashok Patil MBBS, MD : Nothing to Disclose
Sharon E. Byrd MD : Nothing to Disclose
Miral Dhanendra Jhaveri MD : Nothing to Disclose
Mark Patrick Supanich PhD : Research agreement, Siemens AG

TEACHING POINTS

• Dual energy CT can help in differentiation of Intraparenchymal hemorrhage from contrast enhancement. • Dual energy CT allows reliable differentiation between frequent blood brain barrier disruption and rare intracerebral hemorrhage immediately after endovascular recanalization therapy. • Dual energy CT helps in avoiding overestimation of SAH after peri-interventional re-bleeding. • Reduction of metallic streak artifacts arising from spinal hardware. • Reduction of radiation dose by 30-50% as compared to single energy CT.

TABLE OF CONTENTS/OUTLINE

• Siemens dual energy scanner (SOMATOM) was used for performing the dual energy scans. • Retrospective study of 50 patients with hemorrhages at different sites was performed from January 2012 to December 2013. • Patient age from 35-70 years and both sexes. • All patients underwent single energy non-contrast CT and contrast-enhanced dual- source DECT. • DECT images were post-processed with commercial software, applying a three- material decomposition algorithm for brain hemorrhage followed by obtaining iodine images and virtual non-contrast images and generating combined images that created the impression of 120 kvp images.

NRE101

4-dimensional Computerised Tomography of Larynx: Efficacy of an Automated Software Programs for Imaging and Diagnosis of Laryngeal Dysfunction

Education Exhibits
Location: NR Community, Learning Center
Laryngeal dysfunction (LD) characterized by the inappropriate closure of vocal cords during breathing is often misdiagnosed as steroid-resistant asthma. 320-slice CT larynx permits real-time viewing of laryngeal movement and may replace laryngoscopy in the LD diagnosis. An analysis algorithm has been established for quantification of LD based on a Real Time ratio of vocal cord lateral diameter to tracheal diameter (RATIOS). Manual measurements have been tediously performed at 0.35 seconds intervals of the breathing cycle and can be subject to measurement error. The aim of this exhibit is to demonstrate the efficacy of a new computing automated measurement software programme (CAMSP) installed in the workstation that aids LD diagnosis.

1. 154 adult patients with asthmatic symptoms and 46 age-matched normal individuals were recruited for 4-D dynamic CT of larynx.
2. RATIOS were obtained over the breathing cycle both manually and by CAMSP that automatically defines a centre line through the airway lumen and obtains appropriate linear dimensions and area. Bland-Altman analysis confirmed the concordance and agreement between the CAMSP and manual results. Average time required for CAMSP is 72% less compared to manual.
3. CAMSP gives more objective and reproducible results that aids the prompt diagnosis of LD.

**NRE102**

**Bright Ideas: The Physics, Advanced Techniques and Case-based Review of Restricted Diffusion**

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

- Dana Lin MD (Presenter): Nothing to Disclose
- Daniel S. Chow MD: Nothing to Disclose
- Keith Cauley MD, PhD: Nothing to Disclose
- Pallavi Sai Utukuri MD: Nothing to Disclose
- Christopher G. Filippi MD: Nothing to Disclose
- Angela Lignelli-Dipple MD: Nothing to Disclose

**TEACHING POINTS**

Diffusion-weighted MRI has become an indispensable sequence for neuroimaging and is now in widespread use. Although principally used in the evaluation of ischemic injury, other pathologies, including neoplasms, infections, and inflammatory causes, also exhibit characteristic patterns on diffusion. Additionally, new applications including fiber tractography and ADC histogram analysis are now increasingly used clinically. To better utilize diffusion imaging, radiologists must be familiar with the fundamental principles and concepts behind the imaging technique and its limitations or potential pitfalls.

The purpose of this exhibit is to provide
1) a systematic review of the physics behind diffusion imaging
2) an introduction to advanced techniques
3) a case-based review of lesions with restricted diffusion and their differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

A. Background of diffusion imaging B. Roadmap to diffusion physics Description of different types of diffusion Sequence, b-factor, ADC Artifacts that can appear on diffusion imaging C. Applications of advanced techniques (with emphasis on ADC histogram analysis and tractography) D. Case-based review of lesions with restricted diffusion and their differential diagnosis.
scan angulation to the natural line of the 7-8th CNC to reduce "broken tract" phenomenon. Increasing in-plane resolution and reducing slice thickness to improve spatial resolution and reduce partial volume effects, improving discrimination of the 7th from the 8th CN. Use of diffusion-weighted read-out segmented EPI (DW-rs-EPI) to reduce geometric distortions and susceptibility artefacts inherent in the EPI sequence.

**NRE104**

**Cine Phase Contrast CSF Flow Imaging: Basic Physics and Clinical Applications**

**Education Exhibits**

Location: NR Community, Learning Center

**Participants**

- Daniel Ariel Krieger MD (Presenter): Nothing to Disclose
- Judah Burns MD: Nothing to Disclose
- Amit M. Saindane MD: Nothing to Disclose
- Nilesh Desai MD: Nothing to Disclose
- John N. Oshinski PhD: Nothing to Disclose
- Daniel Poliak BA: Nothing to Disclose

**TEACHING POINTS**

Cine Phase Contrast imaging is used for the evaluation of CSF flow in a number of pathological states. Compared with the Time-Of-Flight angiographic technique, many trainees and practicing radiologists are less familiar with the physics of Phase Contrast imaging. Understanding the basic physics will assist practitioners in interpreting and optimizing these studies. As CSF flow imaging is performed on a relatively infrequent basis, a review of some common clinical applications and pathological findings will aid practicing radiologists in providing meaningful image interpretation.

**TABLE OF CONTENTS/OUTLINE**

- Basic Physics of cine Phase Contrast CSF Flow Imaging
- Goals of PC CSF Flow imaging
- Gradient effects on phase of flowing spins
- Gradient Moment Nulling Effects of a bipolar gradient
- VENC and Aliasing
- Directional determinates of Imaging Duration
- 2D and 3D Phase Contrast Imaging
- Image formation
- Velocity quantification
- Artifacts and imaging pitfalls
- Clinical applications
  - 1. Normal CSF Flow Study
  - 2. Chiari I Malformation
  - 3. Postoperative appearance
  - 4. Aqueductal Stenosis
  - 5. Other Uses

**NRE105**

**Clinical Impact of Iterative Model Reconstruction for CT Brain Examinations: Usefulness of Thin-Slice Images for Emergency Neuroradiology**

**Education Exhibits**

Location: NR Community, Learning Center

Certificate of Merit

**Participants**

- Takeshi Nakaura MD (Presenter): Nothing to Disclose
- Masafumi Kidoh: Nothing to Disclose
- Shinichi Tokuyasu RT: Employee, Koninklijke Philips NV
- Shouzaburou Uemura: Nothing to Disclose
- Kazunori Harada: Nothing to Disclose
- Yasuyuki Yamashita MD: Consultant, DAIICHI SANKYO Group
- Yuji Iyama MD: Nothing to Disclose
- Toshinori Hirai MD: Nothing to Disclose
- Seitaro Oda MD: Nothing to Disclose

**TEACHING POINTS**

Image noise is a serious problem in brain CT because of the requirements for good low-contrast resolution. It is difficult to achieve the low-contrast resolution and high-quality brain CT images because general CT reconstruction techniques have a tradeoff between low-contrast detectability and spatial resolution. We aim to explain the utility of iterative model reconstruction (IMR) in brain examinations in emergency neuroradiology. The major teaching points of this exhibit are: 1. IMR reduced image noise and various artifacts, and improved low-contrast detectability in brain CT especially with thin slice images. 2. IMR is a promising technique that satisfies the high demands of low contrast resolution in brain CT at emergency neuroradiology.

**TABLE OF CONTENTS/OUTLINE**

1) Technical explanation of IMR as compared with filtered back projection (FBP) reconstruction and hybrid iterative reconstruction (HIR).
2) Advantages of virtually noise free images and improvement in low-contrast detectability by IMR for low-contrast examinations as compared with FBP and HIR especially with thin slice images.
3) Clinical images reconstructed with FBP, HIR and IMR from patients with various diseases (brain infarction, hemorrhage, and traumatic injury etc.) will be displayed.

**NRE106**

**Clinical Utility of PET-MRI in Neuroradiology: Basics and Beyond**

**Education Exhibits**

Location: NR Community, Learning Center

**Participants**

- Ammar Ahmed Chaudhry MD (Presenter): Nothing to Disclose
- Maryam Gu: Nothing to Disclose
- Jared Dunkin MD: Nothing to Disclose
- Robert George Peyster MD: Nothing to Disclose
- Dinko Franceschi MD: Nothing to Disclose
- Robert Matthews MD: Nothing to Disclose
- Lev Bangiyev DO: Nothing to Disclose
- Jung Hwoon Edward Yoon MD: Nothing to Disclose
TEACHING POINTS
1. Review physical principles and techniques of PET-MRI (positron emission tomography-magnetic resonance imaging). 2. Discuss clinical utility of using functional information obtained from a PET scan and structural information obtained from MR imaging.

TABLE OF CONTENTS/OUTLINE
Outline: 1. Physical principles and techniques of PET-MRI: review image acquisition and postprocessing. 2. Utility of PET-MRI in neuro-oncology: role in initial tumor diagnosis, treatment planning and post-treatment follow-up. 3. Role of PET-MRI in evaluation of neurodegenerative and inflammatory conditions (such as Alzheimer’s, MS). 4. Pearls and Pitfalls: Common pitfalls and controversies regarding PET-MRI in neuroradiology. 5. Future of PET-MRI: Discuss current challenges facing PET-MRI in neuroradiology. Conclusion: PET-MRI is an emerging hybrid imaging modality offering detailed functional and structural imaging with promising clinical applications especially in the field of neuro-oncology, neurodegenerative and inflammatory CNS conditions. Familiarity with the technical and clinical aspects of PET-MRI along with knowledge of common pearls and pitfalls of PET-MRI will aid in better integration and relevant usage of this modality in clinical practice.

NRE108
Get on Board with the ‘Zapping Neurosurgeon’: Case Based Review of MR-guided Laser Ablation Neurosurgery with Attention to Pre-, Intra- and Post Operative Imaging Appearance

Education Exhibits
Location: NR Community, Learning Center

Participants
Elitsa Clark MD (Presenter): Nothing to Disclose
Steven Kohn MD: Nothing to Disclose
Karen S. Black MD: Nothing to Disclose
Shital Ghandi: Nothing to Disclose
Ashesh Mehta: Nothing to Disclose

TEACHING POINTS
1. To describe the technique of minimally invasive MR-guided laser ablation therapy for brain lesions performed by Neurosurgeons at our institution with emphasis on role of imaging during the procedure. These lesions would have otherwise been treated with open surgery. 2. To describe the various indications for laser ablation at our institution and in the literature. 3. To describe the expected MRI findings during and after treatment. 4. To describe potential complications that the radiologist must be aware of.

TABLE OF CONTENTS/OUTLINE
1. Technique of MR-guided laser ablation with emphasis on role of imaging, including CTA head and MRI. 2. Case Presentations from our institution each describing clinical presentation, rationale for laser ablation therapy, MR findings before, during and after therapy, patient outcome after treatment. Cases include - Epilepsy including Mesial Temporal Sclerosis - Neoplasms including Metastatic disease and Glial Neoplasms - Hypothalamic Hamartoma 3. Summary of institutional experience and literature review with respect to clinical outcomes and complications.

NRE109
Gray Matter Atrophy in Mild Cognitive Impairment (MCI) and Alzheimer’s Disease: A Voxel-based Morphometry Study

Education Exhibits
Location: NR Community, Learning Center

Participants
Naoki Kodama PhD (Presenter): Nothing to Disclose
Yasuhiro Kawase MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To describe cognitive function in patients with mild cognitive impairment (MCI). 2. To explain the voxel-based MR imaging of patients with MCI. 3. To explain the difference in gray matter atrophy of the conversion and non-conversion from MCI to Alzheimer’s disease based on 63 cases found in our hospital.

TABLE OF CONTENTS/OUTLINE
1. Appreciate MCI on brain MR images. 2. A method of voxel-based MR imaging on cases with MCI. 3. To explain the difference in gray matter atrophy of the conversion and non-conversion from MCI to Alzheimer’s disease based on 63 cases found in our hospital.

NRE110
Imaging of Salivary Gland with Novel MR Sequence: Does Double Echo Steady State with Water Excitation (DESSWE) Sequence Improve Diagnostic Interpretations?

Education Exhibits
Location: NR Community, Learning Center

Participants
Akifumi Fujita MD (Presenter): Nothing to Disclose
Hiroyuki Fujii MD: Nothing to Disclose
Karen Buch MD: Nothing to Disclose
Anna Yang: Nothing to Disclose
TEACHING POINTS

It is often difficult to visualize peripheral cranial nerves in the head and neck on conventional MRI. Furthermore, MR sialography can only depict T2 high intensity structures. The DESSWE sequence is a new MR imaging technique which can delineate the course of both peripheral cranial nerves and salivary ducts as high intensity structures in the salivary gland regions.

The purpose of this exhibit is:
1. To illustrate the normal anatomy and various pathologies of the salivary glands on a DESSWE sequence.
2. To discuss whether DESSWE sequence will provide us quality diagnostic images for augmentation of diagnostic confidence in salivary gland imaging.

TABLE OF CONTENTS/OUTLINE

1. Review the technique and utilization of DESSWE sequence in the head and neck 2. Review of imaging findings of salivary gland pathology using DESSWE - Normal anatomy of intraparotid facial nerve and salivary ducts - Inflammatory conditions: parotitis, Sjögren syndrome, sialodochitis fibrosa, sialolithiasis, etc - Tumors: benign tumors, malignant tumors, facial nerve schwannoma, lymphoepithelial cyst, etc 3. Illustrate the relationship of the intraparotid facial nerve to parotid lesions for preoperative assessment and pre-surgical planning 4. Potential future applications for additional head and neck imaging: trigeminal nerve, perineural spread

NRE111

Integrated PET-MRI for Clinical Epilepsy Patients: How We Do It

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Timothy Michael Shepherd MD, PhD (Presenter): Nothing to Disclose
Kent P. Friedman MD: Speaker, Bayer AG Spreader, Spectrum Pharmaceuticals, Inc
Christopher Giletti PhD: Employee, Siemens AG
David Duane Faul PhD: Employee, Siemens AG
Kimberly Jackson: Nothing to Disclose
Yu-Shin Ding PhD: Nothing to Disclose
Fernando Boada: Nothing to Disclose
Orrin Devinsky: Nothing to Disclose

PURPOSE

PET-MRI is a recent technologic innovation that has multiple practical advantages for patients and clinicians to obtain rapid, synergistic diagnostic workup of localization-related epilepsy, dementias and other neurologic disorders. PET-MRI also has enormous research potential. We describe our initial experiences integrating this technology into routine clinical care for patients with epilepsy.

METHOD AND MATERIALS

Over the past 18 months, we have used a 3-T PET-MRI scanner (Biograph mMR, Siemens Healthcare) for imaging 49 patients with localization-related epilepsy (mean age 34 +/- 18 yrs, range 8-70 yrs). 18F-FDG was administered at the start of the MRI protocol (mean dose 8.6 +/- 2.2 mCi) for dynamic list-mode data acquisition and posthoc creation of static images. Attenuation correction maps are derived from a Dixon MRI sequence. The MRI protocol includes multiplanar diffusion, FLAIR, T2, 3D T1 and double-inversion recovery sequences.

RESULTS

Combining PET with MRI for epilepsy workup can benefit patients, referring physicians and diagnostic radiologists. We will show multiple examples where integrated PET-MRI studies has altered diagnosis, prognosis or redirected further workup. Subtle MRI findings often have been ruled in or out based on PET concordance, with several patients going on to surgery based on new PET-MRI findings. Conversely reader PET sensitivity is increased with MRI-directed searches, particularly in the coronal plane.

CONCLUSION

Integrated PET-MRI is now the imaging modality of choice for our epilepsy program and exerts a significant impact on patient care. Due to its enormous potential, we stopped using PET-CT in September 2013 and are now using this technology in 6-10 new patients per month.

CLINICAL RELEVANCE/APPLICATION

Our initial experiences demonstrate that PET-MRI has enormous potential for clinical workup in patients with localization-related epilepsy.

NRE112

Many Faces of Intracranial Tuberculoma on 3.0 T MR Spectroscopy: A Pictorial Review

Education Exhibits
Location: NR Community, Learning Center

Participants
Ankur Shah MD (Presenter): Nothing to Disclose
Hemant Tribhovandas Patel MD: Nothing to Disclose
Drushi Vatsal Patel MBBS, MD: Nothing to Disclose
Megha Sanghvi MD: Nothing to Disclose
Mrugesh Doctor: Nothing to Disclose
Pooja Chandrakant Manavadaria MBBS: Nothing to Disclose

TEACHING POINTS
1. To know the basics of MR Spectroscopy
2. To highlight the techniques of MR spectroscopy
3. To discuss changes in the spectra in intracranial tuberculoma and their differentiation from neoplastic lesions
4. To explain the usefulness of MR spectroscopy in diagnosis, follow-up and management of tuberculoma

TABLE OF CONTENTS/OUTLINE
- Background of MR spectroscopy
- Normal MR spectrum and importance of different metabolite peak
- Technique of MR spectroscopy on 3.0 T MR
- Importance of short TE and long TE for demonstration of lipid peak
- Spectroscopy findings in intracranial tuberculoma
- Sample cases with diagnostic queries
- Differentiation of pyogenic abscess and neoplastic lesions from tuberculoma using MR spectroscopy

NRE113
Multimodal Neuroimaging of Intractable Epilepsy: A Primer and Update

Education Exhibits
Location: NR Community, Learning Center

Participants
Tomokazu Nishiguchi MD, PhD (Presenter): Nothing to Disclose
Michiharu Morino MD, PhD: Nothing to Disclose

TEACHING POINTS
- In the current ILAE classification (2010), epilepsies are not only categorized as dichotomized concepts of 'focal' or 'generalized' seizures. It is recommended that epilepsy and epilepsy syndromes are described accurately according to their semilogic features. Therefore, multimodal neuroimaging plays a pivotal role in the comprehensive evaluation of epilepsy patients. Advances enabling higher spatial resolution, tissue contrast, multiplanar imaging capability, 3D-visualization of neuronal pathways, and fusion imaging can assist with microstructural lesion detection and determination of surgical candidates. Radiologists contribute to patient care through both acknowledging the role of imaging and multidisciplinary communication, with consensus.

TABLE OF CONTENTS/OUTLINE
- An algorithmic approach to the evaluation and management of epilepsy patients.
- Illustrations of epileptogenic pathologies and syndromes: (1) hippocampal sclerosis, (2) malformations of cortical development, (3) neoplasms, (4) vascular lesions, (5) ion-channel disorders, (6) metabolic disorders, etc.
- Systematic imaging approach with STIR, 3D-T1WI, DTI, fMRI, FDG-PET, 123I-iomazenil and 99mTc-ECD SPECT, and magnetic source (MS) imaging.
- Post-processing techniques; pros/cons and diagnostic capabilities of imaging.
- Contributions of imaging to surgery.

NRE114
Multimodality Imaging Assessment of Common Neuropsychiatric Conditions

Education Exhibits
Location: NR Community, Learning Center

Participants
Eduardo Jose Ortiz MD (Presenter): Nothing to Disclose
Ana Maria Granados MD: Nothing to Disclose
Juan Felipe Orejuela Zapata BEng: Nothing to Disclose
Cesar Augusto Arango MD: Nothing to Disclose

TEACHING POINTS
- Specific findings for every psychiatric condition assessed with RS-fMRI, MRS, DTI and volumetry increase our knowledge and improve characterization of these pathologies.
- Specific patterns of activation of the DMN at rest in different neuropsychiatric conditions and healthy subjects can help us in the diagnosis and understanding of the mechanisms of disease.
- Differences in volumetric brain analysis between psychiatric patients are a reflex of the variable effects according to the pathology and regions affected.

TABLE OF CONTENTS/OUTLINE
- Introduction to multimodality imaging: fMRI, MRS, DTI and Volumetry - Materials and methods - Findings Schizophrenia - Alzheimer's disease Bipolar disorder - Morbid personality - Affective Disorder

NRE115
Neuroradiology Applications of Dual Energy CT (DECT)

Education Exhibits
Location: NR Community, Learning Center

Participants
Norbert Gilles Joseph Campeau MD (Presenter): Nothing to Disclose
Christopher J. Stevens MD: Nothing to Disclose
Alice Cheung Patton MD: Nothing to Disclose
Amy Louise Kotsenas MD: Nothing to Disclose
David R. De Lone MD: Nothing to Disclose
TEACHING POINTS

-To review the basic physical principles of DECT techniques and how these can be used to perform material decomposition and pseudo/virtual monochromatic imaging which are the principle tools used for manipulating DECT source images into clinically useful information.
-To illustrate the clinical utility of DECT in neuroradiology with current clinical examples, including virtual non-contrast imaging, bone subtracted CTA of the head/neck and CTV of the brain, evaluation of gout in the cervical spine, and depiction of edema in acute vertebral compression fractures.

TABLE OF CONTENTS/OUTLINE

Physics of Dual Energy CT (DECT)
- Radiologic behavior of materials at different x-ray energies
- Methods for performing DECT

Material Decomposition/Differentiation
- Illustrate how DECT information is processed for specific identification of material

Pseudo/Virtual Monochromatic Imaging (P/VMI)
- May be performed with image-based post processing or raw-data based processing. Can be useful to reduce metal artifacts, and accentuate tissue contrast/ iodine contrast enhancement.

Clinical Examples
- Virtual Non Contrast Imaging (hemorrhage, post-angiogram, lipiodol embolus)
- Bone subtracted head/neck CTA
- Bone subtracted dual energy CTV of the brain
- Evaluation of cervical spine involvement by gout
- Bone edema associated with acute compression fracture

NRE116

Read out, Segmented, Multi Shot Echo Planar Imaging in Spinal Cord - White Matter Tracts Better "Read out "?

Education Exhibits
Location: NR Community, Learning Center

Participants
Sanjitha Sivasubramanian MBBS, DMRD (Presenter): Nothing to Disclose
Mathew Cherian MD: Nothing to Disclose
Pankaj Mehta MD: Nothing to Disclose
Venkatesh Kasi Arunchalam MBBS, DMRD: Nothing to Disclose

TEACHING POINTS

1. Read out segmented multi shot Echo Planar Imaging is a high resolution, diffusion weighted imaging protocol which significantly reduces susceptibility and blurring artefacts . 2. Specially suited for smaller regions like spinal cord where the susceptibility artefacts tend to render the images nonreadable 3. The white matter tracts can be clearly delineated ,thus avoiding gray matter inclusion in analysing the diffusion metrics in conditions like cord compression. 4. Exact involvement of the column of the white matter tract ( anterior,posterior,central or lateral) can be ascertained, making clinical correlation feasible.

TABLE OF CONTENTS/OUTLINE

Diffusion weighted Imaging of spinal cord using 3T MRI - Pearls and pitfalls Axial vs sagittal Diffusion Tensor Imaging Susceptibility artefacts Read out ,segmented ,multi shot Echo Planar Imaging - does it help? Single shot vs Read out multi shot EPI White matter tracts 'read out' - analysis of diffusion tensor metrics more accurate

NRE119

The Current and Future of “Diffusion Tensor Imaging” for Spine; an Overview of Diffusion Tensor Imaging in Spinal Cord

Education Exhibits
Location: NR Community, Learning Center

Participants
Woo Young Kang (Presenter): Nothing to Disclose
Joon Woo Lee MD, PhD: Nothing to Disclose
Heung Sik Kang MD: Nothing to Disclose
Jinyoung Lee MD: Nothing to Disclose

TEACHING POINTS

Diffusion tensor imaging (DTI) is a promising imaging tool for evaluating the spinal cord microstructure by tracing water molecular diffusion. Our institution had diverse experiences with DTI and we would like to share our experiences. The major teaching points of this exhibit are: 1. To understand the principles and limitations of diffusion tensor imaging (DTI). 2. To describe the potential clinical applications of DTI in the assessment of the spinal cord disease.

TABLE OF CONTENTS/OUTLINE

1. The concept and principles of DTI 2. Display of DTI data; diffusion anisotropy indices and fiber tractography 3. Demonstration of clinical applications -Normal spinal cord and various pathologic conditions such as multiple sclerosis, spinal cord tumor (astrocytoma, ependymoma, hemangioblastoma), acute transverse myelitis, cervical myelopathy, spinal cord injury and postop state -Illustration of imaging findings on conventional MRI and DTI 4. Limitations of DTI in spinal cord 5. Summary and Take-home message

NRE120
The Fascinating Art and Science of Myelography: From Bygone to Modern Era

Education Exhibits
Location: NR Community, Learning Center

Participants
Nagamani Peri MD (Presenter): Nothing to Disclose
Rafael Rojas MD: Nothing to Disclose
Steve Reddy MD: Nothing to Disclose

TEACHING POINTS
1. To review the history of myelography, how the procedure was performed in the past, indications and complications
2. To review the advances in myelographic techniques including CT Myelogram and MR myelogram with examples and current practice guidelines

TABLE OF CONTENTS/OUTLINE
HISTORY OF CONVENTIONAL MYELOGRAPHY: Describe how and when myelography was performed before the advent of CT and MR, contrast agents used, indications, complications, review of literature
RECENT ADVANCES IN MYELOGRAPHY: CT AND MR MYELOGRAPHY- Description of techniques, contrast agents, indications and complications, review of literature
ACR PRACTICE GUIDELINES FOR MYELOGRAPHY
EXAMPLES OF NORMAL AND ABNORMAL MYELOGRAMS

NRE121
The Multiple Faces of Nervous System Lymphoma. Typical and Atypical MRI Features and Contribution of the Advanced Imaging

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics

Participants
Mar Jimenez De La Pena (Presenter): Nothing to Disclose
Raquel Cano Alonso: Nothing to Disclose
Antonio Maldonado MD: Nothing to Disclose
Silvia Fuertes Cabero PhD: Nothing to Disclose
Lidia Gomez Vicente: Nothing to Disclose
Teresa Maycas: Nothing to Disclose

TEACHING POINTS
1. This pictorial essay focusses on atypical MR imaging features of central nervous system lymphoma, to help radiologists to avoid a delay in the final diagnosis
2. Newer advanced imaging techniques (perfusion, spectroscopy or PET) may potentially aid in the differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Definition of primary central nervous system lymphoma
Review of conventional MR-findings: - Common and uncommon features
Atypical presentation of primary CNS lymphoma: - angiocentric lymphoma - diffuse leucoencephalopathy - spinal cord lymphoma - meningeal lymphoma
Contribution of advanced imaging: perfusion-MR; MR-spectroscopy and PET imaging.
Advanced imaging can aid in the early diagnosis of central nervous system lymphoma with atypical features. The high hypermetabolism on FDG-PET, the low cerebral volume on perfusion maps or the intermediate Choline and the high lipids peaks on spectroscopy curves of these lesions are findings that support the suspected clinical diagnosis.

NRE122
The Role of Heavily T2 Weighted 3D Sequences in CNS MR Imaging

Education Exhibits
Location: NR Community, Learning Center

Participants
Rahul Ganapati Hegde MBBS, MD (Presenter): Nothing to Disclose
Chinmay Nagesh MBBS, MD: Nothing to Disclose
Devendra Kulkarni: Nothing to Disclose
Anagha Rajeev Joshi MD, MBBS: Nothing to Disclose
Suleman Adam Merchant MD: Nothing to Disclose

TEACHING POINTS
T2 weighted 3D MRI sequences such as DRIVE, CISS produce maximal contrast between CSF and soft tissue and a three dimensional data set thereby enabling detection of fine structures. They are widely used for imaging cranial nerves in the posterior fossa but they can also be used to detect fine structures of many other entities that require a high CSF to soft tissue contrast.

Awareness of the utility of this sequence and its addition to the routine MRI protocol in certain clinical scenarios that we have discussed can be highly rewarding.

TABLE OF CONTENTS/OUTLINE
Briefly discuss the physics behind the acquisition of sequences like CISS and DRIVE. We demonstrate the utility of this sequence with a few cases covering a spectrum of etiologies- extra-axial cystic lesions like arachnoid cysts and epidermoid cysts, intra-axial cystic lesions, trigeminal neuralgia, hemifacial spasm, intraventricular lesions, aqueductal stenosis, traumatic brachial plexus injury and spontaneous CSF rhinorrhea. These cases highlight how the DRIVE/CISS sequence trumps the routine imaging sequences and aids in reaching the diagnosis. We discuss the clinical scenarios in which addition of this sequence to the MRI protocol is advisable.
"Little Brain": Evaluation of Sporadic Cerebellar Atrophy

*Education Exhibits*

Location: NR Community, Learning Center

Certificate of Merit
Selected for RadioGraphics

**Participants**

- Dasha Pechersky MD : Nothing to Disclose
- Jamel D. Reid MD (Presenter): Nothing to Disclose
- Deborah L. Reede MD : Nothing to Disclose
- Steven Pulitzer MD : Nothing to Disclose
- Wendy R. K. Smoker MD : Nothing to Disclose

**TEACHING POINTS**

1. Review the function and normal cerebellar anatomy (gross and imaging)
2. Learn the sporadic causes of cerebellar atrophy and their clinical manifestations
3. Discuss etiologies based on the location of findings in the cerebellum and other associated imaging findings

**TABLE OF CONTENTS/OUTLINE**

Cerebellar atrophy is often encountered on imaging incidentally or in the evaluation of ataxia. After a discussion of the normal anatomy and function of the cerebellum, cases are presented in a quiz format. Common sporadic causes of cerebellar atrophy, as well as their relevant clinical histories are discussed. Etiologies include alcoholic degeneration, toxicity from medications, paraneoplasia, multiple system atrophy-cerebellar predominant (MSA-C), radiation induced atrophy, gluten sensitivity, crossed cerebellar atrophy and age related atrophy. Cases are organized based on the location of cerebellar atrophy (focal vs. global) and presence of additional associated imaging findings (midbrain, cerebral hemisphere, basal ganglia, and calvarium).

NRE125

Anatomy of Intracranial Arteries and Vascular Territories: Schematic 3D Illustrations and Correlation between CT, MRI and DSA (Cerebral Angiography)

*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

- Francesco D'Argento MD (Presenter): Nothing to Disclose
- Emilano Visconti MD : Nothing to Disclose
- Andrea Maria Alexandre MD : Nothing to Disclose
- Alessandro Pedicelli MD : Nothing to Disclose
- Simona Gaudino MD : Nothing to Disclose
- Fabio Pilato : Nothing to Disclose
- Emilio Lozupone MD : Nothing to Disclose
- Cesare Colosimo MD : Nothing to Disclose

**TEACHING POINTS**

1) To review the normal anatomy of vascular territories of intracranial arteries with schematic 3D illustrations. 2) To improve the fundamental knowledge about radiologic vascular anatomy of the brain. 3) To improve the CT and MRI diagnostic report of ischemic lesions with a correct cerebral vascular anatomy correlation.

**TABLE OF CONTENTS/OUTLINE**

Normal anatomy of vascular territories and intracranial arteries: schematic 3D pictures compared to DSA, CT, MRI findings. Describe correct vascular territories in ischemic lesions. The cases will be presented in a quiz format. For each case Imaging and typical clinical neurological symptoms will be presented. The list of cases includes acute ischemic lesions of: - Internal carotid and Anterior Choroidal artery. - Anterior cerebral artery (proximal and distal branches). - Middle cerebral artery (proximal and distal branches). - Basilar trunk. - Cerebral posterior artery.

NRE126

Are You for Real? Normal Variants That Mimic Pathology on Brain CT and MR

*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

- Dasha Pechersky MD : Nothing to Disclose
- Andrew Cortes MD (Presenter): Nothing to Disclose
- Deborah L. Reede MD : Nothing to Disclose
- Steven Pulitzer MD : Nothing to Disclose
- Wendy R. K. Smoker MD : Nothing to Disclose

**TEACHING POINTS**

After viewing this module the user will be familiar with:

1. Common normal variants encountered on brain CT and MR
2. Pathologic entities that mimic these normal variants
3. Imaging features and clinical history that aid in the differential diagnosis

**TABLE OF CONTENTS/OUTLINE**
Normal variants encountered on cross sectional imaging of the brain are presented in a quiz format. Variants in the following categories and their pathologic mimics are presented: Parenchymal Variants: Virchow robin spaces (infarction; cystic tumor) and terminal myelination zones (delayed myelination; dysmyelination); Vascular Variants: Arachnoid granulations (dural venous thrombus) and jugular bulb pseudolesions including high riding jugular bulb (paraganglioma, cholesterol granuloma, schwannoma) and Osseous Variants: Asymmetric petrous apex pneumatization (cholesterol granuloma) and venous lakes/transcranial emissary veins (lytic metastasis and multiple myeloma). Imaging and relevant clinical findings that facilitate accurate interpretation are discussed.

**NRE127**

**High Resolution Imaging in Vivo of the Brainstem and Cerebellum at 7T, Focusing on Identification of Normal Anatomy, White Matter Tracts, and Nuclei**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Bernd Friedrich Dauebeler MD (Presenter): Nothing to Disclose
Val Murray Runge MD: Speaker, Bayer AG Speaker, Bracco Group
Michael Wyss: Nothing to Disclose
Mike Bruegger: Nothing to Disclose
Daniel Nanz PhD: Nothing to Disclose
Pinar Oezbay: Nothing to Disclose
Klaas P. Pruessmann: Nothing to Disclose
Spyros Sotirios Kollias MD: Nothing to Disclose

**TEACHING POINTS**

1. High resolution, heavily T1- and T2*-weighted images at 7T provide anatomic recognition of structures in the brainstem and cerebellum not previously possible on MR. Illustration of anatomical detail at 7T facilitates translation of this knowledge to 3T, with potential improvements in diagnosis and correlation of clinical symptoms.

**TABLE OF CONTENTS/OUTLINE**

Two high-resolution 3D sequences were acquired at 7T (Philips Healthcare), in the axial plane, of the brainstem and cerebellum in each of 24 volunteers, with voxel dimensions of (0.65 mm)x3. The first was a T1-weighted IR MP-RAGE scan, with TI selected to further improve gray-white matter differentiation, TR/TE/TI/flip angle = 12/5.8/850/7°, iPAT=1.5, 126 Hz BW, 2 NSA, and 15:34 min:sec scan time (this was also acquired in the sagittal plane in 8 volunteers). The second was a T2*-weighted multiecho GRE scan, with subsequent reconstruction of an R2* map. 10 echoes were acquired (TE of 5 to 50), with TR/flip angle = 60/18°, iPAT=2, 580 Hz BW, 1 NSA, and 12:52 min:sec scan time. These data sets were correlated with two anatomic atlases, Duvernoy's Atlas of the Human Brain Stem and Cerebellum and An Atlas of the Basal Ganglia, Brain Stem and Spinal Cord, Based on Myelin-Stained Material. The presentation focuses on identification of brainstem and cerebellar structures thus visualized.

**NRE128**

**Sensori-motor Functional Brain Anatomy Quiz: Test Your Knowledge**

*Education Exhibits*

*Location: NR Community, Learning Center*

* Magna Cum Laude

**Participants**

John L Ulmer: Nothing to Disclose
Andrew Paul Klein MD (Presenter): Nothing to Disclose
Leighton P. Mark MD: Nothing to Disclose
Malgorzata Franczak MD: Nothing to Disclose

**TEACHING POINTS**

1. Identify sulcal landmarks and compare the same across hemispheres to localize functional gyral anatomy of primary sensori-motor, pre-motor, supplementary motor, and secondary somato-sensory systems. 2. Localize functional deficits including basic contralateral weakness and sensory dysfunctions as well as higher order dysfunctions such as apraxia, mutism, acquired stuttering, alien hand syndrome, impaired discriminative sensations, and tactile agnosia.

**TABLE OF CONTENTS/OUTLINE**

An interactive quiz and discussion format is used to teach localization of sensori-motor functional anatomy. Multiple questions provide choices for the location functional brain substrates and associated deficits, followed by discussions of relevant brain functions and dysfunctions. Cadaver brain images and overlaid illustrations foster a 3-dimenisonal understanding of cortical functional anatomy and deficit localization. Correlative normal brain MRI promotes a 2-D understanding of sensori-motor functional brain anatomy. Imaging of selected brain lesions illustrates applications in clinical practice.

**NRE129**

**The Cerebellum**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Mariko Fitzgibbons MD (Presenter): Nothing to Disclose
Noriko Saatamon MD: Nothing to Disclose

**TEACHING POINTS**
1) A review of cerebellar anatomy and function
2) An exploration of cerebellar pathology including congenital malformations, neurodegenerative processes, and neoplasms.

**TABLE OF CONTENTS/OUTLINE**

Cerebellar anatomy
Cerebellar function
Cerebellar pathology
Congenital malformations--Chiari I malformation, Chiari II malformation, Dandy Walker malformation, Encephalocele
Neurodegenerative process--pontocerebellar hypoplasia, multisystem atrophy, spinocerebellar ataxia
Neoplasm--hemangioma, vermis metastasis

**NRE131**

Tracing the Temporoparietal Connections of the Human Brain Using High Resolution Diffusion Tensor Tractography

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

- Arash Kamali MD (Presenter): Nothing to Disclose
- Siva Prasad Jasti: Nothing to Disclose
- ranjitha kancherla MD: Nothing to Disclose
- Pavan Adapa MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review the anatomy of the temporoparietal white matter pathways. 2. To discuss the relationship of these connections to major adjacent fiber tracts. 3. To explain the utility of MRI and particularly diffusion tensor tractography in visualizing delicate white matter pathways of the brain.

**TABLE OF CONTENTS/OUTLINE**

Anatomy of the major temporo-parietal fiber bundles. Cortical connections of the temporoparietal white matter tracts and relationship with adjacent major fiber tracts. Review of imaging findings - Diffusion tensor imaging Future directions and summary.

**NRE132**

Acquired Diseases of the Pons: MRI Appearance, Anatomy, and Differential Considerations

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

- Henry Chow Chow DO (Presenter): Nothing to Disclose
- Thomas Michael Cullen MD: Nothing to Disclose
- Jason K. Lempel MD: Nothing to Disclose
- Jason S. Vergnani MD: Nothing to Disclose
- Ryan Crawford MD: Nothing to Disclose

**TEACHING POINTS**

- Review the anatomy and vascular supply of the pons
- Elucidate the clinical presentation and features of acquired diseases affecting the pons
- Illustrate and describe the features of pontine pathology on MRI

**TABLE OF CONTENTS/OUTLINE**


**NRE133**

Acquired Toxic-metabolic Disorders Affecting the Central Nervous System

**Education Exhibits**

**Location:** NR Community, Learning Center

**Participants**

- Diego Jose Leao de Oliveira MD: Nothing to Disclose
- Rodrigo Sanford Damasceno MD (Presenter): Nothing to Disclose
- Tatiana Goyanna Lyra MD: Nothing to Disclose
- Luis Filipe de Souza Godoy MD: Nothing to Disclose
- Marcos Fernando de Lima Docena MD: Nothing to Disclose
- Daniel Delgado: Nothing to Disclose
- Hae W. Lee MD: Nothing to Disclose
- Maria Martin: Nothing to Disclose
- Claudia Da Costa Leite MD, PhD: Researcher, Guerbet SA
- Giovanni Guido Cerri MD, PhD: Nothing to Disclose

**TEACHING POINTS**

The reader should be able to: List the most common acquired toxic-metabolic conditions that manifest as central nervous system disturbance; Recognize the clinical, laboratory, and imaging findings of these conditions; Perform adequate differential diagnosis for these disorders.

**TABLE OF CONTENTS/OUTLINE**
Introducing the most common acquired toxic-metabolic disorder and the symptoms and signs that point to a specific disease or narrow the differential diagnosis. Presentation of pathophysiology, clinical features, imaging findings and differential diagnosis of specific disorders: Wernicke's encephalopathy, Subacute combined degeneration, Osmotic demyelination syndrome, Hepatic encephalopathy, Hypoglycemia in adults and children, Hyperosmolar hyperglycemic state, Uremic encephalopathy, Drug toxicity: methotrexate. Diagnostic algorithm. Summary.

NRE135
Clinical and Imaging Spectrum of Neonatal Encephalopathy
Education Exhibits
Location: NR Community, Learning Center

Participants
Ruchir Chaudhari MD (Presenter): Nothing to Disclose
Peter Shen MD: Nothing to Disclose

TEACHING POINTS
1. Review the clinical presentations, risk factors, epidemiology, and diagnostic work-up for the different causes of neonatal encephalopathy.
2. Present normal neonatal brain development especially in regards to the expected sulcation and myelination patterns.
3. Demonstrate the imaging patterns that assist in the diagnosis and future management of these patients.

TABLE OF CONTENTS/OUTLINE

NRE136
Clinical and Radiological Spectrum of Treatment-related Lesions of the Brain: Differentiation and Practical Assessment Using Current Imaging Modalities
Education Exhibits
Location: NR Community, Learning Center

Participants
Matakazu Furukawa MD (Presenter): Nothing to Disclose
Etsushi Iida MD: Nothing to Disclose
Yuko Harada MD: Nothing to Disclose
Takaaki Ueda: Nothing to Disclose
Naofumi Matsunaga MD, PhD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review imaging findings of various spectrum of treatment-related lesions of the brain. 2. To demonstrate the role of current imaging modalities such as MRI and PET-CT in assessing such treatment-related disorders. 3. To highlight the practical imaging assessment, in particular, for the differentiation between post-treatment change from tumor recurrence.

TABLE OF CONTENTS/OUTLINE
This exhibit includes various spectrums of treatment-related disorders. 1. Radiation or chemotherapy to the brain induced disorders such as radiation necrosis, pseudoprogression, secondary tumor, chronic expanding hematoma or cystic formation, and radiation-induced vascular lesion. 2. Operation or intervention related disorders such as hyperperfusion and sinus thrombosis. 3. Treatment to other organs or systemic therapy related disorders such as central pontine myelinolysis, posterior reversible encephalopathy syndrome, and drug-induced leukoencephalopathy. We are presenting: 1. Summary of those clinical symptoms, etiology and outcome. 2. Characteristic findings of diagnostic imaging and key points for practical imaging assessments and follow up.

NRE137
Cystic Sellar Lesions: A Case-based Review
Education Exhibits
Location: NR Community, Learning Center

Participants
Hussan Mohammed MD (Presenter): Nothing to Disclose
Sara Elizabeth Kingston BA: Nothing to Disclose
Daniel Scott Treister BS: Nothing to Disclose
Kristina Elizabeth Hoque MD, PhD: Nothing to Disclose
Francesco D’amore MD: Nothing to Disclose
Maryam Mohammadzadeh MD: Nothing to Disclose
Alexander Lerner MD: Nothing to Disclose
Chia-Shang Jason Liu MD, PhD: Nothing to Disclose
Paul E. Kim MD: Nothing to Disclose
Orest Bohdan Boyko MD, PhD: Nothing to Disclose
Eu-Meng Law MBBS: Speakers Bureau, Toshiba Corporation Medical Advisory Board, Bayer AG Medical Advisory Board, Bracco Group Medical Advisory Board, FUJIFILM Holdings Corporation
Mark S. Shiroishi MD: Nothing to Disclose

TEACHING POINTS
Evaluation of the pituitary gland is a frequently faced request. Accurate and thorough scrutiny of the sellar region is critical in...
neuroradiology practice, as detecting even the tiniest lesion can have a profound clinical impact. The purpose of our exhibit is to expand upon one commonly encountered category of sellar abnormality, the cystic pituitary lesion. We will discuss the defining clinical and imaging characteristics of each of the differential diagnoses using authentic cases from our institution.

TABLE OF CONTENTS/OUTLINE

- Review of the anatomy of the sellar region as well as the relevant embryology and physiology of the pituitary gland.
- Description of the normal pituitary MRI signal characteristics and the differences that must be kept in mind when special populations, such as newborns and pregnant patients, are imaged.
- An illustrative discussion of the differential for cystic/partially cystic pituitary lesions will be presented, including pituitary adenoma, Rathke cleft cyst, craniopharyngioma, arachnoid cyst, epidermoid cyst, and empty sella. The clinical presentations, unique imaging findings, and management options will be highlighted for each diagnosis.
- The typical sequences included in a sella MRI protocol, the role of dynamic contrast MRI, and other protocolling pearls will also be discussed.

NRE138
Diagnosis of Dementia with Lewy Bodies (DLB) with Neuroimaging Techniques

Education Exhibits
Location: NR Community, Learning Center

Participants
Kazunari Ishii MD (Presenter): Nothing to Disclose
Chisa Hosokawa MD: Nothing to Disclose
Tomoko Hyodo MD: Nothing to Disclose
Hiroti Takahashi: Nothing to Disclose
Nobuo Kashiwagi: Nothing to Disclose
Takamichi Murakami MD, PhD: Nothing to Disclose
Mitsuru Matsu : Nothing to Disclose
Ryuichiro Ashikaga MD : Nothing to Disclose

TEACHING POINTS
1. To review the pathophysiology of dementia with Lewy bodies (DLB). 2. To learn the characteristic structural and functional image findings of DLB. Structural and functional imaging biomarkers: brain MRI and SPECT/PET functional imaging have an important role in diagnosing DLB. 3. To show representative MRI, Brain perfusion SPECT, MIBG myocardial scintigraphy, dopamine transporter imaging, FDG-PET and PiB PET images of DLB comparing with those of Alzheimer disease (AD). 4. To show interpretation pitfalls in diagnosing DLB by MR, and SPECT/PET images.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of DLB: DLB is the second most common neurodegenerative dementia accompanying Lewy bodies in the brainstem and cerebral cortices, though it is not well recognized by general radiologists. Characteristic findings of DLB: relative preservation of medial temporal lobe structures, occipital hypoperfusion/hypometabolism associated with parietotemporal and posterior cingulated hypoperfusion/hypometabolism, low dopamine transporter uptake in the basal ganglia, unnecessary neocortical amyloid deposit and low uptake of MIBG myocardial scintigraphy. Characteristic findings of Alzheimer disease (AD) for discrimination. Present a pictorial essay of DLB and AD on MRI and SPECT/PET images. Illustrate imaging pitfalls resulting from misdiagnosis of DLB and AD.

NRE141
MR Imaging Findings in Young-Onset Dementia (YOD): A Pictorial Review

Education Exhibits
Location: NR Community, Learning Center

Participants
Minako Azuma (Presenter): Nothing to Disclose
Toshinori Hirai MD: Nothing to Disclose
Yasuhiko Iryo: Nothing to Disclose
Mika Kitajima MD: Nothing to Disclose
Yasuyuki Yamashita MD: Consultant, DAIICHI SANKYO Group

TEACHING POINTS
1. Young-onset dementia (YOD), that is dementia diagnosed before 65 years of age, includes a wide variety of diseases. 2. The new entities of YOD including hereditary diffuse leukoencephalopathy with spheroids (HDLS) and neuronal intranuclear inclusion disease (NIIID) have been reported. 3. To know the MR imaging characteristics of the brain in patients with YOD is useful for the accurate diagnosis.

TABLE OF CONTENTS/OUTLINE

NRE142
MR Imaging of Autoimmune-mediated Encephalitis and Its Mimickers: A Pictorial Review

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics

Participants
TEACHING POINTS

This exhibit will teach attendees about:
1. A variety of autoimmune disorders that cause encephalitis
2. The clinical manifestation, etiology, pathophysiology, and MR imaging features of autoimmune-mediated encephalitis
3. The differential diagnosis of diseases that can mimic autoimmune-mediated encephalitis on MR images

Radiologists should be familiar with the MR imaging findings, clinical manifestations, etiology, and pathophysiology of autoimmune-mediated encephalitis, as timely and correct diagnosis can ensure prompt, appropriate treatment and a better clinical course.

TABLE OF CONTENTS/OUTLINE

We will present the following types of autoimmune-mediated encephalitis in a quiz format, interpret their characteristics, and discuss the differential diagnosis of mimickers. Autoimmune-Mediated Encephalitis -Neoplasms: Lung cancer (anti-Hu, anti-VGKC), ovarian cancer (anti-Yo), teratoma (anti-NMDA receptor) -Autoimmune diseases: Type 1 DM (anti-GAD), Hashimoto’s thyroiditis (anti-NAE), relapsing polychondritis (anti-neutral glycosphingolipids), Sjögren’s syndrome, SLE -Others: NMO (anti-AQ4), Rasmussen's encephalitis Mimickers -Herpes virus, enterovirus, germinoma, multiple system atrophy, and others
Participants
Raja Sekaran  Kattumannarkudi Ramalingam  MBBS (Presenter): Nothing to Disclose
Sravanthi Mantripragada MBBS : Nothing to Disclose
Natesan Chidambaranathan MD : Nothing to Disclose

TEACHING POINTS
To illustrate the MR features which help in characterisation of corpus callosal lesions
To depict the lesions unique to corpus callosum

TABLE OF CONTENTS/OUTLINE
The corpus callosum is susceptible to a variety of pathological processes, either primary pathologies or lesions arising from adjacent structures. MRI is the modality of choice for evaluation of corpus callosal lesions and on most occasions is specific and obviates the need for any invasive procedures. Here, we present salient MR features of a collection of common and uncommon conditions. Salient MR features like location, extent, signal intensity and contrast enhancement patterns are useful to reach a specific pathological diagnosis. • Lesions occur in specific locations (as illustrated by primary demyelination occurring at the calloso-septal interface, focal edema as a transient splenial lesion, drug toxicity at the posterior body and splenium and changes due to rapid decompression of longstanding hydrocephalus sparing the splenium and lipoma in the pericallosal area) • Lesions exhibit specific signal intensity, extent and contrast enhancement patterns (butterfly pattern of high grade tumors with necrosis or homogenous enhancement, fat signal intensity of lipoma) • Volume of the corpus callosum (reduction in perinatal insult or demyelination), or association with developmental anomalies

NRE147
Neurons under Attack: Autoimmune Mediated Encephalopathy
Education Exhibits
Location: NR Community, Learning Center
Certificate of Merit

Participants
Jay Starkey MD (Presenter): Nothing to Disclose
John Kim MD : Nothing to Disclose
Toshio Moritani MD, PhD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the pathophysiology of Autoimmune Mediated Encephalopathy (AME) 2. To illustrate and discuss the MR imaging findings of various pathological CNS conditions associated with paraneoplastic and nonparaneoplastic disorders 3. To present a systematic approach to aid the radiologist in diagnosis

TABLE OF CONTENTS/OUTLINE
Organize the various imaging presentations of AME into 5 major categories: limbic encephalitis, cerebellar degeneration, striatal encephalitis, brainstem encephalitis, and leukoencephalopathy Show AME cases of commonly associated paraneoplastic antibodies: anti-NMDAR, anti-Yo, and anti-Tr Show cases of non-paraneoplastic encephalopathy: anti-VGKC and Hashimoto’s encephalopathy Demonstrate the pathophysiology of different immune mediated diseases Discuss the differential diagnoses of imaging presentations Future directions and summary

NRE148
Neuropsychiatric Systemic Lupus Erythematosus: Spectrum of Imaging Findings
Education Exhibits
Location: NR Community, Learning Center

Participants
Ahmed Abdel Razek MD (Presenter): Nothing to Disclose
Seif Eldein Farag : Nothing to Disclose
Sherif el bassiony : Nothing to Disclose
Reham Shaat : Nothing to Disclose
Marwa Zaky : Nothing to Disclose

TEACHING POINTS
1. To review basic background about neuropsychiatric systemic lupus erythematosus (NPSLE) 2. To review typical and atypical imaging appearance of NPSLE at routine and advanced MR and CT imaging 3. To discuss impact on imaging findings upon patient prognosis, disease activity and response to therapy

TABLE OF CONTENTS/OUTLINE
1-Basic background about NPSLE 2-Methods of examination included routine and advanced MR imaging 3-White matter ischemic changes 4-Imaging appearance of post reversible encephalopathy syndrome in NPSLE 5-Different imaging pattern of Hemorrhagic lesions in NPSLE 6-Imaging of deep venous sinus thrombosis in NPSLE 7-Imaging of rhombencephalitis and Lupoid sclerosis 8-Imaging of intra and extracranial vasculopathy 9-Imaging findings suggestive of antiphospholipid syndrome in SLE 10-Imaging findings suggestive of associated atypical infection and lymphoma 11-MR imaging suggestive of NPSLE in children 12-Diffusion MR imaging findings in NPSLE 13-Metabolic changes at MRS in patients with NPSLE 14-Imaging findings suggestive of associated atypical infection and lymphoma 15-MR imaging suggestive of NPSLE in children 16-Diffusion MR imaging features helps to differentiate NPSLE of from simulating lesions 17-Conclusion and future directions

NRE149
Neurosarcoidosis: A Great Mimicker!
Education Exhibits
Location: NR Community, Learning Center
Certificate of Merit

Participants

Anagha Rajeev Joshi MD, MBBS (Presenter): Nothing to Disclose
Sneha Deshpande MBBS: Nothing to Disclose
Devendra Kulkarni: Nothing to Disclose
Tilak Dedhia: Nothing to Disclose
Jernail Singh Bava: Nothing to Disclose

TEACHING POINTS

- Sarcoidosis is an idiopathic granulomatous disease which affects various organ systems like the Central Nervous System, lungs, bones etc. It can clinically manifest as acute fulminant disorder or as a chronic smouldering disease. Also, it can have subclinical lesions which may later aggravate leading to significant morbidity and even mortality. • Neurosarcoidosis has diverse clinical and radiological manifestations; mimicking various other pathologies. • Hence, every radiologist should have a high index of suspicion and adequate knowledge to accurately diagnose neurosarcoidosis and hence aid in early institution of treatment.

TABLE OF CONTENTS/OUTLINE

- The various clinical and radiological presentations of neurosarcoidosis would be discussed.
- Radiological manifestations that would be elaborated are as follows:
  1. Dural thickening or mass
  2. Leptomeningeal involvement
  3. Cranial nerve involvement
  4. Enhancing parenchymal lesions
  5. Non-enhancing parenchymal lesions
  6. Spinal cord and nerve root involvement
  7. Hypothalamic-pituitary sarcoidosis
- The radiological differentials of neurosarcoidosis would be illustrated with a case-based approach. Clues to differentiate these closely mimicking pathologies would be described.

NRE150

Normal Physiology of Cerebrospinal Fluid and Diseases That Disrupt It: A Case Based Review

Education Exhibits

Location: NR Community, Learning Center

Participants

Garima Agrawal MD (Presenter): Nothing to Disclose
Hilary L. Purdy MD: Nothing to Disclose
Aseem Sharma MBBS: Stockholder, General Electric Company

TEACHING POINTS

The goal of the exhibit is to:
1. Understand the normal physiology of CSF production, absorption and flow dynamics.
2. Discuss pathophysiology of altered CSF dynamics in various pathologies.
3. Understand imaging characteristics that aid in diagnosis and management of various pathologies of altered CSF dynamics.

TABLE OF CONTENTS/OUTLINE

1. CSF production: Normal physiology and case based discussion of CSF over production
2. CSF absorption: Normal physiology, underestimation of extraaxial fluid collection of infancy and case based discussion of dysfunction of absorptive mechanism in processes such as meningeal, subarachnoid hemorrhage, leptomeningeal carcinomatosis and venous hypertension.
3. CSF flow: Physiology, Munro Kelly doctrine, Imaging of flow and case based discussion of pathologies that will include obstructive hydrocephalus which could be intraventricular, fourth ventricular outlet, craniospinal junction (Chian I and others) or intraspinal obstruction (arachnoid adhesions etc).
4. CSF leaks and hypovolemia: Case based discussion of various causes of CSF leaks and spectrum of imaging findings that lead to establishing the diagnosis and cause of hypovolemia and guide further management based on imaging findings.

NRE151

Novel Imaging Findings in Two Cases of Biotinidase Deficiency- A Treatable Metabolic Disorder

Education Exhibits

Location: NR Community, Learning Center

Participants

Maya Dattatraya Bhat MD (Presenter): Nothing to Disclose
Chandrakri Prasad MBBS, MD: Nothing to Disclose
Parayil Sankaran Bindu MBBS, MD: Nothing to Disclose

TEACHING POINTS

Biotinidase deficiency is an inborn error of metabolism. Many of the clinical and neuroradiological features are reversible with early detection and simple treatment. We report novel MRI features in two patients with profound biotinidase deficiency that have not been reported previously on imaging.

TABLE OF CONTENTS/OUTLINE

- Two patients aged 8 months and 15 years respectively presented with features suggestive of biotinidase deficiency. Plasma levels of enzymes were low in both patients. MRI brain in first case revealed T2 and FLAIR hyperintensities in both hippocampi(H), parahippocampal gyrI(PHG), posterior limbs of internal capsules and corticospinal tract. Diffusion restriction was seen in the above mentioned areas along with brachium of inferior colliculus(IC). Central tegmental tracts (CTT), middle cerebellar peduncles and cerebellar grey and white matter. Brain imaging findings of hyperintensities of H and PHG have not been reported. Diffusion restriction of CTT, crus cerebri, cerebellum, R, PHG and IC is a novel observation. MRI spine in second case revealed bilateral symmetrical involvement of anterior, lateral and posterior columns. Selective tract involvement has never been described. Both the patients were treated with oral biotin supplements and recovered considerably. This report emphasizes the importance of imaging in metabolic disorders.

NRE152

Perivascular Space Enhancement: Key Points for Diagnosis
Participants
- Fatma Fatma Ouamer MD (Presenter): Nothing to Disclose
- Anne Bertrand MD, PhD: Nothing to Disclose
- Delphine Leclercq MD: Nothing to Disclose
- Damien Pierre Galanaud MD, PhD: Research Consultant, Olea Medical
- Peggy Bienvenot MD: Nothing to Disclose
- Sophie Beranger-Gibert: Nothing to Disclose
- Didier Dormont MD: Nothing to Disclose

TEACHING POINTS
To recognize an abnormal enhancement of perivascular spaces on MR imaging. To list the different diagnoses related to perivascular space enhancement on MR imaging. To characterize the specific MR appearance of each of these diagnoses.

TABLE OF CONTENTS/OUTLINE
- Anatomical and neuropathological considerations
- Imaging findings and key points
- Perivascular space enhancement can be recognized as punctate and linear enhancement located along the perforating arteries: within the pons, the basal ganglia and the centrum semi ovale. Possible diagnoses included: Inflammation: Neurosarcoidosis: granulomatous leptomeningitis with predilection for the basal meninges and basal midline structures. Lymphomatoid granulomatosis: multifocal angiocentric lymphoreticular proliferative and granulomatous lesions perivascular space enhancements are associated with patchy hyperintense lesions on T2WI Erdheim-Chester disease causing osteosclerosis of the facial bone, orbital masses and periarterial masses. C.L.I.P.P.E.R.S Chronic Lymphocytic Inflammation with Pontine Perivascular Enhancement Responsive to Steroids. CNS vasculitis, angitis granulomatosis. Tumors: CNS lymphoma and glioma. Infections: PML-IRIS and Cryptococcal meningitis-IRIS in the setting of HIV-related immunosuppression: perivascular spaces enhancement suggest inflammatory response, a hallmark of CNS-IRIS

NRE153
Pituitary Stalk Transection Syndrome: Comparison of Clinico-radiological Features in Adults and Children

Participants
- Chinmay Bhimaji Kulkarni MBBS, MD (Presenter): Nothing to Disclose
- Srikanth Moorthy MD: Nothing to Disclose
- Sreekumar K P MBBS, MD: Nothing to Disclose
- Rajesh Ramaih Kannan MD: Nothing to Disclose

TEACHING POINTS
- What is pituitary stalk transection syndrome?
- To understand the aetio-pathogenesis.
- Characteristic MRI features of pituitary stalk transection syndrome.
- How does the clinical and MRI feature differ in adults and children?
- Impact of newer MRI sequences on pituitary stalk transection syndrome.

TABLE OF CONTENTS/OUTLINE

NRE154
Reversible Cerebral Vasoconstriction Syndrome: Etiology, Pathophysiology and Radiographic Review of a Spectrum of Diseases and Their Complications

Participants
- Sana Ali MD (Presenter): Nothing to Disclose
- Leah H. Portnow MD: Nothing to Disclose
- Anna Derman MD: Nothing to Disclose
- Evan Gary Stein MD, PhD: Nothing to Disclose

TEACHING POINTS
1. Review the spectrum of vasoconstrictive diseases which fall under the umbrella of Reversible Cerebral Vasoconstriction Syndrome (RCVS) with a discussion of the most common etiologies, the currently understood pathophysiology and the potential complications with a particular focus on Posterior Reversible Encephalopathy Syndrome (PRES). 2. Pictorial case review of RCVS from our collection and a review from the literature. 3. Review of the complications associated with RCVS, including PRES, hemorrhage, and infarction. 4. Recognizing the radiographic appearance and complications of RCVS on anatomic imaging can suggest underlying vascular pathology and lead to angiographic imaging necessary for the diagnosis of RCVS. 5. One explanation for the general etiology of RCVS is failure of the central nervous system vascular autoregulatory system, which may explain its frequent co-existence with PRES.

TABLE OF CONTENTS/OUTLINE
Reversible Cerebral Vasoconstriction Syndrome (RCVS)
- Diagnostic Criteria
b. Etiologies (e.g., pregnancy, substance abuse, catecholamines, etc)

c. Pathophysiology

d. Imaging Appearance

i. CT and CT Angiography

ii. MRI and MR Angiography

iii. Digital subtraction angiography

e. Complications and the corresponding imaging appearance

i. Hemorrhage

ii. PRES

iii. Infarct

**NRE155**

**Thunderclap Headache: Imaging of Subarachnoid Hemorrhage and Imitators**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Elizabeth H. Y. Du, BA, BSc (Presenter): Nothing to Disclose

Luck Jan-Luck Louis MD: Nothing to Disclose

Patrick McLaughlin FFR(RCSI): Nothing to Disclose

Savvas Nicolaou MD: Nothing to Disclose

**TEACHING POINTS**

- Noncontrast head CT is the initial test of choice within the first 12-24 hours
- DSA remains the gold standard for identifying bleeding source in aneurysmal SAH
- MRI with T2* or FLAIR sequences may distinguish pseudo-SAH from true SAH; timely use of MRI may avoid unnecessary angiographic studies

**TABLE OF CONTENTS/OUTLINE**

- DDx of thunderclap headache; pathophysiology, clinical presentation (incl. clinical grading scale), DDx of traumatic and nontraumatic true subarachnoid hemorrhage (SAH); sensitivity/specificity of imaging modalities for detection of SAH
- Indications, spectrum of imaging findings with examples, relative utility and practical considerations of imaging modalities used for assessment of traumatic and nontraumatic SAH - Grading system for CT appearance predicting likelihood of SAH-related vasospasm; CT angiography vs. digital subtraction angiography (DSA) in evaluating aneurysm location - Imaging approach to and imaging examples of SAH imitators: diffuse cerebral edema, mass lesions e.g. subdural hematoma, severe obstructive hydrocephalus, anoxic encephalopathy, infections, unrecognized IV contrast; reversible cerebral vasospasm syndromes, venous sinus thrombosis, cervical artery dissection, intracranial hypotension, pituitary apoplexy, retroclival hematoma, reversible posterior leukoencephalopathy syndrome, third ventricle colloid cysts

**NRE156**

**X-Linked Adrenoleukodystrophy MRI: A Pictorial Essay to Emphasize Unusual Patterns**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Heitor Castelo Branco Rodrigues Alves, MD (Presenter): Nothing to Disclose

Renato Hoffmann Nunes, MD: Nothing to Disclose

Antonio Rocha: Nothing to Disclose

Lazaro F. Amaral, MD: Nothing to Disclose

**TEACHING POINTS**

To review the pathophysiology of X-Linked adrenoleukodystrophy (X-ALD) To review recognizable neuroimaging patterns of X-ALD Emphasizing atypical brain patterns in X-ALD using conventional MRI. Reviewing the role of advanced MR techniques to better comprehend in vivo X-ALD pathophysiology.

**TABLE OF CONTENTS/OUTLINE**

X-Linked adrenoleukodystrophy (X-ALD) is a peroximal disorder that has a wide range of clinical manifestations. Usually, X-ALD presents with bilateral symmetric involvement of the parieto-occipital white matter (WM). However, different MR imaging patterns have been described that do not conform to the typical pattern. Our current aim was to study a selected series of X-ALD patients (n=12) with unusual MR findings to didactically list recognizable features, including topography and Gd-enhancement patterns. Frontal lobe (anterior pattern), exclusive unilateral (infra or supratentorial disease) and also, either diffuse bilateral, posterior or anterior asymmetrical WM lesions were all scrutinized. Advanced MR techniques, including DTI, MTC and MRS, were useful to show involved structures and to detect early T2/FLAIR unsuspected WM involvement. Radiologists must be aware to recognize X-ALD based on both conventional and advanced MR techniques, in its typical or atypical presentations of this rare disease.

**NRE157**

**Brain Asymmetry in Newborns: Radiological Items for a Rational Diagnostic Evaluation. Case Series and Literature Review**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Certificate of Merit**

**Participants**

Rosalinda Calandrelli (Presenter): Nothing to Disclose

Gabriella D’Apolito, MD: Nothing to Disclose

Marco Panfili: Nothing to Disclose
TEACHING POINTS

- To propose a systematic step-by-step approach to guide the correct diagnostic process in children with brain asymmetry, due to atrophy or hyper-growth of one hemisphere compared to the contralateral one. • To offer some key findings to differentiate the hamartomatous malformations (hemimecroencephaly/ hemimacroencephaly) from the cerebral hemiatrophies (congenital versus acquired), underlying the complementary role of MRI and CT.

TABLE OF CONTENTS/OUTLINE

- Introduction to hamartomatous malformations, congenital (Sturge Weber syndrome, Encephalocraniocutaneous Lipomatosis...) and acquired hemiatrophies (trauma, infection, vascular abnormality, ischemic/hemorrhagic insults). • To illustrate a comprehensive set of MRI and CT features to help in the diagnosis: 1) Asymmetry of head circumference (hemimacrocrania or hemimicrocrania); bone abnormalities of the skull. 2) Hemispheres asymmetry. 3) Parenchymal abnormalities: alterations of the cortical development, atrophy of white and gray matter, gyral/ subcortical white matter calcifications. 4) Falx position: midline, shifted. 5) Ventricles size: enlarged, normal, dysmorphic. 6) Choroid plexus: enlarged, normal. 7) Deep venous occlusion: present, absent. 9) Associated findings: "arachnoid cyst", lipomas.

NRE158
Chronology in Embryology: Review of the Timeline of the Congenital Malformations of Brain

Education Exhibits
Location: NR Community, Learning Center

Participants
Siddaroodha Mahantappa Saijan MBBS (Presenter): Nothing to Disclose
Zarina Abdul Assis MBBS, MD.: Nothing to Disclose
Sunita P Kumaran MBBS, MD.: Nothing to Disclose
Sanjaya Viswamitra MD.: Nothing to Disclose

TEACHING POINTS

- To educate the reader about embryological development of brain and MRI findings of congenital malformations of the brain.
- To understand the correlation between the stage of development and resultant malformation

TABLE OF CONTENTS/OUTLINE

- Introduction: Congenital anomalies of the brain are extremely complex and are best studied by correlating with embryological development. • Methods: 91 patients scanned between 2008 to 2013 on 1.5T MRI who had congenital malformations of the brain (other than neuro cutaneous syndromes) are presented under the following subheadings based on the stage of developmental defect: 1) Defective dorsal induction (3 - 4 weeks): Chiari I, II and III malformations, cephaloceles. 2) Defective ventral induction (2 - 3 months): Corpus callosum agenesis/dysgenesis, holoprosencephaly, septo optic dysplasia, complete commissural agenesis, Joubert’s syndrome, Dandy Walker complex and cerebellar hypoplasia/dysplasia. 3) Defective cellular migration (3 - 5 months): Agyria--pachygyria complex, heterotopia, polymicrogyria, schizencephaly, Lhermitte - Duclos disease, coronal cleft in the pons.

NRE160
Genetics, Clinical and Neuroimaging Findings in Patients with Mucopolysaccharidoses: What You Really Need to Know

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics

Participants
Roberta Reichert MD (Presenter): Nothing to Disclose
Lillian Goncalves Campos: Nothing to Disclose
Filippo Vairo: Nothing to Disclose
Carolina Fischinger Moura de Souza: Nothing to Disclose
Juliano Adams Perez MD: Nothing to Disclose
Juliana Duarte: Nothing to Disclose
Fernando Araujo Leina MD: Nothing to Disclose
Leonardo Vedolin MD, PhD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: To review the pathophysiology and genetics of mucopolysaccharidoses (MPS) To describe the typical imaging features of different types of MPS, particularly in brain and spine To show illustrative neuroimaging findings in magnetic resonance imaging (MRI),computed tomography (CT) and X-ray of confirmed cases from the Radiology and Genetic Divisions of our hospital

TABLE OF CONTENTS/OUTLINE

- Introduction • Genetics and pathophysiology of MPS • Neuroimaging findings in MPS, particularly in brain and spine - MRI - CT - X-ray • Clinical correlation with imaging features and discussion of physiopathologic mechanisms • Summary and key teaching points

NRE161
Imaging in Medication Refractory Epilepsy: Pearls and Pitfalls

Education Exhibits
Location: NR Community, Learning Center
Participants

Yingming Amy Chen MD (Presenter): Nothing to Disclose
Timo Krings MD, PhD: Nothing to Disclose

TEACHING POINTS

- To review the epidemiology, clinical classification and typical causes for seizures, epilepsy and medication refractory epilepsy (MRE)
- To discuss the role of dedicated MRI protocol in the preoperative workup of MRE, with useful information on sequence selection and quality factors
- To review the common and rare clinical etiologies of MRE, and present imaging pearls differentiating their diagnoses

TABLE OF CONTENTS/OUTLINE

- Definition and Epidemiology of Seizures, Epilepsy, and Medical Refractory Epilepsy (MRE)
- Clinical classification of Epilepsy
- How to Perform MRI in Epilepsy
- Pearls and pitfalls in the imaging of epileptogenic pathologies: - Part 1: mesial temporal sclerosis and malformations of cortical development [ - Part 2: epilepsy-associated neoplasms, neurocutaneous diseases, and other miscellaneous entities (vascular malformations, trauma, infection and inflammation) ]
- Overview of the role of post-treatment MRI

NRE163

Posterior Periventricular Heterotopia: Description and Spectrum of Associate Defects

Education Exhibits
Location: NR Community, Learning Center

Participants

Chawar Hayoun (Presenter): Nothing to Disclose
Ana Alvarez Vazquez: Nothing to Disclose
Mar Jimenez de La Pena: Nothing to Disclose
Manuel Recio Rodriguez: Nothing to Disclose
Ana Fernandez Alfonso: Nothing to Disclose
Vicente Martinez de Vega: Nothing to Disclose

TEACHING POINTS

1. Posterior periventricular heterotopia usually is not an isolated impaired neuronal migration, but it is a distinct complex entity and it is part of a continuous spectrum of cortical malformations, disordered infra-Sylvian development and posterior fossa abnormalities. 2. High-field MRI with specific sequences is essential for a correct diagnosis of these entities.

TABLE OF CONTENTS/OUTLINE

- Embryological brain development
- High field MRI
- Review of imaging findings
- Clinical-radiological correlation with sample cases

NRE164

Structural Brain Anomalies Associated with Inborn Errors of Metabolism

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics

Participants

Matt Whitehead MD (Presenter): Nothing to Disclose
Audrey Pichair McCarron: Nothing to Disclose
Andrea Gropman: Nothing to Disclose

TEACHING POINTS

Major teaching points include: 1. Developmental brain defects and inborn errors of metabolism may coexist. Detection of either on imaging studies should prompt a detailed search for the other. 2. Common congenital metabolic disorders with associated structural defects include peroxisomal disease, fatty oxidation defects, dystroglycanopathies, mitochondrial disorders, and amino acidopathies.

TABLE OF CONTENTS/OUTLINE

- Introduction and background information
- Typical structural abnormalities associated with inborn metabolic error subclass

NRE166

“The Many Faces of Central Nervous System Tuberculosis: A Great Mimic”

Education Exhibits
Location: NR Community, Learning Center

Participants

Jaime Isern MD (Presenter): Nothing to Disclose
Elisenda Grive MD: Nothing to Disclose
Ana Maria Olarte MD: Nothing to Disclose
Anna Maria Gallart Ortuno MD: Nothing to Disclose
Silvia Llaverias MD: Nothing to Disclose
Vicenc Querol Borras: Nothing to Disclose
TEACHING POINTS
1. To illustrate TC and MR imaging spectrum of CNS Tuberculosis. 2. To present a review of magnetic resonance features with special emphasis on the pathogenesis and the relevant clinical settings. 3. To discuss about the differential diagnosis.

TABLE OF CONTENTS/OVERSEVIEW

NRE167
“Neuromyelitis Optica” Evokes Merely Optic Neuritis and Transverse Myelitis, but Are We Ignoring Brain Lesions?

Education Exhibits
Location: NR Community, Learning Center

Participants
Gunes Orman MD (Presenter): Nothing to Disclose
Izlem Izbudak MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the pathophysiology and history of neuromyelitis optica (NMO) 2. To emphasize that majority of NMO patients have brain lesions over the course of the disease and approximately 70% of brain lesions are characteristic for NMO 3. To demonstrate multiple types of brain lesions shown to be characteristic for NMO on brain MRI

TABLE OF CONTENTS/OVERSEVIEW
History of NMO Pathophysiology of NMO and Recent Discoveries Review of Brain MRI Findings - Conventional MRI: • T2 and FLAIR sequences (periependymal lesions surrounding aqueduct, third and fourth ventricles, diencephalon and brainstem lesions, longitudinally extensive corticospinal tract lesions, extensive hemispheric white matter lesions, nonspecific lesions) • Post-contrast T1 sequence (periependymal, cloud-like, leptomeningeal, isolated, ring enhancement) - Diffusion Weighted Imaging Sample cases and mimics Future directions and summary

NRE168
A Pattern Based Approach to Intracranial Contrast Enhancement on MRI with Clinical and Pathological Correlation: Differentials, Discussion and Diagnostic Challenges

Education Exhibits
Location: NR Community, Learning Center

Participants
Sunitha P Kumaran MBBS, MD (Presenter): Nothing to Disclose
Zarina Abdul Assis MBBS, MD : Nothing to Disclose
Sanjaya Viswamitra MD : Nothing to Disclose

TEACHING POINTS
To review and categorize the various patterns of intracranial enhancement on MRI with illustrative examples. Learn a pattern recognition algorithm to give appropriate differentials. Learn to correlate the imaging features with clinical and histopathological findings.

TABLE OF CONTENTS/OVERSEVIEW
Introduction: Appropriate radiological diagnosis of brain lesions can be made with knowledge of location (cortical, grey-white matter, deep white matter, periventricular or ependymal) and pattern of contrast enhancement. Methods: 15 different contrast enhancement patterns of common and rare pathologies are categorized under the following broad headings: meningeal, parenchymal, cranial nerve and vessel wall enhancement. Meningeal includes lepto and pachymeningeal enhancement. Parenchymal includes gyral, nodular, ring, open ring, onion ring ,cyst with mural nodule, diffuse lesional enhancement, satellite lesional enhancement, ependymal enhancement, swiss- cheese, tree-in-bud and folia pattern of enhancement. Cranial nerve and vessel wall enhancement patterns. We present our institution experience of the above mentioned patterns in a case based algorithm with relevant differentials with supporting clinical findings and histological correlation when available.

NRE169
Central Nervous System Infections in Patients Not Infected with HIV

Education Exhibits
Location: NR Community, Learning Center

Participants
Tomoaki Sasaki (Presenter): Nothing to Disclose
Keigo Kobayashi : Nothing to Disclose
Yasuomi Fujimoto : Nothing to Disclose
Shunta Ishiota : Nothing to Disclose
Rie Murata : Nothing to Disclose
Naoumi Watanabe : Nothing to Disclose
Toshihiro Yamaki : Nothing to Disclose
Koji Takahashi MD : Nothing to Disclose
Masayuki Mineta MD : Nothing to Disclose

TEACHING POINTS
A delay of diagnosis for central nervous system (CNS) infection could become fatal. Although CNS infections associated with
human immunodeficiency virus (HIV) have been widely reported, diagnosis of CNS infections in patients without HIV, healthy population or immunocompromised host after chemotherapy, might be difficult. The purpose of this exhibit is: 1. To understand pathophysiology of CNS infections 2. To review radiological findings of CNS infections in patients without HIV

**TABLE OF CONTENTS/OUTLINE**

Herpes simplex virus type 1, Cytomegalovirus, Human herpesvirus-6, Subacute sclerosing panencephalitis, Rasmussen encephalitis, Human T-cell lymphotropic virus type 1, Acute disseminated encephalitis, Aspergillosis, Zygomycosis, Cryptococcosis, Creutzfeldt-Jakob disease, Difference with the HIV infected patients, Summary.

**NRE170**

**Central Nervous System Vasculitis and Vasculopathy: Imaging Clues to Differentiate From Demyelinating Disease**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Javier Villanueva Meyer MD (Presenter): Nothing to Disclose
- Marc Christopher Mabray MD: Nothing to Disclose
- Soonmee Cha MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: To review the etiologies of CNS vasculitis and vasculopathy To illustrate the imaging findings in a variety of CNS vasculitides and vasculopathies To explain the utility of MRI and particularly susceptibility imaging in the diagnosis and differentiation of CNS vasculitis and vasculopathy from demyelinating disease

**TABLE OF CONTENTS/OUTLINE**

- Pathophysiology of CNS vasculitis and vasculopathy
- Review of imaging findings in CNS vasculitis and vasculopathy: Pattern of distribution
- Susceptibility-weighted imaging
- Diffusion-weighted imaging
- Post-contrast enhancement
- Associated findings related to underlying disease
- Sample cases and demyelinating disease mimics
- Summary

**NRE171**

**Diagnostic Criteria of Neurobehcet’s Disease: A Prerequisite for a Proper Management**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Sahar Saleem MD (Presenter): Nothing to Disclose

**TEACHING POINTS**

1. To identify neuro-behcet's disease (NBD) as a preferential target of Behcet's disease and recognize its vascular and parenchymal sub-types. 2. To review the latest international consensus of the diagnostic criteria of NBD: 3. To discuss the role of MRI (particularly special sequences) in diagnosis and differential diagnosis of NBD

**TABLE OF CONTENTS/OUTLINE**

1. Review the pathophysiology, classification, clinical presentations and mimics of NBD
2. Discuss the latest international consensus criteria for clinical, laboratory, and imaging diagnosis of NBD
3. Discuss the specificity of the used imaging modalities in diagnosis and follow up of vascular and parenchymal NBD (CT, MRI, conventional angiography, venography)
4. Discuss the common MRI findings in NBD using conventional sequences and the role of advanced sequences such as Diffusion Tensor Imaging, Susceptibility imaging, 3D-FFE, MRA, MRV, and MR spectroscopy
5. Discuss the differential diagnosis and mimics of NBD including Multiple sclerosis, systemic lupus vasculitis, primary CNS vasculitis, and others
6. Future directions

**NRE174**

**From Tuberculous Meningitis to Localised CNS Tuberculomas-No Boundary to Multifaceted Involvement by Mycobacterium Tuberculosis**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Shumaila Arooj MBBS (Presenter): Nothing to Disclose
- Fatima Mubarak MBBS: Nothing to Disclose
- Shayan S.M. Anwar MBBS: Nothing to Disclose

**TEACHING POINTS**

- Caseating granulomas have hypointense T2W solid centre and hypointense T2W rim with ring enhancement on post contrast images. Basilar meningitis most often seen. At times there is enhancement of leptomeninges along superficial sulci. Contrast T1WI show pachymeningitis with dural thickening and enhancement and ventriculitis,vasculitis, choroid plexiitis. DWI may show complications including infarct or cerebritis/abscess. Others can be hydrocephalus.

**TABLE OF CONTENTS/OUTLINE**

- Multiple ring enhancing lesions-tuberculomas vs metastasis FLAIR hyperintense signals with Leptomeningeal enhancement-Subarachnoid hemorrhage vs meningitis
- Basilar Meningeal enhancement in a patient with nonspecific fever-Tuberculosis vs Neurosarcoidosis dural based ring enhancing lesions in an immunocompromised patient-tuberculous involvement vs dural based metastasis
- Pachymeningitis with dilated ventricular system-complicated tubeculous meningitis vs post hemorrhagic hydrocephalus
**NRE175**

**Imaging Findings in Patients with Natalizumab-related Progressive Multifocal Leukoencephalopathy**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Magna Cum Laude**

**Participants**

Jerome Hodel (Presenter): Nothing to Disclose  
Olivier Outterryck: Nothing to Disclose  
Anne-Laure Bocher toledano MD: Nothing to Disclose  
Helene Zephir: Nothing to Disclose  
Celine Dubron: Nothing to Disclose  
Marc Zins MD: Nothing to Disclose  
Jean-Pierre Pruvo: Nothing to Disclose  
Patrick Vermersch: Nothing to Disclose  
Xavier Leclerc, MD, PhD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To describe the key imaging features of Natalizumab associated PML 2. To explain the utility of brain MRI plays a major role for the early diagnosis of PML. FLAIR is considered as a reference standard for detecting supratentorial PML lesions while T2w images improve the detection of intra-tentorial lesions and intralesional microcysts. Diffusion may suggest acute demyelination. 3D TSE MR sequences (GE, SPACE, Siemens; Brainview, Philips) may improve the detection of small PML lesions due to better image contrast and spatial resolution. Specific imaging findings for early PML include: - subcortical location involving U-fibers; - ill defined border toward the white matter; - increased signal intensity on both T2 and diffusion weighted images. Key imaging features of natalizumab-associated PML are: - subcortical U-fibers involvement, - extension to adjacent gray matter, - peripheral small punctuate hyperintense lesions and intra-lesional microcysts (« milky way appearance »)

**TABLE OF CONTENTS/OUTLINE**

1) MR protocol 2) Pictorial review: imaging features of natalizumab-associated PML 3) Pitfalls and mimics 4) Take home messages

**NRE177**

**Imaging Spectrum of Neurocystercicosis**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Melissa Mei Chen MD (Presenter): Nothing to Disclose  
Wilson Altmeyer MD: Nothing to Disclose  
Carlos Bazan MD: Nothing to Disclose  
Erin Flaherty MD: Nothing to Disclose  
David F. Jimenez MD: Nothing to Disclose  
James Henry MD: Nothing to Disclose  
Ameya Jagadish Baxi MBBS, DMRD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to:

1. To review the pathophysiology of the infection of neurocystercicosis.  
2. To discuss the four pathologic stages including vesicular, colloid vascular, granular nodular and nodular calcified.  
3. To demonstrate the wide imaging spectrum and gross appearance of neurocystercicosis, including typical and atypical presentations.  
4. Life cycle of cystercicosis infection with different hosts leading to neurocystercicosis in the human.  
5. Overview of the four pathologic stages of the infection with imaging correlation, including a review of the typical, including subarachnoid and ventricular cysts, and atypical imaging findings, which can mimic malignancy.  
6. Discussion of the clinical diagnostic criteria for neurocystercicosis, which includes imaging and pathologic findings.  
7. Multimodality imaging with pathologic correlation, including intra-operative videos of neurocystercicosis.

**NRE178**

**MR Imaging Spectrum of CNS Manifestations in Dengue**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Tejas Harish Kapadia MBBS (Presenter): Nothing to Disclose  
Yogini Nilkantha Sawant MBBS: Nothing to Disclose  
Darshana Sanghvi MD, MBBS: Nothing to Disclose  
Abhijit A. Raut MD: Nothing to Disclose  
Mihir Munshi: Nothing to Disclose  
Prashant Sadashiv Naphade MBBS, MD: Nothing to Disclose
TEACHING POINTS

- Dengue encephalitis is a rare fatal condition caused by flavivirus that is common in endemic areas. • CNS involvement is known complication of dengue fever and shows imaging features of meningoencephalitis, few of them present as stroke or intraparenchymal hemorrhage. • In this exhibit we present complete spectrum of various imaging patterns of CNS involvement in Dengue encephalitis. • MRI features include: Meningeal/parenchymal enhancement, intraparenchymal hemorrhages, chorioretinal hemorrhage etc.

TABLE OF CONTENTS/OUTLINE

Clinically verified patients suspected to have dengue encephalitis were subjected for MRI examination with post contrast evaluation.

Etiopathogenesis of CNS involvement in dengue haemorrhagic fever and dengue shock syndrome.

Review of imaging features listed in literature.

Atypical presentations of dengue encephalitis with emphasis on imaging findings of spinal cord involvement

NRE179

Neurocysticercosis of the Spine

Education Exhibits

Location: NR Community, Learning Center

Participants

Sara Elizabeth Kingston BA (Presenter): Nothing to Disclose
Daniel Scott Treister BS: Nothing to Disclose
Hussan Mohammed MD: Nothing to Disclose
Kristina Elizabeth Hoque MD, PhD: Nothing to Disclose
Eu-Reung Law MBBS: Speakers Bureau, Toshiba Corporation Medical Advisory Board, Bayer AG Medical Advisory Board, Bracco Group Medical Advisory Board, FUJIFILM Holdings Corporation
Francesco D’Amore MD: Nothing to Disclose
Maryam Mohammadzadeh MD: Nothing to Disclose
Alexander Lerner MD: Nothing to Disclose
Chia-Shang Jason Liu MD, PhD: Nothing to Disclose
Mark S. Shiroishi MD: Nothing to Disclose

TEACHING POINTS

1. To provide an overview of pathophysiology of spinal neurocysticercosis 2. To use imaging modalities to identify various stages of disease progression and to guide management

TABLE OF CONTENTS/OUTLINE

- Epidemiology - Isolated spinal NCC vs. spinal with intracranial NCC - Anatomic locations - Cervical, thoracic, lumbar, lumbosacral - Vertebral, extradural, intradural, and intramedullary regions - Migration routes: - Hemopoietic venous route - Ventriculoependymal route - Subarachnoidal route - Direct extension from intestinal mucosa to intradural space - Differential diagnosis - Symptomotology - Diagnosis - MRI - CSF ELISA - Biopsy • Complications • Treatment: - Curative vs. Preventative of re-infestation/dissemination - Treatment of neurologic complications

NRE180

Neuroimaging Findings in Autoimmune-Mediated Encephalitis

Education Exhibits

Location: NR Community, Learning Center

Participants

Esther De Alencar Araripe Falcao Feitosa MD (Presenter): Nothing to Disclose
Bruno Meira Castro Trindade MD: Nothing to Disclose
Raul Raposo Pereira Feitosa MD: Nothing to Disclose
Mateus Simabukuro MD: Nothing to Disclose
Leandro Tavares Lucato MD: Nothing to Disclose
Ricardo Nitrini MD, PhD: Nothing to Disclose
Maria Martin: Nothing to Disclose

TEACHING POINTS

To review the pathophysiology of autoimmune-mediated encephalitis, as well as the importance of the classification of the antibodies involved.

To discuss the relationship between autoimmune-mediated encephalitis and paraneoplastic syndrome.

To explain the utility of MRI in the diagnosis of autoimmune-mediated encephalitides.

To aid radiologists in the correct diagnosis of this pathology.

TABLE OF CONTENTS/OUTLINE

Pathophysiology of autoimmune-mediated encephalitides.

CNS antibodies-mediated involved.

Relevant clinical manifestations.

Review of imaging findings on MRI.

Sample cases and mimics.

The importance of early diagnosis and good prognosis.

Future directions and summary

NRE181

Out of Africa: Advanced Cases of Infectious Diseases in Mozambique
Out of Africa: Advanced Cases of Infectious Diseases in Mozambique

Education Exhibits
Location: NR Community, Learning Center

Participants
Renata Rolim Soares (Presenter): Nothing to Disclose
Maud Mostafa Morshed MD, PhD: Speaker, Surefire Medical, Inc
Mitchell Gudmundsson MD: Nothing to Disclose

TEACHING POINTS
Mozambique, an underdeveloped country in Southeast Africa, is a nation of 24 million people but with a health expenditure of $35 per capita and a life expectancy of 52.6 years, one of the lowest in the world. The prevalence of infectious disease such as HIV, tuberculosis, and malaria are high and a significant portion of the population does not receive treatment until they present with advanced stages of these and other infectious diseases. Given the limited experience of radiologists in more developed countries with these advanced disease processes, this exhibit reviews the multimodality imaging findings of some of the most common infectious diseases seen at the largest teaching hospital in Mozambique. It is critical for radiologists to be familiar with imaging findings of advanced infectious diseases in order to provide accurate diagnosis and guide treatment.

TABLE OF CONTENTS/OUTLINE
We provide a comprehensive pictorial review of a variety of advanced infectious diseases seen in Mozambique, including central nervous system tuberculosis, spondylodiscitis with multiple abdominal and retroperitoneal collections, disseminated cryptococcosis, neurotoxoplasmosis, cerebral malaria, and viral encephalitis, review their differential diagnoses, and discuss their clinical presentations.

NRE183
Progressive Multifocal Leukoencephalopathy: A Reemerging Beast

Education Exhibits
Location: NR Community, Learning Center

Participants
Arbab Zafar Iqbal MD (Presenter): Nothing to Disclose
Thomas Lostracco MD: Nothing to Disclose
Ali Haikal Hussain MD, FRCR: Nothing to Disclose

TEACHING POINTS
Provide a thorough overview of progressive multifocal leukoencephalopathy. Discuss PML and its specific risk factors including new immune modulating agents like Natalizumab for treatment of MS. Stress the importance of early detection of PML for treatment. Review the imaging appearance of PML in both conventional and advanced imaging modalities including DTI, perfusion, and spectroscopy to help distinguish PML from other related conditions such as PML IRIS and demyelination. After the review, show a series of cases which highlight the most important teaching points.

TABLE OF CONTENTS/OUTLINE
Overview of PML. Discuss the reemergence of PML secondary to treatment of MS. Discuss the treatment of PML. Overview and discussion of the radiological appearance of PML on both conventional and advanced imaging modalities such as DTI, perfusion, and spectroscopy. Review the key imaging findings which distinguish PML from other related conditions using cases to help illustrate the differences.

NRE184
Radiologic Manifestation of Fungal Infections in the Head and Spine

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics

Participants
Luis Raul Ramos-Duran MD (Presenter): Nothing to Disclose
Tatiana Andrea Chacon-Quesada MD: Nothing to Disclose
Enrique Palacios MD: Nothing to Disclose
Ramon Edgardo Figueroa MD: Nothing to Disclose
Robbie Shoots MD: Nothing to Disclose
Jose Gavito MD: Nothing to Disclose
M Nawar Hakim MD: Nothing to Disclose
Akle Nassim MD: Nothing to Disclose
Roy Riascos MD: Nothing to Disclose
Andrea Corral: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the pathophysiology and epidemiology of fungal infections involving the CNS, spine, orbits and paranasal sinuses in the setting of immunocompromised and immunocompetent hosts. 2. To describe the imaging patterns associated with intracranial, spinal, orbital and paranasal sinus fungal infection. 3. To highlight the role of magnetic resonance and computed tomography evaluation in the timely assessment of these diseases.

TABLE OF CONTENTS/OUTLINE
OUTLINE The increasing incidence of CNS fungal infections, a disease with high morbidity and mortality rates highlights the need for their timely and reliable identification. Although imaging findings alone are often non-specific; recognition of specific imaging patterns when correlated with clinical, epidemiological and laboratory findings, can provide a reliable tool for the accurate diagnosis of fungal infection. TABLE OF CONTENTS • Epidemiology and pathophysiology of fungal infections • Imaging patterns described in the setting of fungal infections Intracranial Abscesses Encephalitis Meningitis Spondylodiscitis Intraspinal Abscess Saprophytic sinusitis Allergic sinusitis Invasive Sinusitis Orbital cellulitis Orbital Abscess • Most common associated pathogens
NRE185

Spectrum of Imaging Presentation of Central Nervous System Cryptococcal Infection in Immunocompetent and Immunocompromised Patients

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**
- Stenio Bruno Leal Duarte (Presenter): Nothing to Disclose
- Felipe Barjud Pereira do Nascimento MD: Nothing to Disclose
- Mariana Mari Oshima: Nothing to Disclose
- Joao Amaral Mesquita MD: Nothing to Disclose
- Fabiano Reis: Nothing to Disclose

**TEACHING POINTS**

1. To review the pathophysiology and epidemiology of CNS cryptococcosis.
2. To discuss peculiarities of gatti and neoformans variants.
3. To explain and illustrate the utility of MRI in the diagnosis.
4. Exposure results of a 16-case series.

**TABLE OF CONTENTS/OUTLINE**

- Pathophysiology of CNS cryptococcosis
- Peculiarities of gatti and neoformans variants
- Review of imaging findings of 16 patients (MRI of 14 patients and CT scans of 2 patients) of immunocompetent
  - Leptomeningeal enhancement (28.57%)
  - Perivascular spaces involvement (42.85%)
  - Cryptococcal granulomas (28.57%)
  - Only hydrocephalus (14.28%)
  - 28.57% had two or three concomitant different imaging findings, 71.43% had one or no radiological finding.
- Leptomeningeal enhancement (66.67%)
- Perivascular spaces involvement (33.37%)
- Cryptococcal granulomas (22.22%)
- Pachymeningeal enhancement, only hydrocephalus, miliary nodule, plexitis (11.11% each)
- 55.56% had two or three concomitant different imaging findings, and 11.11% had one or no radiological finding.

NRE186

The Cocci has Moxie: Central Nervous System Coccidioidomycosis and Approach to the Differential

*Education Exhibits*

*Location: NR Community, Learning Center*

**Certificate of Merit**

**Participants**
- Stephanie Channual MD (Presenter): Nothing to Disclose
- Jimmy C.S. Huang MD: Nothing to Disclose
- Gasser M. Hathout MD: Nothing to Disclose

**TEACHING POINTS**

1. To provide a pictorial review of the different presentations of Coccidioidomycosis within the central nervous system.
2. To identify imaging pearls to differentiate Coccidioidomycosis from similar-appearing diseases.

**TABLE OF CONTENTS/OUTLINE**

- Introduction to and pathophysiology of CNS coccidioidomycosis
- Multi-modal imaging review of CNS coccidioidomycosis lesions
- Differential diagnoses to CNS coccidioidomycosis, which include eosinophilic granuloma, lymphoma, sarcoidosis, neurocysticercosis, tuberculosis, and bacterial abscesses
- Approach to the differential
- Summary

NRE187

What Is so Hard about Diffusion Tensor Theory? The Fast and Easy “Tract” to Learning Diffusion Tensor Imaging and Tractography

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**
- Mariana Coelho Silva (Presenter): Nothing to Disclose
- Jeremy Binh Nguyen MD: Nothing to Disclose
- Enrique Palacios MD: Nothing to Disclose
- Harold Robert Neitzschman MD: Nothing to Disclose
- Matthew James Brunner BA: Nothing to Disclose
- Mandy Coarse Weidenhaft MD: Nothing to Disclose
- Quan Ngoc Nguyen: Nothing to Disclose
- Montu Patel: Nothing to Disclose
- Navid Eghbalish: Nothing to Disclose
- Erin Werhun: Nothing to Disclose

**TEACHING POINTS**

1. Describe the physical principle and mathematics of diffusion tensor imaging (DTI).
2. Describe the utilization of DTI data.
3. Explain the principle of tractography.
4. Review the normal anatomy of the fiber tracts of the brain in correlation with tractography.
5. Illustrate the applications of DTI to characterize encephalopathies including stroke, neoplasm, neurodegenerative disorders, congenital anomalies, trauma and demyelinating pathologies.

**TABLE OF CONTENTS/OUTLINE**

Physical and mathematical principles of DTI Fiber tract neuroanatomy: Illustrative cases demonstrating the appearance of...


**NRE188**

**18FDG-PET-CT and MRI at Clinical Presentation of Neurolymphomatosis**

*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

ERI OUCHI (Presenter): Nothing to Disclose  
Toshihiro O’Uchi MD : Nothing to Disclose

**TEACHING POINTS**

Neurolymphomatosis is a rare clinical entity that is defined as infiltration of the peripheral nervous system by a known or unknown hematological malignancy and is difficult to diagnose. Usefulness of 18 FDG-PET-CT in diagnosing of NL is emphasized in recent case presentations. According to our experience of nine cases of NL which includes four cases of intravascular lymphoma and five cases of DLBCL, combination of MRI with Gd and 18 FDG-PET-CT is useful to demonstrate involvement of NL due to those morphological and functional images. Seven cases out of nine showed abnormal findings both of imaging modality. Primary NL was recognized in three out of five cases of DLBCL. Understanding of clinical symptoms and typical findings of imaging modalities such as 18 FDG-PET-CT and MRI is very important to diagnose NL properly. Ther purpose of this exhibit is: 1. To review neurolymphomatosis, which is a rare entity and usually difficult to diagnose 2. To learn the typical features of NL in 18 FDG-PET-CT and MRI

**TABLE OF CONTENTS/OUTLINE**

- Epidemiology of Neurolymphomatosis (NL)  
- Pathogenesis of NL  
- Clinical Presentation of NL  
- Appearance of NL - MRI - 18FDG-PET-CT - others

**NRE190**

**Advanced MRI of Diffuse Low Grade Gliomas**

*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

Ana Alonso-Torres MD (Presenter): Nothing to Disclose  
Franziska Charlotte Elisabeth Baudraxler PhD : Nothing to Disclose  
Felix Guerra-Gutierrez PhD : Nothing to Disclose  
Juan Jesus Gomez-Herrera PhD : Nothing to Disclose  
Victor Manuel Suarez-Vega PhD : Nothing to Disclose  
Jaime Fernandez Cuadrado : Nothing to Disclose  
Pablo De Andres PhD : Nothing to Disclose

**TEACHING POINTS**

-To Understand how the management of Diffuse Low Grade Gliomas (DLGG) has dramatically changed lately due to the introduction of new surgical techniques, such as intraoperative electrophysiological monitoring, and new chemotherapy agents, and how imaging plays an increasing role in this new scenario.  
-To present imaging features of DLGG at advanced MRI, and to show the role of advanced MRI in differential diagnosis, grading, surgical planning and follow-up.

**TABLE OF CONTENTS/OUTLINE**

I) PRESENTATION - Epidemiology, Clinical presentation, and Histology  
II) DIAGNOSIS AND ADVANCED MRI  
B. Differential Diagnosis - Non-tumoral and tumoral lesions  
III) MANAGEMENT AND ADVANCED MRI  

**NRE191**

**Benign CNS Neoplasms Showing Restricted Diffusion on DWI- A Radiopathological Correlation Study**

*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

Zarina Abdul Assis MBBS, MD (Presenter): Nothing to Disclose  
Sunita P. Kumaran MBBS, MD : Nothing to Disclose  
Nandita Ghosal MD : Nothing to Disclose  
Sanjaya Viswamitra MD : Nothing to Disclose

**TEACHING POINTS**

Readers will know the differentials of various benign primary CNS neoplasms demonstrating restricted diffusion on MRI. Readers will better appreciate the correlation between diffusion characteristics and histopathological features.

**TABLE OF CONTENTS/OUTLINE**

Introduction: Tumours which demonstrate restricted diffusion are commonly thought of as high grade CNS neoplasms. This is presumed due to increased cellularity and high nuclear-cytoplasmic ratio. We present a pictorial exhibit of benign CNS neoplasms showing restricted diffusion. Methods: The following pathologies will be demonstrated in case-wise manner with...
Bevacizumab in Recurrent Glioma: Patterns of Treatment Failure and Complications

Education Exhibits
Location: NR Community, Learning Center

Cum Laude

Participants
Yi Li MD (Presenter): Nothing to Disclose
Saad Shahid Ali MD: Nothing to Disclose
Jennifer Clarke MD, MPH: Nothing to Disclose
Soonmee Cha MD: Nothing to Disclose

TEACHING POINTS
1. Bevacizumab blocks the action of vascular endothelial growth factor, and is used in the treatment of recurrent glioblastoma.
2. Response to Bevacizumab is indicated by marked decrease in enhancement and decrease in vasogenic edema.
3. The purpose of this educational exhibit is to demonstrate four main patterns of Bevacizumab failure described in the literature and associated non-neoplastic complications following therapy. After describing these patterns, we will present cases in quiz format to reinforce the major teaching points.

TABLE OF CONTENTS/OUTLINE
1. Bevacizumab in the treatment of recurrent glioma - Mechanism of action and evidence behind Bevacizumab therapy - Patterns of treatment response 2. Four main patterns of Bevacizumab failure have been identified in the literature: - Pattern 1: Local tumor progression with increasing FLAIR abnormality, but without enhancement - Pattern 2: Diffuse tumor infiltration in a gliomatosis-like pattern, with minimal enhancement - Pattern 3: Improvement in local tumor, but development of new distant unifocal or multifocal enhancing tumor - Pattern 4: Continued progression of local or multifocal disease with increase in FLAIR and enhancement 3. Several complications of Bevacizumab therapy have been seen: - Diffusion abnormality: ischemic injury or hypoxic/hypercellular tumor - Hemorrhage

Case in the Base: Skull Base Tumors- A Radiological Approach

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Prasanna M MBBS, DMRD (Presenter): Nothing to Disclose
Piyushkumar Chandubhai Pokar: Nothing to Disclose
Zarina Abdul Assis MBBS, MD: Nothing to Disclose
Sunitsa P Kumaran MBBS, MD: Nothing to Disclose
Sanjaya Viswamitra MD: Nothing to Disclose

TEACHING POINTS
• Viewer will learn the skull base anatomy.
• To highlight the specific imaging characteristics on CT and MRI that will enable the viewer to arrive at an appropriate diagnosis for skull base lesions.

TABLE OF CONTENTS/OUTLINE
• Introduction: CT and MR imaging complement each other and are often used together for complete evaluation of skull base lesions such as preoperative staging of the tumors, planning for surgery and to detect recurrences and follow up. • Methods: A review of 50 histopathologically proven cases involving the skull base (arising from or extending to) from 2011-2013 in our institution are used to demonstrate the variety of skull base lesions. CT and MR imaging appearances of the tumors arising from the skull base and the tumors involving the skull base are discussed along with appropriate differentials whenever necessary. Cases include Rosai dorfmann disease, Intradiploic Meningioma, Chondrosarcoma, Fibrous dysplasia, Nasopharyngeal carcinoma, Lymphoma, Schwannoma, Esthesioneuroblastoma, Epidermoid, Paraganglioma, Meningioma, Pituitary adenoma, Craniopharyngioma, Juvenile Nasopharyngeal Angiofibroma.

Dural-based Tumors and Mass-like Lesions: Five Imaging Clues to Diagnose Meningioma Mimics

Education Exhibits
Location: NR Community, Learning Center

Participants
Christopher Jenn Starr MD, PhD (Presenter): Nothing to Disclose
Gregory Edward Punch MD: Nothing to Disclose
Jay Starkey MD: Nothing to Disclose
Soonmee Cha MD: Nothing to Disclose

TEACHING POINTS
- To illustrate five key differential imaging clues which can be extremely helpful in differentiating other dural-based brain masses (i.e., meningioma mimics) from meningiomas. These include: 1) lack of dural tail 2) osseous destruction 3) very dark T2 signal 4) high T2 signal 5) leptomeningeal extension - To illustrate intracranial masses, both benign and malignant, that can
closely mimic meningioma on imaging. - To recognize that a high index of suspicion is a must to be able to differentiate meningioma and its mimics for proper surgical and medical management of patients.

TABLE OF CONTENTS/OUTLINE
1) The audience will first be presented with a set of unknown cases and asked to decide whether an unknown mass represents a meningioma or a meningioma mimic. 2) Using a series of example cases, we will then review a general approach to dural-based brain masses and five key imaging signs that can aid in diagnosing a meningioma mimic. 3) Cases include chondrosarcoma, solitary fibrous tumor, plasmacytoma, lymphoma, schwannoma, metastasis, astroblastoma, and empyema. 4) During the final quiz at the end of the module the audience will be asked to use five imaging signs to help pick out meningioma mimics from a series of unknown cases.

NRE196
Essentials of Glioblastoma: Current Clinical Issues and Imaging Challenges

Education Exhibits
Location: NR Community, Learning Center

Participants
Akira Kunimatsu MD (Presenter): Speakers Bureau, Terumo Corporation
Harushi Mori MD : Nothing to Disclose
Shiori Amemiya MD : Nothing to Disclose
Masaki Katsura MD : Nothing to Disclose
Natsuko Kunimatsu MD : Nothing to Disclose
Kuni Ohtomo MD : Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group

TEACHING POINTS
The purpose of this exhibit is:
1. To review the current concept on genetic alterations of glioblastoma and relevant imaging biomarkers
2. To understand MR imaging findings of glioblastoma with relation to tumor prognosis
3. To discuss how imaging modalities should be used in pre-operative evaluation and post-treatment follow-up

TABLE OF CONTENTS/OUTLINE
1. Genetics and imaging genomics of glioblastoma
2. Tumor biology of glioblastoma and relevant imaging findings
3. Imaging findings and prognosis
4. Imaging strategies to follow up the evolution pathways from low-grade astrocytoma to glioblastoma
5. Evaluation of treatment response and its pitfalls
6. Detection of tumor recurrence and discrimination from necrosis

NRE197
Gliomatosis Cerebri: The Great Misunderstood

Education Exhibits
Location: NR Community, Learning Center

Participants
Lina Marcela Cruz Hernandez ARRT (Presenter): Nothing to Disclose
Isabel Herrera : Nothing to Disclose
Elena Capilla : Nothing to Disclose
Raquel Martin Hernandez : Nothing to Disclose
Ximena Aragon Tejada MD : Nothing to Disclose
Rafael Gonzalez Gutierrez : Nothing to Disclose
Paula Maria Hernandez Guilabert MD : Nothing to Disclose

TEACHING POINTS
Gliomatosis cerebri (GC) is a rare diffusely infiltrating usually bilateral glial tumor involving at least 3 lobes. Its etiology is controversial and is classified as neoplasm of unknown histogenesis. The prognosis is generally poor, survival ranges from weeks to years. The imaging appearances of GC may be similar to more common diseases like herpes encephalitis, but the clinical presentations differ. We will be using material from our Neuroradiology Section to illustrate imaging findings and its correlation with clinical and histological features. The purpose of this exhibit is: To review general GC issues To show characteristic imaging findings at computed tomography (CT) and magnetic resonance (MR) and its correlation with microscopic pathology features To explain the utility of MR advanced techniques in the diagnosis and monitoring To illustrate differences between GC and its principal differential diagnosis using sample cases and diagnostic algorithms

TABLE OF CONTENTS/OUTLINE
Epidemiology, natural history and clinical presentation of GC
Review of imaging findings
- CT features
- Traditional MR features
- Functional imaging findings (Diffusion, perfusion and spectroscopic imaging)
- Radiopathologic correlation

Differential Diagnosis
- Sample cases and diagnostic algorithms

NRE198
"I Can’t See; Could I Have a Pituitary Tumor?": CT and MRI Findings in Patients with Pituitary Tumor (PT) and Visual Disturbances
Participants

Aurymar Fraino (Presenter): Nothing to Disclose
Jose Federico Ojeda Esparza MD: Nothing to Disclose
Roberto Correa Soto: Nothing to Disclose
Teresa Gonzalez De La Huebra Labrador: Nothing to Disclose
Percy Alexander Chaparro Garcia: Nothing to Disclose
Jose Manuel Villanueva Rincon: Nothing to Disclose
Heidy Saenz Acuna MD: Nothing to Disclose
Manuel Jesus Uribe Heredia MEd: Nothing to Disclose
Jose David Abilio Labarra MEd: Nothing to Disclose

TEACHING POINTS

To describe the different CT and MRI findings in patients with PT. To correlate the presence of PT with visual disturbances. To point out the importance of MRI images in PT symptomatic patients.

TABLE OF CONTENTS/OUTLINE

- Epidemiology of PT • To discuss the different etiologies in adults implicated in PT. • To review of imaging findings: o Conventional CT o Findings on contrast-enhanced CT o Conventional MRI o Findings on gadolinium-enhanced MRI • Sample cases.

NRE199

Imaging Of CNS Lymphoma and Its Treatment Complications: Typical, Atypical and Bizarre!

Participants

Girish Bathla MBBS (Presenter): Nothing to Disclose
Bruno A. Policeni MD: Nothing to Disclose
Toshio Moritani MD, PhD: Nothing to Disclose
Aristides Andres Capizzano MD: Nothing to Disclose
Manish Bajaj MBBS, MD: Nothing to Disclose

TEACHING POINTS

1) To discuss the spectrum of imaging findings in both primary and secondary CNS lymphoma and revisit useful imaging signs. 2) To briefly review imaging of treatment related neurotoxicity and other CNS complications.

TABLE OF CONTENTS/OUTLINE

Primary CNS lymphoma [PCNSL] accounts for 1-5% of primary brain neoplasms. Given the increasing incidence, it is projected to become the most common primary brain neoplasm over the next decade. PCNSL can have a myriad of appearances although the location, appearance and epidemiology vary between immunocompetent and immunocompromised patients. It may present as a parenchymal, ventricular or meningeal lesion or uncommonly, may mimic infarcts or diffuse parenchymal infiltration. Lymphomatous CNS involvement may also occur in systemic disease, either at initial presentation or during relapse. In the later instance, CNS involvement may antedate or accompany systemic relapse. Treatment related neurotoxicity may occur due to chemo/ radiation therapy and frequently manifests as diffuse or focal white matter changes, volume loss or shunt infection. Understanding of the underlying disease, its imaging and complications are of vital importance to the radiologist to avoid misdiagnosis and potential pitfalls.

NRE200

Imaging Review: Neoplastic and Tumor-like Lesions of the Skull

Participants

Burke Morin DO (Presenter): Nothing to Disclose
Steven Paul Meyers MD, PhD: Nothing to Disclose

TEACHING POINTS

1. Illustrate characteristic CT and MR imaging features of various neoplastic and tumor-like lesions of the skull.
2. Describe the significant clinical epidemiologic and histopathologic findings associated with each condition.
3. Assist in the development of an appropriate differential diagnosis for skull neoplasms.

TABLE OF CONTENTS/OUTLINE

Specific cases include: Malignant Lesions Metastatic disease, Myeloma, Lymphoma, Leukemia, Chordoma, Chondrosarcoma, Osteosarcoma, Ewing's Sarcoma and Sinonasal Tumors (Esthesioneuroblastoma, Squamous Cell Carcinoma, Adenoid Cystic Carcinoma). Benign Lesions Menigioma, Osteoma, Gliomas Tumor/Paragangioma, Hemangioma, Giant Cell Tumor, Enchondroma, Osteoblastoma, Osteoid Osteoma and Chondroblastoma. Tumor-like Lesions Eosinophilic Granuloma, Sarcoïd, Fibrous Dysplasia, Mucocele, Cholesterol Granuloma, Pseudoaneurysm and Aneurysmal Bone Cyst

NRE203

Multimodality Imaging of Hematologic Neoplasms at Central Nervous System: Can Sound Similar but They Are Not!
Hematologic neoplasms that affects central nervous system (CNS) includes a broad spectrum of radiological appearances. Lymphoma, myeloma and leukemia can mimic many other pathologies of brain and spine and should be included in the differential diagnosis for almost any lesion in these structures. Knowledge of traditional and advanced imaging techniques and their findings is key to making the diagnosis and follow treatment response. The major teaching points of this exhibit are: To review typical and atypical presentations of CNS hematologic neoplasms at traditional computer tomography (CT) and magnetic resonance imaging (MR). To show characteristic findings with advanced imaging techniques. To illustrate differences between CNS hematologic neoplasms and their principal differential diagnosis.

## Table of Contents/Outline
- Lymphoma CT and MR Findings
- Intracranial Lymphoma
- Intravascular Lymphoma
- Ocular and Orbital Lymphoma
- Spinal Lymphoma
- Myeloma CT and MR Findings
- Cranial Affectation
- Spinal Myeloma
- Plasmocytoma
- POEMS Syndrome
- Leukemia CT and MR Findings
- Osseous Affectation
- Meningeal Disease
- Intravascular Aggregates
- Choroma
- Functional Imaging Findings
- Diffusion, Perfusion and Spectroscopic Imaging
- Differential Diagnosis

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**NRE204**

### Neuroimaging in Childhood Leukemia and Lymphoma: A Pictorial Review

#### Table of Contents/Outline
- The neuroimaging features of childhood leukemia and lymphoma have been classified into three main categories.
  1. Central nervous system findings of primary malignancy - Cerebrovascular disease (Craniospinal hemorrhage, cerebral infarction)
  2. Central nervous system involvement (Infiltration of leptomeninges, bone marrow, orbit, spine)
  3. Complications of therapeutic procedures - Radiation therapy (White matter disease, cerebral volume loss and hydrocephalus, cryptic vascular malformations)
  4. Chemotherapy and bone marrow transplantation (Dural sinus thrombosis, white matter disease, posterior reversible leukoencephalopathy syndrome)
  5. Infectious diseases due to immunosuppression - Fungi (Mucormycosis, aspergillus, candida)

Summary: Recent developments in the treatment of pediatric hematologic neoplasms have improved the prognosis but resulted in an increased incidence of neurologic complications. The awareness of the imaging features is essential for early diagnosis and proper treatment of neurologic symptoms to increase survival in pediatric patients with leukemia and lymphoma.

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**NRE205**

### New Faces of an Old Foe: Unusual Appearances of Glioblastoma Multiforme on MRI

#### Table of Contents/Outline
- Introduction: Atypical GBM’s are rare and provide a diagnostic challenge. This exhibit helps to familiarise atypical appearances and location of GBM alongside the classical appearances.
- Methods: 25 atypical cases of GBM were obtained from 125 histopathologically proven cases of GBM from year 2010-2013. We present a review of the MR findings, the differentials and histological grades of these atypical cases. Atypical locations included extra axial, intraventricular, posterior third ventricular, posterior fossa. Unusual appearances were purely cystic lesion, cystic lesion with a mural nodule, non enhancing, multifocal, GBM with sub ependymal spread.
- Summary: It would be of interest to the viewer that most of the atypical GBM’s with non aggressive appearances on MR imaging turned out to be a Grade IV tumor on histopathology.
Opportunistic Infection of Head and Neck: Spectrum of Appearances at CT and MR Imaging

Education Exhibits
Location: NR Community, Learning Center

Participants
Ryutarou Ukisu MD (Presenter): Nothing to Disclose
Yusuke Inoue MD, PhD: Nothing to Disclose
Takuro Yamane: Nothing to Disclose
Asami Otsuka: Nothing to Disclose
Rie Shimada: Nothing to Disclose

TEACHING POINTS
Patients with immune suppression may present with unusual infectious process of the head and neck. Sinonasal diseases are the most frequent and manifest in up to 60% of immunosuppressed adult patients. Early recognition and timely treatment of these potentially life-threatening disorders are essential. In this exhibit, we review and describe the CT/MR imaging characteristics together with signs and symptoms of the pathologic conditions in the head and neck in immunosuppressed patients. The teaching points of this exhibit are: 1) to know the opportunistic head and neck infections in patients with immunosuppression; 2) to expose radiologists for relatively unusual lesions on CT/MR imaging in order to improve their diagnostic ability.

TABLE OF CONTENTS/OUTLINE
Introduction Case presentation Each case will be presented with a review of clinical signs and symptoms, epidemiology, treatment as well as CT/MR imaging pearls with unique pathological insights. 1) Invasive aspergillosis 2) Aspergillus otomastoiditis 3) Malignant external otitis 4) Tuberculosis lymphadenitis 5) Chronic osteomyelitis of mandible 6) Gingival actinomycosis 7) Venous thrombosis 8) Others Summary

NRE208
Post Therapy Evaluation of Brain Tumors

Education Exhibits
Location: NR Community, Learning Center

Cum Laude

Participants
Jeffrey Ware MD (Presenter): Nothing to Disclose
Ronald L. Wolf MD, PhD: Nothing to Disclose
Harish Poptani PhD: Nothing to Disclose
Donald M. O'Rourke MD: Nothing to Disclose
Suyash Mohan MD: Nothing to Disclose

TEACHING POINTS
Understanding the key concepts of pseudoprogression and pseudoresponse Specific MRI features that can help differentiate between residual tumor and treatment related changes Understanding the Response Assessment in Neuro-Oncology (RANO) criteria

TABLE OF CONTENTS/OUTLINE
Current therapy and standard of care Principles of post operative evaluation True progression vs Pseudoprogression (PsP) Treatment related/ Radiation Necrosis (RN) Antiangiogenic therapy and Pseudoresponse (PsR) Limitations of Macdonald’s criteria and rationale for the RANO criteria Advanced imaging techniques in the post treatment setting - MR perfusion (DSC and DCE), DWI, MRS, and PET Future perspectives - emerging techniques in molecular imaging and radiogenomics; tumor vaccine trials

NRE210
Radiologic Findings of Primary Posterior Fossa Brain Tumors in Children

Education Exhibits
Location: NR Community, Learning Center

Participants
Tae Wook Heo (Presenter): Nothing to Disclose
Seul Kee Kim: Nothing to Disclose
Woong Yoon MD: Nothing to Disclose
Heoung-Keun Kang MD: Nothing to Disclose

TEACHING POINTS
1. To review the MRI findings of infratentorial pediatric primay brain tumor
2. To explain the utility of advanced MRI (diffusion-weighted imaging and susceptibility-weighted imaging) in diagnosis
3. To explain the diagnostic flow chart of posterior fossa tumor

TABLE OF CONTENTS/OUTLINE
Overview of pediatric brain tumor - age distribution - tumor locations Review the MRI findings of the following posterior fossa tumors. - Medulloblastoma - Atypical teratoid/rhabdoid tumor - Ependymoma - Pilocytic astrocytoma - Brain stem glioma Explain the utility of the advanced MRI (DWI and SWI) in diagnosis Diagnostic flow chart in differential diagnosis of posterior fossa tumors

NRE212
Response Assessment Criteria in Neuro-Oncology: Past, Present and Future
TEACHING POINTS


TABLE OF CONTENTS/OUTLINE

Hystory revision of response assessment criteria for high-grade Gliomas MacDonald RECIST (v 1.0) RECIST (v 1.1) RANO Differences and changes between them Important concepts (review of imaging findings and sample cases) Pseudoprogression Pseudoresponse Future directions and summary

NRE213

Spectrum of Imaging Findings of Glioblastomas (GBMS): Focused on MR Findings

Participants

Yutaka Ozaki MD, PhD (Presenter): Nothing to Disclose
Shigeki Aoki MD, PhD : Nothing to Disclose
Maki Amano MD : Nothing to Disclose
Mirei Watanabe MD : Nothing to Disclose
Masato Hishii MD, PhD : Nothing to Disclose
Yoshihisa Ogura MD, PhD : Nothing to Disclose
Masaaki Hori MD : Nothing to Disclose
Yoshitaka Masutani PhD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: To illustrate the spectrum of imaging findings of GBMs, and to discuss protocol of preoperative examination, especially focused on MR images. To learn common and unusual manifestations; such as infratentorial location, secondary GBM, multifocal GBM, paucity of contrast enhancement, marked cystic degeneration, massive bleedings mimicking intracerebral hemorrhage. To learn recent application of advanced techniques to GBM, such as diffusion kurtosis imaging, ASL, and etc. The major teaching points of this exhibit are: Each unusual manifestations of GBM, such as multifocal, secondary, mainly cystic, massive hemorrhage, and poor enhancement visualized in approximately less than 5% of the patients. It is important to make a correct diagnosis of GBM complementary usage of MRS, diffusion, and perfusion imaging.

TABLE OF CONTENTS/OUTLINE

Introduction General aspects of GBM Protocol of MRI for pretreatment of GBM Location of GBM Multifocal GBM Primary vs. secondary GBM Gd enhancement of GBM T2 prolongation and diffusion restriction of GBM Secondary degeneration of GBM MR spectroscopy Diffusion tensor imaging/ DKI and other diffusion MR metrics Perfusion imaging: DSC, ASL and pearmeability 18F-FDG vs. 11C-MET PET

NRE214

Spectrum of Tumors involving Posterior Third Ventricle: Anatomical, Clinical, Radiological and Histopathological Review

Participants

Sunitha P Kumaran MBBS, MD (Presenter): Nothing to Disclose
Zarina Abdul Assis MBBS, MD : Nothing to Disclose
Sanjaya Viswamitra MD : Nothing to Disclose

TEACHING POINTS

Understand the anatomy of posterior third ventricular region. Learn the imaging appearances of posterior third ventricular tumors with histopathological correlation. Utilise radiological clues to arrive at the diagnosis.

TABLE OF CONTENTS/OUTLINE

Introduction: Posterior third ventricle and its surrounding region is rich in varied tissue types clustered within a very small area. Common pathologies in this uncommon location and rare pathologies may be found here. Thus, understanding the anatomy of this region and the various lesions that occur here is important in making the correct diagnosis. Methods: Detailed anatomy of posterior third ventricle region will be followed by 20 histologically proven cases from our institutional experience, presented in a case based format with MR imaging. Viewers will be encouraged to deduce the anatomy of origin and specific tissue characteristics when possible in the following common and rare tumors: Pineoblastoma Pineocytoma Pilocytic astrocytoma Pleomorphic xanthoastrocytoma Anaplastic Astrocytoma Pilomyxoid Astrocytoma Glioblastoma multiforme Quadrigeminal plate lipoma Epidermoid Teratoma Germinoma Meningioma Hemangioma Atypical neurocytoma Epidermodyoma Choroid plexus papilloma Pineal metastasis Fibro-osseous tumor Mixed germ cell tumors
The Faces of Intraventricular Neoplasms: Narrowing a Difficult Differential

**Participants**

Mark Broadbent MD (Presenter): Nothing to Disclose  
Ted Alexander Selzman MD: Nothing to Disclose  
Jared Shields BS: Nothing to Disclose  
Isaac Wu: Nothing to Disclose

**TEACHING POINTS**

The differential diagnosis of intraventricular neoplasm is large, and is complicated by significant overlap between the different entities. This exhibit discusses key points from imaging and patient history that allow radiologists to appropriately narrow the differential.

**TABLE OF CONTENTS/OUTLINE**


NRE216

Third Eye Blind? Pearls for Differentiating Pineal Lesions

**Participants**

Robert Joseph Shroyer MD (Presenter): Nothing to Disclose  
Ammar Ahmed Chaudhry MD: Nothing to Disclose  
Alexander Filatov MD: Nothing to Disclose  
Avraham Bluestone MD, PhD: Nothing to Disclose  
Robert George Peyster MD: Nothing to Disclose  
Lev Bangiyev DO: Nothing to Disclose

**TEACHING POINTS**

Pineal region pathology is relatively common and has a broad differential diagnosis. A systematic approach is therefore required in narrowing the differential for various pineal lesions. It is important to consider not only the pertinent imaging findings, but also the patient's demographics and available history in order to improve diagnosis accuracy. The purpose of this educational exhibit is to present an algorithmic approach to pineal region lesions with emphasis on patient clinicopathologic findings and imaging features.

**TABLE OF CONTENTS/OUTLINE**

Using quiz format key differential diagnostic points will be highlighted in the discussion of each case. Systematic review will include following categories and cases:  
• Germ Cell Tumors - germinoma, teratoma, malignant NOS  
• Pineal Parenchymal Tumors - pineocytoma, pineoblastoma, pineal parenchymal tumor of intermediate differentiation, trilateral retinoblastoma  
• Neoplasms of adjacent tissues - tectal glioma, meningioma, Lymphoma  
• Metastasis  
• Papillary tumors of the pineal region  
• Non-neoplastic - pineal cyst, pineal lipoma, arachnoid cyst, epidermoid cyst, neurocysticercosis, cavum velum interpositum

NRE217

Too Late for a Pilocytic Astrocytoma?

**Participants**

Joao Maia Jacinto MD (Presenter): Nothing to Disclose  
Mariana Goncalves Dias Diogo MD: Nothing to Disclose  
Isabel Fragata MD, MSc: Nothing to Disclose  
Carla Conceicao MD: Nothing to Disclose  
Joao Reis: Nothing to Disclose

**TEACHING POINTS**

• Astrocytomas are the single largest group of all primary central nervous system (CNS) neoplasms.  
• They are currently classified according to histological features and the subtypes prevalence differs on peak age.  
• The pilocytic subtype occurs almost exclusively in children and frequently in the posterior fossa.  
• Despite the fact that diffuse subtypes are more common in adults and mostly located in the cerebral hemispheres, pilocytic astrocytoma should not be discarded from differential diagnosis, regardless of age or lesion topography.

**TABLE OF CONTENTS/OUTLINE**

• Review of our prospective database of CNS neoplasms between January and December 2013.  
• A total of 255 CNS tumors were found, with 10 pilocytic astrocytomas. Of these, 3 were found in adults above 60 years-old. One was infratentorial and the other two were hemispheric.  
• Clinical data, imagiological findings and pathological features were analyzed.

NRE218

Uncommon and Unusual Lesions of the Pineal Region

**Participants**

Joao Maia Jacinto MD (Presenter): Nothing to Disclose  
Mariana Goncalves Dias Diogo MD: Nothing to Disclose  
Isabel Fragata MD, MSc: Nothing to Disclose  
Carla Conceicao MD: Nothing to Disclose  
Joao Reis: Nothing to Disclose

**TEACHING POINTS**

• Review of our prospective database of CNS neoplasms between January and December 2013.  
• A total of 255 CNS tumors were found, with 10 pilocytic astrocytomas. Of these, 3 were found in adults above 60 years-old. One was infratentorial and the other two were hemispheric.  
• Clinical data, imagiological findings and pathological features were analyzed.
Certificate of Merit

Participants
Gabriela De La Vega Muns MD (Presenter): Nothing to Disclose
Gaurav M. Saigal MBBS: Nothing to Disclose
Rita G. Bhatia MD: Nothing to Disclose

TEACHING POINTS
1. Discuss the differential diagnosis of lesions in the pineal region focusing on uncommon and unusual masses encountered in this region.
2. Describe the salient imaging findings of uncommon pineal region lesions.
3. Review the literature in regard to CT and MRI findings associated with the pineal region masses discussed.

TABLE OF CONTENTS/OUTLINE
Pineal gland region masses present a diagnostic challenge to the radiologist because many of their imaging findings overlap. Furthermore, making the correct diagnosis is important since it may alter surgical approach and subsequent management in some cases. Representative cases for each entity will be presented along with a review of the relevant literature regarding CT, MRI, and, in some cases, PET/CT in order to emphasize the imaging characteristics that help to differentiate them, when possible.

TABLE OF CONTENTS/OUTLINE

NRE220
Applications of FDG-PET and Arterial Spin Labeling MR Imaging in Quantification of Cerebral Metabolic Activity and Blood Flow in Neurodegenerative Diseases: Comparison of FDG-PET and ASL

Education Exhibits
Location: NR Community, Learning Center

Participants
Sina Houshmand MD (Presenter): Nothing to Disclose
Ali Salavati MD, MPH: Nothing to Disclose
Benjapa Khiewvan: Nothing to Disclose
Sudipto Dolui PhD: Nothing to Disclose
Abass Alavi MD: Nothing to Disclose

TEACHING POINTS
To review applications of currently available FDG-PET quantification techniques in assessment of cerebral metabolic activity of Alzheimer’s disease patients. To review and compare arterial spin labeled MR imaging with FDG-PET in diagnosis and characterization of Alzheimer's disease.

TABLE OF CONTENTS/OUTLINE
Alzheimer’s disease (AD) is a neurodegenerative disease associated with alterations in cerebral blood flow (CBF) in different regions of brain. These changes have been well correlated with cerebral metabolism abnormalities using 18F-fluorodeoxyglucose positron emission tomography (FDG-PET). Arterial spin labeling (ASL) MRI which utilizes magnetically labeled blood water as a tracer for CBF quantification has shown to be a potential non-invasive biomarker for AD over the last several years. In this review we will discuss applications of these two modalities and compare their characteristic features and potential for diagnosis of AD and its spectrum. 1. FDG-PET i. Pathophysiology of changes in FDG-PET images ii. Pattern of changes iii. Correlation with clinical severity iv. Use as therapeutic endpoint v. Sensitivity and specificity vi. Quantitative methods 2. ASL MRI i. Technical aspects of ASL ii. Regions of hypoperfusion iii. Correlation with PET

NRE221
Approach to Acute Visual Loss

Education Exhibits
Location: NR Community, Learning Center

Participants
Sameer Surendra Soneji DMRD (Presenter): Nothing to Disclose
Ritu Manoj Kakkar MBBS: Nothing to Disclose
Ankit Radhakrishna Bajpai MBBS: Nothing to Disclose
Shrinivas Balaji Desai MD: Nothing to Disclose

TEACHING POINTS
To outline a clinico-radiological approach to acute visual loss.

TABLE OF CONTENTS/OUTLINE
Causes of acute visual loss are optic or neurological. Optic causes are refractive errors and media opacities and do not require cross-sectional imaging. Neurological visual loss assessed by unilateral relative afferent pupillary defect (RAPD) and pattern of visual loss (POVL). RAPD differentiated between prechiasmal and retrochiasmal lesions. Characteristic POVL’s are Central scotoma in optic neuritis (ON) Altitudinal defect in anterior ischemic optic neuritis (AION) Bitemporal deficit in chiasmal lesions Peripheral constriction with enlarged blind spot in papilledema or pseudotumor cerebri Homonymous Incongruous Hemianopia/ Homonymous Quadrantanopia/Homonymous Congruous Hemianopia in optic tract and optic radiation lesions. Commonest causes of Optic Neuritis are Demyelination, ADEM, Infectious, inflammatory, compressive and traumatic. Giant cell arteritis is important caused of AION. In Papilledema differential diagnosis to consider are hydrocephalous, masses and venous thrombosis. Sellar and parasellar lesions can compress the chiasma. Optic tract and radiations affection can be seen by vascular causes, tumors, trauma and migraines. Radiological evaluation of acute visual loss with neuro-ophthalmological findings can guide timely emergency management.

NRE222
Be Smart and Know SMART

Education Exhibits
Location: NR Community, Learning Center

Participants
Arbab Zafar Iqbal MD (Presenter): Nothing to Disclose
Mohammed Mohsin Khadir MD : Nothing to Disclose
Ali Haikal Hussain MD, FRCR : Nothing to Disclose

TEACHING POINTS
1) Gain a thorough understanding of this rare, but important condition including presenting symptoms and prognosis. 2) Discuss the radiological manifestations of SMART syndrome and its mimics. 3) Become aware of the proposed diagnostic criteria

TABLE OF CONTENTS/OUTLINE
Background of SMART syndrome Review proposed diagnostic criteria and postulated pathophysiological mechanisms Review of radiological presentations Discussion of differential diagnoses Show cases of SMART syndrome in addition to cases of mimics Summary of SMART syndrome with emphasis on most pertinent take home points

NRE224

Brain Death: Radiologic Signs of a Nonradiologic Diagnosis

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics

Participants
Joseph Brian Gastala MD (Presenter): Nothing to Disclose
Aristides Andres Capizzano MD : Nothing to Disclose
Patricia A. Kirby : Nothing to Disclose
Toshio Moritani MD, PhD : Nothing to Disclose

TEACHING POINTS
1. Review the clinical findings of brain death
2. Illustrate the multimodal imaging findings of brain death
3. Explain the utility of imaging in the diagnosis of brain death

TABLE OF CONTENTS/OUTLINE

NRE225

Cerebellar Tonsillar Herniation: More than the Chiari Malformation

Education Exhibits
Location: NR Community, Learning Center

Participants
Erik Steckler MD, BS (Presenter): Nothing to Disclose
Ryan David Murtagh MD, MBA : Nothing to Disclose
Robert Andrew Zamore MD : Nothing to Disclose

TEACHING POINTS
1. The reader should understand criteria for cerebellar tonsillar herniation as well as appropriate landmarks and measurement techniques used to confirm presence of herniation. 2. Reader should understand differential diagnosis of cerebellar tonsillar herniation and be aware of relevant imaging findings that can be used to suggest etiology.

TABLE OF CONTENTS/OUTLINE

NRE227

Changes Post Neurosurgery: A Pictorial Review for Residents

Education Exhibits
Location: NR Community, Learning Center

Selected for RadioGraphics
## Participants

Luiz Carlos Donoso Scoppetta MD (Presenter): Nothing to Disclose  
Fabricius Andre Lyrio Trappe MD: Nothing to Disclose  
Janaina Johansson MD: Nothing to Disclose  
Roberta Stoppato De Carvalho: Nothing to Disclose  
Andre de Queiroz Pereira da Silva MD: Nothing to Disclose  
Maria Eugenia Durante: Nothing to Disclose  
Simone Shibao MD: Nothing to Disclose  
Bruno Barcelos Nobrega MD: Nothing to Disclose

## Teaching Points

To review the expected postoperative appearances and complications in neurosurgery. To explain the usefulness of computed tomography and magnetic resonance imaging in diagnosis of each particular post surgical complication.

## Table of Contents/Outline

Introduction  
Review the normal postoperative appearances, as extra cranial soft tissues findings, burr holes, craniotomy, craniectomy, cranioplasty, pneumocephalus and surgical bed appearance.  
Review the complications like tension pneumocephalus, infection (abscess, empyema, osteomyelitis), hemorrhagic lesions (such as hematomas and remote cerebellar hemorrhage), brain herniation (paradoxical herniation, extra cranial herniation), vascular lesions (arterial occlusion and venous thrombosis) and CSF fistula.

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### NRE228

**Clinical Utility and Pitfalls of Arterial Spin Labeling (ASL) in Depressed Patients**

**Education Exhibits**  
**Location:** NR Community, Learning Center

#### Participants

Yoko Kaichi (Presenter): Nothing to Disclose  
Toru Higaki PhD: Nothing to Disclose  
Chihiro Tani MD: Nothing to Disclose  
Yuko Nakamura MD: Nothing to Disclose  
Fuminari Tatsugami: Nothing to Disclose  
Kazuo Awai MD: Research Grant, Toshiba Corporation; Research Grant, Hitachi Ltd; Research Grant, Bayer AG Research Consultants; DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd

#### Teaching Points

1. The clinical utility of ASL, a noninvasive neuroimaging modality, for the objective assessment and differential diagnosis of neuropsychiatric deficits in depressed patients. Although some diseases eliciting depression share neuropsychiatric features, their regional cerebral blood flow (rCBF) distribution is different.  
2. Some depressed patients manifest carotid artery stenosis. As the delayed arterial transit effect may result in the retention of labeled arterial blood in the feeders, this must not be misinterpreted as increased rCBF. The presence of extra-axial lesions must be considered.

#### Table of Contents/Outline

1. Interpretation of ASL in depressed patients - principles of ASL - rCBF distribution in depressed patients  
2. Value of ASL for evaluating the severity of depression - correlation between rCBF and depression severity  
3. Value of ASL for the differential diagnosis of diseases that may produce depression - comparison of the rCBF distribution in patients with transient hypothyroidism, major depressive disorder, and the controls  
4. Value of ASL for predicting the response to antidepressants - comparison of the rCBF distribution in patients with refractory- and responsive depressive disorder  
5. Value of ASL for the assessment of cure from depression  
6. Diagnostic pitfalls in readings of ASL

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### NRE229

**High Resolution 3D Magnetic Resonance Imaging of the Oculomotor Nerve: Segmental Anatomic and Pathologic Considerations**

**Education Exhibits**  
**Location:** NR Community, Learning Center

#### Participants

Marinos Kontzialis MD (Presenter): Nothing to Disclose  
Asim F. Choudhri MD: Nothing to Disclose  
Vivek R. Patel MD: Nothing to Disclose  
Prem Subramanian: Nothing to Disclose  
Gary Gallia: Nothing to Disclose  
Masaru Ishii MD: Nothing to Disclose  
Nafi Aygun MD: Nothing to Disclose  
Ari Meir Blitz MD: Research Grant, B. Braun Melsungen AG

#### Teaching Points

1. On imaging the cranial nerves may be generically divided into segments based on the surrounding tissue (and referred to with the abbreviation CN #.segment). This variation in environment poses particular imaging challenges, influences the differential diagnosis and, when applicable, has implications for neurosurgical approach. 2. High-resolution 3D skull base MRI without and with contrast allows for visualization of the oculomotor nerve along much of its course and may increase sensitivity for abnormalities of the oculomotor nerve in regions that were previously challenging to evaluate. For each segment the high resolution anatomy is described along with important considerations for localization on physical examination and relevant pathologic entities.

#### Table of Contents/Outline

Segmental anatomy of the oculomotor nerve: -Nuclear (CN III.a) -Parenchymal fascicular (CN III.b) -Cisternal (CN III.c) -Dural cave (CN III.d) -Interrudal (CN III.e) -Foraminal (CN III.f) -Extraforaminal (CN III.g). In this scientific exhibit, we share our experience to date with high resolution imaging of the anatomic segments of the oculomotor nerve and review pathologic...
TEACHING POINTS

1. Review the anatomy of middle cerebellar peduncles (MCP) and associated fiber tracts
2. Discuss how to characterize bilateral MCP lesions in narrowing the differential diagnoses
3. Present an interactive case series on bilateral MCP lesions to improve diagnostic accuracy of radiologists

TABLE OF CONTENTS/OUTLINE

1. MCP - anatomy, vascular supply, and associated fiber tracts
2. Interactive case series with relevant clinical data and key differential diagnostic features
   A. Neurodegenerative
      - Sporadic olivopontocerebellar atrophy
      - Parkinson-plus syndromes
      - Spinocerebellar ataxia
      - Fragile X-associated tremor/ataxia syndrome
   B. Metabolic
      - Adrenoleukodystrophy
      - Hepatic encephalopathy
      - Extra-pontine myelinolysis
      - Hypoglycemia
   C. Cerebrovascular
      - Infarction
      - Posterior reversible encephalopathy syndrome
   D. Infectious / Inflammatory
      - Multiple sclerosis
      - Neurosarcoidosis
      - PML in HIV
      - Rhombencephalitis
      - ADEM
   E. Neoplastic
      - Glioma
      - Lymphoma
      - Metastasis / meningeal carcinomatosis
   F. Genetic / Developmental
      - Pontine tegmental cap dysplasia
      - Von Hippel-Lindau disease
3. Conclusion - Understanding how underlying pathophysiology relate to certain imaging patterns, combined with relevant clinical data, is very useful in narrowing the differential diagnoses of bilateral MCP abnormalities.

TEACHING POINTS

The purpose of this exhibit is: Investigate the meaning of the images punctate of low signal ("black dots") on magnetic susceptibility sequences. Consider the differential diagnosis of the various causes of cerebral microbleeds, illustrating all with images collected during assistencial activity developed in our center.

TABLE OF CONTENTS/OUTLINE

"Hot spots" in the sequence T2 * and currently the most modern magnetic susceptibility sequences are hypointense lesions less than half centimeter of diamtero, that go unnoticed in other MR sequences. These images are derived from a ferromagnetic artifact produced by accumulation of hemosiderin inside macrophages after microhemorrhages. Causes of "black dots" produced by micro bleedles are: - Congofilia or amyloid angiopathy. - Hypertensive angiopathy. - Multiple cavernous. - Diffuse axonal-injury. - Hemorrhagic micrometastasis. - Microembolisms metal originators from artificial heart valves. - Vasculitis - CADASIL. With magnetic susceptibility sequences we identify "black spots" not visible in other sequences. Considering its distribution, morphology, other MRI findings and the clinical context of the patient, we can guide a differential diagnosis between various pathologies that may determine it.
Participants

Maria Del Pilar Sanchez-Camacho Gonzalez-Carrato MD (Presenter): Nothing to Disclose
Isabel Herrera: Nothing to Disclose
Paula Maria Hernandez Guillabet MD: Nothing to Disclose
Elena Capilla: Nothing to Disclose
Manuel Amosa: Nothing to Disclose
Rafael Gonzalez Gutierrez: Nothing to Disclose

TEACHING POINTS

1. To review the normal findings and intra-extracranial complications after hydrocephalus treatment by ventricular shunt
2. To learn the normal imaging findings and intra-extracranial complications after ventricular shunt placement with computed tomography (CT), magnetic resonance imaging (MRI), digital radiography (DR), abdominal ultrasound (AU) and transfontanelar ultrasound (TU)

TABLE OF CONTENTS/OUTLINE

We retrospectively reviewed the ventricular shunt procedures performed at our center from October 2012 to January 2014, analyzing postprocedural normal imaging findings and complications. Postoperative control was carried out with CT, MRI, DR, AU and/or TU. Out of overall 614 neurosurgical procedures, 206 were ventricular shunt placements. Postoperative complications were observed in 72 (34.95%) of them: Intracranial complications (65 - 90.28% -): - 19 infections, - 16 shunt obstructions, - 11 pericatheter or intraventricular bleedings, - 11 overshuntings, - 4 misplacements into brain parenchyma, - isolated cases of ventricular loculation, corpus callosum edema, cerebral venous thrombosis and paradoxical herniation. Extracranial complications (7 - 9.72% -): - 2 abdominal pseudocysts, - isolated cases of intestinal perforation, peritoneal fibrosis, distal catheter misplacement, broken shunt and atrial thrombosis.

NRE235

Imaging Review: Non-neoplastic Skull Abnormalities

Participants

Burke Morin DO (Presenter): Nothing to Disclose
Steven Paul Meyers MD, PhD: Nothing to Disclose

TEACHING POINTS

1. Give an overview of non-neoplastic conditions that affect the skull, to include congenital, developmental, hematologic, metabolic, genetic and inflammatory causes.
2. Provide a description of characteristic imaging findings illustrated with CT and MRI.
3. Describe significant clinical epidemiologic and histopathologic findings associated with each condition.

TABLE OF CONTENTS/OUTLINE

Examples Include: Congenital Meningoceles, Meningoencephaloceles and Atretic cephaloceles (e.g. Nasal glioma, Dermoid/Epidermoid, Neurenteric cyst, Sinus pericranii, Parietal foramina). Developmental Microcephaly (e.g. Hypoxic ischemic injury, TORCH, Trisomies 13 and 21). Macrocephaly (e.g. Alexander, Canavan, Megalencephalic Leukodystrophy with subcortical cysts, Hydrocephalus). Cranial Asymmetry (e.g. Craniosynostosis, Apert, Crouzon, Cleidocranial dysostosis, Achondroplasia). Hematologic Sickle cell disease, Thalassemia and Leukemia. Metabolic/Genetic Osteogenesis imperfecta, Achondrogenesis, Hypophosphatasia, Menkes syndrome, Osteopetrosis, Oxalosis, Hyperparathyroidism, Hyperphosphatemic rickets, Paget’s disease. Inflammatory Osteomyelitis, Sarcoïd, Eosinophilic granuloma, Erdheim Chester disease, Sinusitis, Potts puffy tumor and Mastoiditis.

NRE236

Intracranial Hypotension; A Clinical Conundrum

Participants

Mustafa Al Roubaie MD (Presenter): Nothing to Disclose
David Borukhov MD: Nothing to Disclose
Adam Evans MD: Nothing to Disclose

TEACHING POINTS

The purpose of this educational exhibit is to: 1. Review the clinical presentation of patients with intracranial hypotension, which is often confusing. Intracranial hypotension can masquerade as intracranial hypertension due to the presence of subdural hematomas, and this may have grave consequences since management is considerably different. 2. Review imaging findings of intracranial hypotension.

TABLE OF CONTENTS/OUTLINE

1. Intracranial Hypotension.
   a. Etiology, pathophysiology and clinical presentation.
   b. Imaging findings and other work-up.
   c. Treatment.
2. Sample Cases.
NRE237

Is Magnetoencephalography for Radiologists? Yes!

*Education Exhibits*

Location: NR Community, Learning Center

Certificate of Merit

**Participants**

Judith Ann Gadde DO (Presenter): Nothing to Disclose
William C. Gaetz PhD : Nothing to Disclose
Timothy Roberts PhD : Nothing to Disclose
Erin Simon Schwartz MD : Nothing to Disclose

**TEACHING POINTS**

1. To increase awareness of the technique and utility of magnetoencephalography (MEG), particularly in the settings of intractable epilepsy and presurgical functional mapping. 2. To emphasize the unique role that Radiologists can play in integrating multimodal imaging for MEG patients.

**TABLE OF CONTENTS/OUTLINE**

1. Brief introduction to MEG, including a review of current techniques, clinical indications, and relevant literature. 2. Correlation of MEG, MRI, electroencephalography (EEG), and clinical findings in patients with intractable epilepsy, including demonstration of the valuable contributions of MEG data in presurgical evaluation and planning. 3. Correlation of MEG findings with histopathology and clinical outcome from surgical resection in intractable epilepsy.

NRE239

Like a Hole in the Head: An Anatomical Approach to Calvarial Lesions

*Education Exhibits*

Location: NR Community, Learning Center

Certificate of Merit

**Participants**

Amar P. Patel MD (Presenter): Nothing to Disclose
Thomas P. Madaielli MD : Nothing to Disclose
James W. Berger MD : Nothing to Disclose
Matthew Shawn Parsons MD : Nothing to Disclose

**TEACHING POINTS**

1. Understand cross sectional calvarial anatomy
2. Recognize the characteristic imaging findings of various calvarial lesions
3. Use location, key imaging features, and radiological pearls to accurately diagnose calvarial lesions

**TABLE OF CONTENTS/OUTLINE**

1. Review cross sectional calvarial anatomy categorized into the outer table, diploic space, and inner table 2. Case-based presentation with emphasis on the location and distinguishing imaging features of the following benign and malignant calvarial lesions: - Outer Table Parietal thinning Osteoma Emissary vein - Diploic Space Diploic veins Venous lakes Epidermoid Dermoid Eosinophilic granuloma Hemangioma - Inner Table Arachnoid granulations Meningioma Hyperostosis frontalis interna - All Tables Parietal foramen Leptomeningeal cyst Cephalocele Multiple myeloma Metastasis Paget’s disease Acromegaly Fibrous dysplasia
3. Review of some fundamental rules to keep in mind when trying to distinguish benign from malignant calvarial lesions 4. Summary table of lesions classified by location within the calvaria

NRE241


*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

Chris Bent MD (Presenter): Nothing to Disclose
Peter Shen MD : Nothing to Disclose
Paul Sung Lee MD : Nothing to Disclose

**TEACHING POINTS**

1. Review normal skull base anatomy and common pathologies treated with endonasal endoscopic surgery 2. Demonstrate normal post-operative MR appearance of nasoseptal flap reconstruction 3. Review imaging findings for most common complications after nasoseptal flap reconstruction

**TABLE OF CONTENTS/OUTLINE**

MRI Findings of Acute Toxic and Acquired Metabolic Encephalopathies: Role of Diffusion Weighted Imaging

Education Exhibits
Location: NR Community, Learning Center

Participants
Eun Ja Lee (Presenter): Nothing to Disclose
Bo Young Jeong: Nothing to Disclose
Eun Kyoung Lee: Nothing to Disclose

TEACHING POINTS
To review and illustrate the characteristic MRI features of common and uncommon toxic-acquired metabolic encephalopathies and correlate with their clinical features. To determine the role of diffusion weighted imaging (DWI) for the diagnosis of toxic and acquired metabolic encephalopathies. To help narrow the differential diagnosis in a case of acute encephalopathy.

TABLE OF CONTENTS/OUTLINE
1. General overview of altered metabolism and acute exposure to toxic agents
2. Review of imaging findings and clinical features in common and uncommon toxic and acquired metabolic encephalopathies - Metabolic encephalopathy: hypoglycemic encephalopathy, hypoxic ischemic encephalopathy, hepatic and hyperammonemic encephalopathies, non-ketotic hyperglycemia, diabetic uremic syndrome, Fahr’s disease, osmotic myelinolysis, Wilson disease, and MELAS
3. Acute exposure to toxic agents: carbon monoxide, methanol, ethyl alcohol, ethylene glycol, ethylene oxide, and metronidazole
4. Summary and conclusion

Multiparametric and Multidetector Computed Tomography Role in the Supplementary Evaluation of Suspicion of Brain Death

Education Exhibits
Location: NR Community, Learning Center

Participants
DOUGLAS MENDES NUNES: Nothing to Disclose
Antonio Rocha: Nothing to Disclose
Carlos Jorge da Silva (Presenter): Nothing to Disclose
REGINALDO CARLOS BONI: Nothing to Disclose

TEACHING POINTS
1. To review the pathophysiology of brain death
2. To review recognizable neuroimaging patterns of brain death
3. To gain awareness of the pitfalls in the vascular imaging when brain death is suspected
4. To learn optimal methods using multiparametric computed tomography to reduce false-negative patients

TABLE OF CONTENTS/OUTLINE
Brain death is the final stage of a progressive and irreversible brain damage. Some countries legislation requires a full supplementary method to corroborate the diagnosis of brain death by demonstrating the absence of electrical activity, metabolic or brain circulation. We evaluated multiparametric multidetector computed tomography (MDCT), such as CT angiography and CT perfusion maps, of 50 patients after the diagnosis of brain death through clinical examination and evidentiary complementary methods. The international experience confirms the use of multiparametric MDCT as a complementary alternative for the diagnosis of brain death, that this is a safe, reliable, and reproducible. We aimed to create a standard protocol for brain death diagnosis and to describe the imaging patterns found in MDCT of patients with confirmed brain death.

Pachymeninges: MRI Findings in Benign and Malignant Disease

Education Exhibits
Location: NR Community, Learning Center

Participants
Kwesi Frempong Agyem MD (Presenter): Nothing to Disclose

TEACHING POINTS
1. Gain an understanding of the components of the pachymeninges, its relation to other anatomical structures, and its various functions.
2. Develop an approach for assessing and describing the imaging appearance of the pachymeninges, and develop skills to localize abnormalities within the subdural or epidural spaces.
3. Review specific benign etiologies (intracranial hypotension, osteomyelitis/discitis, trauma, soft tissue infections) that affect the appearance of the pachymeninges on MRI.
4. Review specific malignancies that commonly involve the pachymeninges (meningiomas, secondary CNS lymphoma, small cell lung cancer, prostate cancer) and their typical appearances on MRI.

TABLE OF CONTENTS/OUTLINE
1. Pachymeningeal Composition and Anatomy
   * Anatomy
   * Composition and Function
2. Evaluating the pachymeninges: Normal or Abnormal?
3. Pachymeningeal Appearances in Benign Diseases
   * Intracranial hypotension
   * Pachymeningitis
4. Pachymeningeal Appearances of Malignant Diseases
   * Meningiomas
   * Lymphoma
   * Metastases
5. Summary
Pictorial Review of Cerebral Venous Thrombosis; Causal Factors, Clinical Manifestations and Imaging Finding

**Education Exhibits**
Location: NR Community, Learning Center

**Participants**
Kushal Singh MBBS : Nothing to Disclose
Zarina Abdul Assis MBBS, MD : Nothing to Disclose
Sunita P Kumarar MBBS, MD : Nothing to Disclose
Sanjaya Viswamitra MD (Presenter): Nothing to Disclose

**TEACHING POINTS**
1. Familiarize readers to the key imaging features of cerebral venous thrombosis.
2. Discuss etiopathogenesis of cerebral venous thrombosis.

**TABLE OF CONTENTS/OUTLINE**
Introduction: Cerebral venous thrombosis is not uncommon. The clinical signs are highly variable with headaches, seizures, focal neurologic deficits, and impaired level of consciousness representing the most common symptoms. Missed diagnosis of cerebral venous thrombosis can lead to potentially fatal outcome. Methods: Our pictorial essay is from a single institute experience of 48 patients of cerebral venous thrombosis. In this study 28 patients had idiopathic venous thrombosis. Out of these, 17 patients had venous infarct of various stages, 10 patients had otherwise normal brain imaging and 1 patient had diffuse subarachnoid hemorrhage. 20 patients had secondary venous thrombosis. Underlying conditions included 17 patients with neoplastic lesions, 1 with eosinophilic granuloma, 1 with chronic otitis media, 1 with SLE and ALPA syndrome.

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**Spectrum of Radiation Induced Changes in the Brain**

**Education Exhibits**
Location: NR Community, Learning Center

**Participants**
Sudheer Balakrishnan MD : Nothing to Disclose
Lisa Marie Tartaglino MD (Presenter): Nothing to Disclose

**TEACHING POINTS**
Mechanism of radiation injury is likely multifactorial representing a combination of demyelination, vascular injury/ischemia as well as host immune response. Neurotoxicity can be divided into three phases: Acute, Early delayed and Late delayed Acute radiation neurotoxicity is due to disruption of the blood-brain barrier and associated vasogenic edema Early delayed neurotoxicity involves continued vasogenic edema and demyelination Late delayed neurotoxicity results from continued demyelination, white matter necrosis and ischemic vasculopathy

**TABLE OF CONTENTS/OUTLINE**
1. Introduction 2. Expected changes to the brain following radiation 3. Acute encephalopathy -White matter edema 4. Early delayed -White matter edema +/- enhancement that spontaneously resolves 5. Late delayed -Cerebral atrophy -Vascular complications (ischmic vasculopathy, cavernoma) -Radiation necrosis -Cysts -SMART (stroke like migraine attacks after radiation therapy) syndrome

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**Teach a Man to Fish: Clinical Applications of Brain PET Tracers by Biochemical Schema**

**Education Exhibits**
Location: NR Community, Learning Center

**Participants**
Javier Villanueva Meyer MD (Presenter): Nothing to Disclose
David Meybin Wilson MD, PhD : Nothing to Disclose

**TEACHING POINTS**
The purpose of this exhibit is: To review current clinically relevant tracers used in PET neuroimaging. To describe the underlying biochemical mechanism of selected tracers used in brain PET. To identify several broad clinical applications of PET tracers in the evaluation of neuropathology with an emphasis on a biochemical schema.

**TABLE OF CONTENTS/OUTLINE**
- Basic principles of PET
- Review of mechanism of action, targets, and applications of selected PET tracers in three different imaging schemas: Metabolic imaging (18F-FDG, 18F-FLT, 11C-Methionine, 11C-Choline) Imaging of the chemical microenvironment (18F-MISO) Receptor/protein target imaging (11C-PIB, 18F-Florbetapir, 18F-T807, 18F-RGD) • Future directions • Summary

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**The Stalk Matters: Imaging of Pituitary Infundibulum**

**Education Exhibits**
Location: NR Community, Learning Center
Participants
Manish Bajaj MBBS, MD (Presenter): Nothing to Disclose
Bruno A. Policeni MD: Nothing to Disclose
Joan Elizabeth Maley MD: Nothing to Disclose
Shalini Bajaj MD, MBBS: Nothing to Disclose
Tushar Chandra MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is 1. To provide an overview of normal anatomy of pituitary and surrounding important structures in diagrammatic form with emphasis on structure of infundibulum including embryologic aspects. 2. To establish a step-by-step approach to diagnosis of lesions involving /affecting the infundibulum to reach final diagnosis.

TABLE OF CONTENTS/OUTLINE
The pituitary infundibulum can be affected by pathologies extending from pituitary as well as adjacent structures in the form of infiltration or displacement. Some pathologies may present with isolated involvement of pituitary stalk. Congenital anomalies such as ectopic neurohypophysis may be identified by noting absence of infundibulum on MR imaging. Neoplastic pathologies like germinoma may be specifically localized to infundibulum. Drug induced hypophysitis may present with smooth enhancing thickening of pituitary infundibulum. Vascular causes like pituitary apoplexy may also have their pathological correlate in blood vessels traversing the stalk. Inflammatory pathologies including sarcoidosis may manifest as thickening and enhancement of infundibulum. A knowledge of important MR imaging characteristics and common differentials to be considered can help pin point the diagnosis.

NRE250
Tips and Tricks for Narrowing the Differential Diagnosis of Bilateral Abnormal Thalamic Signal Intensity on MRI

Education Exhibits
Location: NR Community, Learning Center

Participants
Mohammad Hossein Gharavi MD (Presenter): Nothing to Disclose
Michael Markovic MD: Nothing to Disclose

TEACHING POINTS
1. To review the differential diagnosis of symmetric bilateral thalamic diseases. 2. To illustrate MRI features of different thalamic pathologies, and review the associated extrathalamic findings and clinical history that aid in differentiation.

TABLE OF CONTENTS/OUTLINE
Pathophysiology, MRI characteristics, images and clinical course of various pathologies resulting in abnormal bilateral thalamic MRI abnormalities. The differential diagnosis includes vascular, infectious, metabolic and neoplastic entities including but not limited to: Creutzfeldt-Jakob disease(CJD) Vasculitis Hypoxic ischemic encephalopathy(HIE) Hypertensive encephalopathy, PRES Osmotic demyelination Wilson’s disease Wernicke’s encephalopathy Viral encephalitis West Nile/Japanese/rabies/E. Equine Fabry disease Leigh syndrome Fahr disease Venous occlusion/deep vein thrombosis Arterial ischemia: Artery of Percheron occlusion Bilateral thalamic glioma

NRE251
To Bleed or Not to Bleed: An Updated Review of the Causes and MR Appearance of Cerebral Microhemorrhages

Education Exhibits
Location: NR Community, Learning Center

Participants
Stephen Quinet MD (Presenter): Nothing to Disclose
Patrick A. Turski MD: Research support, General Electric Company

TEACHING POINTS
(1) Review the common etiologies of cerebral microhemorrhages with recent imaging examples of each entity. An emphasis will be placed on distinguishing these entities based on location and pattern of hemorrhage as well as clinical presentation and patient demographics. (2) Briefly review T2* GRE and SWI techniques. (3) Emphasize the utility of T2* and SWI for the detection and classification of cerebral microhemorrhages.

TABLE OF CONTENTS/OUTLINE
Comparison of conventional T2* GRE imaging with SWI: - Brief overview of the sequences - Comparison GRE and SWI for detection of microbleeds, integrated with clinical examples of the various etiologies of microhemorrhages (as outlined below) for which these sequences are particularly valuable Review of cerebral microhemorrhage, including review of pathophysiology, patient demographics, and appearance/pattern on imaging. Etiologies to be reviewed include: - Cerebral amyloid angiopathy (CAA) - Hypertensive arteriopathy - Hemorrhagic metastatic disease - Sporadic and inherited developmental venous anomalies and cavernomas - Radiation-induced vasculopathy and vascular lesions - Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) - Hemorrhagic infarct - Diffuse axonal injury (DAI) - Infection - Vasculitis

NRE252
When to Call the (Spinal) Plumber?: Spontaneous Intracranial Hypotension, Typical and Unusual Cases of Spinal Leak, and Blood Patch Treatment

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit
**TEACHING POINTS**

1. To discuss the typical imaging findings and clinical presentation of spontaneous intracranial hypotension (SIH).
2. To discuss the imaging work-up for several of the most common causes of spinal CSF leaks that can lead to intracranial hypotension.
3. To detail the imaging features of several interesting cases of spinal CSF leak associated with SIH.
4. To discuss the indications and proper technique for image guided blood patching for sites of CSF leak in the spine.

**TABLE OF CONTENTS/OUTLINE**

- **Review of imaging findings and clinical presentation of SIH**
  - Typical imaging and clinical findings of SIH
  - Additional findings associated with an underlying spinal cause
- **Presentation of interesting cases of spinal CSF leaks leading to or associated with SIH**
  - Iatrogenic: Delayed hardware failure
  - Perineural cyst/Arachnoid cyst
  - Discogenic injury
  - Collagen vascular disease related
  - Idiopathic spinal cord herniation
- **Discussion of the imaging work-up for spinal leak identification**
  - Cross-sectional imaging
  - Radionuclide cisternography
  - Myelography: CT and MR
- **Discussion of blood patch technique**
  - Indications and patient preparation
  - Pictorial demonstration of technique
  - Post-procedural imaging and interventional management

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**NRE253**

**Emergent CTA: A Primer - Tips/Pitfalls and What the Clinician Needs to Know**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Cuong Tho Nguyen MD (Presenter): Nothing to Disclose
- Hamza Ailin Shaikh MD : Nothing to Disclose
- Bryan Anthony Pukenas MD : Proctor, DFINE, Inc
- Robert W. Hurst MD : Nothing to Disclose
- Alexander C. Mamourian MD : Nothing to Disclose
- Suyash Mohan MD : Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit to review: 1. To present in an interactive manner a series of challenging cases to help improve the radiologist’s diagnostic accuracy and to provide clinical context for better reporting (i.e. ‘what the clinician needs to know’). 2. To address common interpretive errors in an attempt to improve the diagnostic accuracy of the interpreting radiologist. 3. To review basic vascular anatomy, common anatomic variants and sites that are most likely to harbor missed vascular entities (i.e. ‘blind spots’) and to present a comprehensive checklist that will help decrease the likelihood of interpretation errors at routine CTA interpretation.

**TABLE OF CONTENTS/OUTLINE**

- Indications for emergent CTA
- Technical considerations/troubleshooting
- Basic approach to CTA (including discussion of using TeraRecon, other thin clients)
- Cases (including discussion of pathophysiology, signs/symptoms, imaging approach including tips/pitfalls and what the clinicians need to know from the radiologist, treatment)
  1. Acute stroke
  2. Aneurysmal subarachnoid hemorrhage
  3. Cerebral venous thrombosis
  4. Vasospasm
  5. Traumatic cerebral vascular injury

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**NRE254**

**How to Detect Carotid Dissections in the Acute Stroke Setting. Survival Guide for Beginners**

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

- Maria Diez Blanco (Presenter): Nothing to Disclose
- Enrique Marco de Lucas : Nothing to Disclose
- Sara Sanchez Bernal MD : Nothing to Disclose
- Elena Lopez Uzquiza : Nothing to Disclose
- Marta Drake Perez : Nothing to Disclose
- Eva Ruiz Perez : Nothing to Disclose
TEACHING POINTS
To describe the imaging findings, including CT angiography and CT perfusion, in patients with acute carotid dissection. To establish a differential diagnosis with other diseases that can mimic carotid dissection and their correlation with MR angiography.

TABLE OF CONTENTS/OUTLINE

NRE255
Neuroradiological Findings of Paediatric Cerebral Sinovenous Thrombosis due to Acquired Risk Factors: Personal Experience and Literature Review

Education Exhibits
Location: NR Community, Learning Center

Participants
Chiara Carducci MD (Presenter): Nothing to Disclose
Lorenzo Figa Talamanca : Nothing to Disclose
Stefania Galassi : Nothing to Disclose
G. Stefania Colafati : Nothing to Disclose
Daniela Longo : Nothing to Disclose
Francesco Randisi : Nothing to Disclose
Bruno Bernardi MD : Nothing to Disclose

TEACHING POINTS
Pediatric sinovenous thrombosis (CSVT) is relatively rare but potentially life-threatening condition; nevertheless in Children's Hospitals (CH) an increasing of CSVT is reported, likely due to increase clinical awareness, risks related to intensive care, longer survival to primary disease, imaging improvement. Early symptoms are often not specific, neuroimaging can be request without suspect of CSVT; early diagnosis/treatment are important for decreasing the morbidity and mortality. Purpose: illustrate neuroimaging of CSVT or severe flow impairment secondary complication of primary underlying disease; underline potential/limit of neuroradiological techniques; improve radiologist's knowledge/diagnostic accuracy.

TABLE OF CONTENTS/OUTLINE
Epidemiology, pathophysiology, acquired risk factors of pediatric CVST. Case series: 23 children, older that 1 month with CVST or severe flow impairment due to epidural compression, followed up (Sept 2011 to March 2014) in our CH. Neuroradiological findings (MRI-MR, CT-CTA), clinical onset and follow-up, presented to identify diagnostic key for each technique, depending on clinical condition. CVST diagnosis in childhood without inherited thrombophilia could be delayed or missing. It is important to know the myriad of acquired risk factors, potential/limit of each diagnostic tool, best modality for neuroimaging follow-up.

NRE257
Tissue Characterization of Carotid Atherosclerotic Plaque with Magnetic Resonance (MR) Imaging

Education Exhibits
Location: NR Community, Learning Center

Participants
Takafumi Naka (Presenter): Nothing to Disclose

TEACHING POINTS
1) Histopathology of carotid atherosclerotic plaque
2) Magnetic resonance imaging techniques of carotid atherosclerotic plaque
2-1 Comparison and feature of several T1 weighted imaging techniques
3) Relationship between signal hyperintensity on T1WI of carotid atherosclerotic plaque and pathological findings

TABLE OF CONTENTS/OUTLINE
1) The thickness of the fibrous cap is significantly thinner in symptomatic patients. Furthermore, plaque ulceration and thrombus formation are more common with symptomatic patients.
2) Although electrocardiograph(ECG) gating has been used in conventional imaging technique for carotid atherosclerotic plaque has been used, there is a serious problem that TR changes with the heart rate of the patient. However, 3 dimensional(3D) fast spin echo(FSE) sequence and 3D inversion recovery gradient echo(IR-GRE) sequence dose not have the necessity for ECG gating. In addition, these new imaging techniques make higher in-plane resolution and shorter imaging time possible.
3) Carotid plaque with hyperintensity on T1WI consists of abundant hemorrhage, and lipid core beneath thin fibrous cap. And there are highly correlated with ischemic events.

NRE258
High Resolution 3T MR-Neurography of the Brachial Plexus: Normal Anatomy and Traumatic ,
Non-traumatic Brachial Plexopathies

Education Exhibits
Location: NR Community, Learning Center

Participants
Mar Jimenez De La Pena (Presenter): Nothing to Disclose
Ana Fernandez Alfonso : Nothing to Disclose
Luis Carlos Hernandez Gonzalez : Nothing to Disclose
Javier Carrascoso Arranz : Nothing to Disclose
Luis Herraiz Hidalgo : Nothing to Disclose
Vicente Martinez de Vega : Nothing to Disclose

TEACHING POINTS
1. To illustrate the anatomy and common pathologies of the brachial plexus, describing the respective imaging findings at 3T MR neurography. 2. To highlight the 3D high-resolution imaging which plays a significant role, aiding in the early diagnosis and patient management 3. In traumatic plexopathy, the MR study must include the shoulder to detect muscle edema, which facilitate the diagnosis

TABLE OF CONTENTS/OUTLINE
The complex anatomy of the brachial plexus is better depicted with the new 3D-MR sequences, the better fat-suppression techniques, the new coils and the increasing use of 3T magnets. In this pictorial review, the anatomy of the roots, trunks, divisions and cords is shown, facilitated by comparison with cadaver cross sections. Indeed common pathologies as neurogenic tumors, superior sulcus tumors and other tumors in the vicinity of the brachial plexus, radiation and metastatic plexopathy, trauma, neurogenic thoracic outlet syndrome and immune-mediated neuropathies are discussed. –Normal MR anatomy of the brachial plexus with cadaver cross sections correlation –Contribution of the high resolution 3D techniques –Review of imaging findings in common traumatic, non-traumatic plexopathies

NRE260
Intraoral Sonography for the Evaluation of the Depth of Invasion of the Tongue Carcinoma Using Acoustic Polymer Gel

Education Exhibits
Location: NR Community, Learning Center

Participants
Takafumi Hayashi DDS, PhD (Presenter): Nothing to Disclose
Taichi Kobayashi : Nothing to Disclose
Motoki Shingaki : Nothing to Disclose
Yutaka Nikkuni DDS, PhD : Nothing to Disclose
Kouji Katsura : Nothing to Disclose

TEACHING POINTS
The application of the acoustic polymer gel to the intraoral sonography provides the reliable visualization of the muscular invasion of the tongue carcinoma.

TABLE OF CONTENTS/OUTLINE
It is important to evaluate the depth of invasion in order to predict the subsequent cervical lymph node metastasis in patients with tongue carcinoma. Recent studies addressed that the depth of invasion is a reliable parameter for predicting regional nodal involvement and patient survival. In this presentation, I will propose the three layer structures of normal tongue mucosa, i.e., (1) mucosal surface, (2) mucosal layer, (3) submucosal and muscular layers demonstrated on the intraoral sonography. Intraoral sonographic examination is performed using a small 'hockey-stick' probe and an acoustic polymer gel with a thickness of 3 mm in order to obtain fine image quality, and commonly, the superficial carcinoma is demonstrated as a thickened mucosal layer.

NRE261
Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) of Lower Cranial Nerves (IX, X, XI and XII): A Pictorial Essay

Education Exhibits
Location: NR Community, Learning Center

Participants
Tatiana Goyanna Lyra MD (Presenter): Nothing to Disclose
Samir El-Kadum Noujaim MD : Nothing to Disclose
Lucas Nunes Silva MD : Nothing to Disclose
Luís Filipe de Souza Godoy MD : Nothing to Disclose
Eloisa Maria Santiago Gebrim MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To review and understand the anatomy of lower cranial nerves (IX, X, XI and XII) using original drawings, CT and MR images.
2. To present a variety of common and uncommon pathologies that affect the lower cranial nerves using CT and MRI images from our digital archives emphasizing important findings and their differential diagnosis.

TABLE OF CONTENTS/OUTLINE
The authors will discuss the normal anatomy of the lower cranial nerves and their relationship with the corresponding anatomic structures. It will include practical review of the jugular fossa and the hypoglossal canal using original drawings, CT, and MRI.
images. Several pathologic conditions will be presented with emphases on imaging findings and differential diagnosis. Pathologic conditions to be presented include, but not limited to: primary and extrinsic tumors (schwannoma, neurofibroma, paraganglioma, meningioma, metastasis), jugular fossa syndrome (Vernet’s syndrome), vocal cord paralysis caused by high and lower vagus nerve injury, denervation atrophy, perineural tumor spread, infectious (Lyme’s disease), autoimmune conditions, Wallenberg syndrome, carotid artery dissection, glossopharyngeal neurovascular conflict.

### NRE262

**MR Imaging Anatomy of the Cervical Sympathetic and Parasympathetic Nerves**

#### Education Exhibits

**Location:** NR Community, Learning Center

#### Participants

- Hajime Yokota MD (Presenter): Nothing to Disclose
- Koji Matsumoto RT: Nothing to Disclose
- Hiroki Mukai: Nothing to Disclose
- Atsushi Saiga MD: Nothing to Disclose
- Takuro Horikoshi MD: Nothing to Disclose
- Ken Motoori MD: Nothing to Disclose
- Takashi Uno: Nothing to Disclose

#### TEACHING POINTS

- The cervical sympathetic and parasympathetic nerves are a potential risk of injury during surgery, target for local anesthetic block and origin of neoplasms. However, there are few reports about imaging anatomy of these nerves.
- Although it is difficult to detect the nerves totally, recent high-resolution MR neuraphy sequences can identify their ganglions. Recognizing the ganglions can help you predict the nerve routes. Exceptionally, hypertrophic neuropathy improves anatomical visualization of the nerve routes.
- Previous reports with cadavers are partially different from MR imaging anatomy. Postmortem changes and autopsy procedures may affect morphology and locations of the nerves. High-resolution MR neurography can be gold standard to evaluate anatomical features of the nerves.

#### TABLE OF CONTENTS/OUTLINE

1. Imaging technique - High-resolution MR sequences, especially 3D-STIR
2. Sympathetic nerve: the cervical sympathetic trunk - Location and morphology of the ganglions: Superior cervical ganglion, middle cervical ganglion, vertebral ganglion and stellate ganglion - White and gray ramus communications
3. Parasympathetic nerve: the vagus nerve - Location and morphology of the ganglion: the nodose ganglion - The vagus nerve on hypertrophic neuropathy
4. Differences between previous reports with cadavers and MR imaging anatomy

### NRE263

**Ossicular Anatomy Revisited: Virtual Otoscopy with 3-D Volume Reconstructions**

#### Education Exhibits

**Location:** NR Community, Learning Center

#### Participants

- Jennifer Lynn McCarty MD (Presenter): Nothing to Disclose
- John Louis Dornhoff MD: Inventor, Olympus Corporation
- Rohan Samant MD: Nothing to Disclose
- Rudy Lee Van Hemert MD: Nothing to Disclose
- Raghu Hosahalli Ramakrishnaiah MBBS, FRCP: Nothing to Disclose
- Manoj Kumar MD, MBBS: Nothing to Disclose
- Edgardo J.C. Angtuaco MD: Nothing to Disclose
- Ryan T. Fitzgerald MD: Nothing to Disclose

#### TEACHING POINTS

1. Review the anatomy of the middle ear -- including osseous, ligamentous, and neurovascular structures -- using diagrams, cross sectional imaging and 3-D volumetric reconstructions (VR). 2. Explore the concept of a virtual otoscopic exam using 3-D VR.
3. Correlate clinical and intraoperative otoscopic exam with imaging and virtual otoscopy.
4. Present a few common pathologic entities of the middle ear and demonstrate their involvement with the ossicular chain, using a quiz format.

#### TABLE OF CONTENTS/OUTLINE

- Anatomy - Osseous - Ligamentous - Neurovascular Imaging - CT and MR of the Middle Ear - 3-D Volumetric Reconstructions and Virtual Otoscopy - Limitations of Imaging Clinical - Clinical Otoscopic Exam - Clinical Intraoperative Exam Cases - Glomus Tympanicum Paraganglioma - Cholesteatoma - Otosclerosis - Trauma - Ossicular Chain Reconstruction

### NRE266

**Abnormalities of Middle Ear in Pierre-Robin Sequence**

#### Education Exhibits

**Location:** NR Community, Learning Center

#### Participants

- Harutyun Haroyan MD: Nothing to Disclose
- Daniel Thomas Ginat MD (Presenter): Nothing to Disclose

#### TEACHING POINTS

1. Understanding of sequence of events leading to development of Pierre-Robin sequence and associated middle ear abnormalities based on discussion of embryology of facial and middle ear development. 2. Learning about range of middle ear abnormalities encountered in Pierre-Robin sequence. 3. Discussion of clinical correlation of observed imaging findings and brief discussion of severity and observed frequency of middle ear abnormalities.
TABLE OF CONTENTS/OUTLINE

NRE267
Congenital Anomalies of the Branchial Apparatus: Focusing on Embryologic Background and Radiologic Features

Education Exhibits
Location: NR Community, Learning Center

Participants
Seul Kee Kim : Nothing to Disclose
Yang jun Kang MD (Presenter): Nothing to Disclose
Woong Yoon MD : Nothing to Disclose
Heoung-Keun Kang MD : Nothing to Disclose

TEACHING POINTS
1. To review the embryologic basis related to branchial apparatus anomalies 2. To explain the radiologic findings of branchial apparatus anomalies

TABLE OF CONTENTS/OUTLINE
1. Normal embryology of branchial apparatus
2. Imaging findings of branchial apparatus anomalies
3. Imaging finding of complication of branchial apparatus anomalies
4. Summary

NRE268
Imaging of Benign Jaw Lesions and Tumor-like Processes with Pathologic Correlation

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Chikaodili Iloanusi Logie MD (Presenter): Nothing to Disclose
Eric A. Walker MD : Research Consultant, Medical Metrics, Inc
Matthew J. Minn MD : Nothing to Disclose
Mark Douglas Murphey MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the wide range of benign processes that involve the jaw, including jaw cysts, inflammatory processes, and histologically benign tumors. 2. To review benign processes of the jaw, which may appear aggressive, such that they are nearly indistinguishable from malignant jaw tumors. 3. To establish familiarity with imaging features of the most commonly encountered benign jaw lesions.

TABLE OF CONTENTS/OUTLINE

NRE269
Imaging of the Congenital Anomalies of the Facial Nerve (CN7): How to Make Sure Your Favorite Surgeon Does Not Hit CN7 during His Procedure?

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Aina Venkatasamy (Presenter): Nothing to Disclose
Marcela DE ALMEIDA CAVALCANTI : Nothing to Disclose
Sophie Anne Cahen Riehm MD : Nothing to Disclose
Francis P. Veillon MD : Nothing to Disclose

TEACHING POINTS
Anomalies of the course of the tympanic portion of the CN7 (VII-2) are the most common. An anterior displacement of the
mastoid portion of the CN7 (VII-3) is important to specify before cochlear implantation. The CN7 canal may be dehiscent, with or without inferior herniation of the corresponding nerve. The CN7 must always be analyzed on temporal bone CT / MRI.

**TABLE OF CONTENTS/OUTLINE**

1) Agenesia or hypoplasia of the CN7 2) Anatomical abnormalities of the course of the facial nerve and/or canal 2.1 Above the internal auditory meatus 2.2 Open angle between VII-1 and VII-2 2.3 Absence of VII-2 2.4 Lateralized VII-2 in the tympanic cavity 2.5 Inferior herniation of the nerve in a dehiscent bony canal 2.6 Lowered facial nerve in, close or not to the stapes, or below the oval window 2.7 Medialized VII-3 canal in or close to the jugular bulb 2.8 Anteriorized VII-3 3) Anomalies of size of the facial nerve canal The normal CN7 canal size has numerous normal variants: geniculate ganglion fossa ranging from 1.8 to 4.5 mm, VII-2 from 1.3 to 2.9 mm. MRI HR T2 images are necessary for the detection of CSF in the geniculate ganglion fossa, which is a normal variant. The T1 postcontrast images eliminate a tumor. The enlarged geniculate ganglion fossa may also be due to a meningocele. 4) Nerve duplication VII-1, VII-2 or VII-3 duplication

**NRE271**

**Radiology of Cleft Lip and Palate: Imaging for the Prenatal Period and throughout Life**

**Education Exhibits**

Location: NR Community, Learning Center

Selected for RadioGraphics

**Participants**

Zachary Abramson DMD (Presenter): Nothing to Disclose
Harris L. Cohen MD : Nothing to Disclose
Asim F. Choudhri MD : Nothing to Disclose

**TEACHING POINTS**

After completing this education exhibit, participants will be able to: 1. Describe normal and abnormal development of the nose, lip, primary and secondary palates. Cleft lip occurs following failure of fusion of the medial fronto-nasal processes with the maxillary process of the 1st pharyngeal arch. Cleft palate occurs as a result of failure of fusion of the palatal shelves at 6-8 weeks gestation. 2. Identify cleft lip and palate both pre-natally and post-natally on ultrasound, CT and MRI. Unilateral vs. bilateral Complete vs. incomplete Cleft lip and/or palate vs. isolated cleft palate 3. Discuss and identify anomalies associated with cleft lip and/or palate, as well as secondary conditions, such as congenitally absent teeth, oronasal fistula, velopharyngeal insufficiency, and maxillary growth restriction.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Embryology (Normal and abnormal development) 3. Radiologic Appearance a. Prenatal Imaging Diagnosis: ultrasound, CT and MRI Associated Anomalies: Brain anomalies on ultrasound and MRI b. Postnatal Imaging Associated Anomalies Secondary Deformities: Absent or supernumerary teeth; Oronasal Fistulae; Velopharyngeal Insufficiency; Maxillary Growth Restriction 4. Conclusion 5. References

**NRE272**

**Spectrum of Cranio-Vertebral Junction Anomalies on MRI: Pictorial Review**

**Education Exhibits**

Location: NR Community, Learning Center

**Participants**

Sonia Sandip MD (Presenter): Nothing to Disclose
Neera Kohli MBBS, MD : Nothing to Disclose
Ishrat Afshan MD : Nothing to Disclose
Rohit K Khadejwal MD : Nothing to Disclose
Devasenathipathy Kandasamy : Nothing to Disclose
Sheragaru H. ChandraShekhar MD : Nothing to Disclose

**TEACHING POINTS**

1) MRI is a novel modality for assessment of cranio-vertebral junction. 2) Because of excellent spatial and contrast resolution of MRI, detailed evaluation of anatomic relationship as well as associated abnormalities of CVJ can be done.

**TABLE OF CONTENTS/OUTLINE**

The craniovertebral junction(CVJ) is the most complex region of the axial skeleton, residing between the skull and the upper cervical spine. CVJ refers anatomically to the occiput, first (atlas) and second cervical (axis) vertebra segments, their articulations and connecting ligaments. CVJ anomalies are defects of development, not necessarily congenital and may not manifest at birth. The spectrum of CVJ anomalies include: A- Congenital: 1. Malformation of occipital bone(clivus segmentation, occipital vertebra, platybasia, condylar hypoplasia) 2. Malformation of atlas(secondary failure of segmentation ossification) 3. Malformation of axis(segmentation failure of arches) 2. Aquired: 1. Atlanto-axial dislocation 2. Secondary basilar invagination. The exhibit will include the following contents. 1. Anatomy 2. Embryology and Development 3. Relevant lines and landmarks at CVJ 4. Classification of CVJ anomalies 5. Spectrum of CVJ anomalies on MRI and associated findings.

**NRE274**

**Unravelling the Link of Mind to Body: Role of CT and MRI in Evaluation of Craniovertebral Junction Anomalies**

**Education Exhibits**

Location: NR Community, Learning Center

**Participants**

Nishchint Jain MBBS (Presenter): Nothing to Disclose
Ritu Verma MBBS, MD : Nothing to Disclose
Sachin Kumar Jain MD : Nothing to Disclose
BARINDRA BARUAH : Nothing to Disclose
TEACHING POINTS
1. To study embryology, anatomy and topographic relationship of craniovertebral junction on imaging.
2. To understand imaging features of various craniovertebral junction anomalies on CT and MRI.

TABLE OF CONTENTS/OUTLINE
Craniovertebral Junction (CVJ) is a complex osseous-ligamentous structure responsible for enclosing the traversing neural elements as they make a transition from brain to spine. EMBRYOLOGY and ANATOMY: The CVJ is the product of the occipital and first three cervical somites with subsequent endochondral ossification. A myriad of congenital and acquired anomalies affect CVJ presenting with varying clinical symptoms. CVJ ANOMALIES: Congenital anomalies include basilar invagination, atlanto axial dislocation, platybasia, atlas defects (split atlas, posterior Rachiscisis), defect in synchondrosis of axis (aplasia, Os odontoideum, Os terminale). Acquired conditions include trauma, infections, inflammatory (rheumatoid, JRA, CPPD, ankylosing spondylitis) and tumors. IMAGING: CT and MRI are used to assess craniometry, morphology and topographic relation of various constituents, pre dental soft tissue, cord status, ligamentous morphology, vertebral artery course and stability of AAD. CONCLUSION: CT and MRI characterisation of CVJ anomalies is must for accurate diagnosis and management.

NRE275
A Broadened Differential for Signal Loss in the Semicircular Canals on MRI or Sclerosis of the Semicircular Canals on CT: Pictorial Overview with CT and MRI Correlation

Education Exhibits
Location: NR Community, Learning Center

Participants
Jurgen Bielen MD (Presenter): Nothing to Disclose
Bruno Mutien Marie Marcel Termote MD: Nothing to Disclose
Steven Schepers MD: Nothing to Disclose

TEACHING POINTS
The differential diagnosis for signal loss in the semicircular canals on MRI or sclerosis of the semicircular canals on CT can be broadened with a specific hereditary form of progressive severe hearing loss.

TABLE OF CONTENTS/OUTLINE
Anatomy of the semicircular canals (CT and MRI) Pathology: differential diagnosis of signal loss of the SCC's on MRI or sclerosis on CT Broadened differential with overview of genetics sample (12) cases (both CT and MRI for every patient) and mimics summary

NRE276
Abnormal Intensity/Density in the Labyrinth: Diseases and Diagnostic Points

Education Exhibits
Location: NR Community, Learning Center

Participants
Yoshiko Yakushiji Kurihara MD (Presenter): Nothing to Disclose
Hirotaka Ikeda MD: Nothing to Disclose
Atsuko Fujikawa MD: Nothing to Disclose
Hayato Tomita: Nothing to Disclose
Takuya Suzuki: Nothing to Disclose

TEACHING POINTS
1) To review the pathological categories and diseases causing abnormal intensity/density in the membranous labyrinth
2) To show the anatomical location and pattern of abnormality
3) To assist the exact diagnosis, inform the additional clinical issues other than hearing loss or vertigo

TABLE OF CONTENTS/OUTLINE
Anatomy and normal intensity/density of labyrinth Causes of abnormal intensity/density of labyrinth Pathological categories and imaging findings - trauma - inflammation - tumors - congenital - influences of adjacent pathological changes Summary

NRE278
Eye and Orbit MRI Multiple Choice Quiz: What Is Your Diagnosis?

Education Exhibits
Location: NR Community, Learning Center

Participants
Ana Isabel Cisneros (Presenter): Nothing to Disclose
Beatriz Rodriguez-Vigil MD: Nothing to Disclose
Jon Echeveste: Nothing to Disclose
Carmen Romero MD: Nothing to Disclose
Rocio Pelaya-Chato: Nothing to Disclose
Blanca Martinez de Guerenu MD: Nothing to Disclose

TEACHING POINTS
By viewing this exhibit we will learn to: Characterize the most common pathological entities of the eye and orbit through different cases of daily clinical practice in a tertiary hospital MRI department Limit differential diagnosis and lead to an accurate
diagnosis by recognizing pearls and pitfalls in MR imaging.

TABLE OF CONTENTS/OUTLINE
Spectrum of disease: MRI findings, differential diagnosis, pearls and pitfalls
Congenital: lymphangioma, dermoid and epidermoid, neurofibromatosis, cavernous hemangioma
Infection: cellulitis, subperiosteal abscess
Inflammation: idiopathic orbital inflammatory disease, sarcoidosis, optic neuritis, mucocele
Vascular: venous varix and carotid-cavernous fistula
Traumatic: fractures, extrinsic ocular muscles hematoma
Neoplastic: hemangioma, neural tumors, optic nerve glioma, lymphoma, basocellular carcinoma, melanoma, metastases, sphenoidal meningioma.
Postsurgical: silicone explants
Miscellaneous: thyroid associated orbitopathy, fibrous dysplasia, intracranial hypertension

NRE279
Imaging of Non-acute Laryngeal Conditions: Clinicoradiological Correlation

Education Exhibits
Location: NR Community, Learning Center

Participants
Marie Kim MD (Presenter): Nothing to Disclose
Akifumi Fujita MD: Nothing to Disclose
Joan M. Cheng MD: Nothing to Disclose
Hiroyuki Fujii MD: Nothing to Disclose
Scharukh Jalisi MD: Owner, DRX UC Watertown PC
Osamu Sakai MD, PhD: Speaker, Bracco Group Speaker, KYORIN Holdings, Inc Speaker, Eisai Co, Ltd

TEACHING POINTS
Laryngeal abnormalities are easily assessed clinically via direct visualization or endoscopically. Imaging may not be indicated in the setting of acute airway obstruction and diagnosis of common epithelial tumors such as squamous cell carcinoma is often made prior to imaging. However, non-acute laryngeal or other airway conditions often require radiological assessment because clinical pictures can be nonspecific and direct visualization or endoscopy cannot assess submucosal diseases very well.

The purpose of this exhibit is to:
1. Review various non-acute pathologies that cause laryngeal and airway compromise
2. Provide a clinicoradiological correlation of various disorders
3. Review of key imaging findings to narrow the differential diagnosis

TABLE OF CONTENTS/OUTLINE
1. Endoscopic and radiological anatomy of the larynx and trachea
2. Non-acute laryngeal abnormalities
   a. Non-squamous cell neoplasms
      -Epithelial tumors
      -Non-epithelial tumors: granular cell tumor, rhabdomyoma, schwannoma, hemangioma, chondrosarcoma, lymphoma, metastasis, etc.
   b. Amyloidosis
   c. Laryngocele, laryngeal cyst
   d. Inflammatory / infectious conditions
      -Inflammatory: Granulomatosis with polyangitis, sarcoidosis, relapsing polychondritis
      -Infectious: Tuberculosis
   e. Post-traumatic abnormalities
   f. Post-treatment changes
      -Post-radiation changes
      -Post-surgical changes

NRE280
Intraocular Lesions at 3T Magnetic Resonance Imaging

Education Exhibits
Location: NR Community, Learning Center

Participants
Naim Ceylan MD, PhD (Presenter): Nothing to Disclose
Selen Bayraktaroglu: Nothing to Disclose
Ozlem Sezgin Okcu: Nothing to Disclose
Recep Savas MD: Nothing to Disclose

TEACHING POINTS
1. To demonstrate various diseases involving intraocular spaces at 3T MRI
2. To highlight importance of surface coil usage in the intraocular lesions
3. To make differential diagnosis between intraocular lesions

TABLE OF CONTENTS/OUTLINE
Imaging Techniques
Classification of intraocular lesions
Review of imaging findings
Sample cases
Summary

NRE282
Multimodality Approach to Imaging of Epiphora - Tears Matter

Education Exhibits
Location: NR Community, Learning Center

Participants
Anand Sastry MBBS (Presenter): Nothing to Disclose
Muthu Balasubramaniam FRCR: Nothing to Disclose
Arun David Jacob MBBS, FRCR: Nothing to Disclose

TEACHING POINTS
1. The nasolacrimal drainage system drains the tears from the eyes. This system is susceptible to a variety of pathological entities presenting clinically as epiphora. 2. Imaging provides both structural and functional information of the nasolacrimal duct (NLD) system. 3. The digital subtraction dacryocystography and dacryoscintigraphy provides structural and functional information respectively, whilst the cross-sectional studies such as CT and MRI provide additional soft tissue information.

TABLE OF CONTENTS/OUTLINE
1. Imaging anatomy of the nasolacrimal apparatus using digital subtraction dacryocystography with schematic illustration.
2. Aetiology of epiphora is classified under congenital, inflammatory, infection, traumatic, neoplastic, and functional. Each topic is described with relevant examples using multi-modality imaging. Examples of some of the cases include absent inferior canaliculus, dacrocystocele, chronic canaliculitis, aspergillosis, orbital floor fracture involving the NLD, sinonasal neoplasms invading the NLD, functional epiphora with normal anatomical patency of NLD etc.
3. Post-operative imaging appearance of dacryocystorhinostomy - A surgery commonly performed in the management of epiphora.
4. Emerging role of MR dacryocystography and the limitations.

NRE283
Multimodality Imaging of Diffuse Thyroid Disease: More than Just "Goiter"

Education Exhibits
Location: NR Community, Learning Center

Participants
Shuchi Kiri Rodgers MD (Presenter): Nothing to Disclose
Crystal Chang MD: Nothing to Disclose
Peter S. Wang MD: Nothing to Disclose
Huyen D. Tran MD: Nothing to Disclose

TEACHING POINTS
1. To describe a systematic approach to thyroid ultrasound. 2. To review the classic patterns of benign diffuse thyroid disease focusing on autoimmune thyroid disease (Graves' disease and various forms of thyroiditis including Hashimoto's thyroiditis). 3. To review the classic appearance of thyroid goiter on ultrasound and other imaging modalities. 4. To review imaging findings differentiating benign from malignant diffuse thyroid disease.

TABLE OF CONTENTS/OUTLINE
Systematic approach thyroid ultrasound size, contour, echogenicity assessment of nodules or calcifications thyroid vascularity on color Doppler evaluation of adjacent lymph nodes Benign diffuse thyroid disease Classic patterns of Graves' disease and thyroiditis Imaging characteristics of suspicious focal lesion in background of thyroiditis Multimodality imaging of the thyroid goiter ultrasound chest x-ray nuclear medicine computed tomography magnetic resonance imaging Malignant diffuse thyroid disease Key imaging features in distinguishing benign from malignant thyroid disease Case examples: Metastatic disease Infiltrating papillary carcinoma Lymphoma Anaplastic thyroid cancer

NRE284
Pitfalls in Ultrasound Diagnosis of Major Salivary Glands Diseases

Education Exhibits
Location: NR Community, Learning Center

Participants
Ewa Jolanta Bialek MD, PhD (Presenter): Nothing to Disclose
Wieslaw Jakubowski MD, PhD: Nothing to Disclose

TEACHING POINTS
Recall shortly ultrasound (US) anatomy of salivary glands. Describe basic US features of most common salivary glands diseases and present potential diagnostic pitfalls. Display anatomic US cases mimicking pathology. Familiarize with overlapping US presentations of different pathologies (benign and malignant) affecting major salivary glands. Exemplify circumstances of overlooking a malignancy. Present diseases of surrounding organs or tissues possible to be mistaken with salivary glands disease.
NRE285

Sizing Up the Extraocular Muscles: Small or Big?

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Minesh Patel MD (Presenter): Nothing to Disclose
Anna Knobel MD : Nothing to Disclose
Deborah Rachelle Shatzkes MD : Nothing to Disclose

**TEACHING POINTS**

- Review the anatomy and innervations of the extraocular muscles (EOM). Present various pathological conditions that cause the EOMs to either increase or decrease in size. Describe the general categories of relevant disease processes, which will help approach cases in a systematic manner. Discuss patterns of involvement and other imaging features specific to some conditions that can help narrow the differential diagnosis. Emphasize the importance of correlating radiologic findings with clinical history, ancillary tests and in some cases, tissue sampling.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction  
2. Anatomy and innervation  
4. Large EOMs: Etiologies:  
5. Conclusion

NRE286

Spitting Images: Anatomy and Pathology of the Major Salivary Glands

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Susan Sotardi MD, MS (Presenter): Nothing to Disclose  
Jacqueline Anne Bello MD : Nothing to Disclose  
Thomas Ow : Nothing to Disclose  
Keivan Shifteh MD : Nothing to Disclose  

**TEACHING POINTS**

1. Review anatomy of the major salivary glands.  
3. Provide a pictorial review of common and rare major salivary gland pathologies, including congenital, infectious, inflammatory, acquired, benign and neoplastic abnormalities.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of anatomy of the parotid, submandibular and sublingual glands.  
2. Approach to establishing a differential diagnosis for salivary gland pathology based on: Age Location Distribution Morphology Aggressive Features  
3. Pictorial review with examples of:  
   - Congenital: First branchial cleft cyst, Hemangioma, Lymphangioma, AVM Infection: Sialoadenitis, Sialolithiasis, Sialosis, Suppurative parotitis, Abscess  
   - Inflammatory: Kuttner tumor, Sjogren's syndrome, Sarcoid, Lymphoepithelial cyst  
   - Benign tumor: Schwannoma, Oncocytoma, Pleomorphic adenoma, Warthin's tumor, Lipoma  
   - Malignant tumor: Mucoepidermoid Ca, Adenoid cystic ca, Lymphoma, spindle cell sarcoma, Acinic cell ca, Malignant mixed tumor, Metastatic squamous cell  
   - Acquired: Sialoceles, Simple and Plunging ranula, Wharton's duct dilatation due to floor of the mouth SCCa  
   - Miscellaneous: Accessory salivary tissue in the mylohyoid (boutonniere), Post-radiation therapy, Accessory parotid gland

NRE287

Stones, Bones, Groans and Moans- Case Based Review of Ectopic Parathyroid Adenomas

*Education Exhibits*

*Location: NR Community, Learning Center*

**Participants**

Michael James Connolly BSC, MD (Presenter): Nothing to Disclose  
Santanu Chakraborty FRCR, DMRD : Speakers Bureau, Merck KGaA Speakers Bureau, Novartis AG Grant, Bayer AG  
Marlise Peruzzo Dos Santos MD : Nothing to Disclose  

**TEACHING POINTS**

The purpose of this exhibit is: - To review the embryogenesis of parathyroid glands - To review the prevalence and locations of ectopic parathyroid adenomas, a major cause for failed neck exploration for primary hyperparathyroidism - To explain the utility of preoperative, multi-modality imaging studies for localization of parathyroid adenomas.

**TABLE OF CONTENTS/OUTLINE**

Pathophysiology of primary hyperparathyroidism and parathyroid adenomas  
Embryogenesis of parathyroid glands  
Incidence and locations of ectopic parathyroid adenomas  
Review of imaging findings - CT - Sestamibi iodine I123 subtraction studies - 99mTc-MIBI SPECT/CT  
Sample cases  
Summary and Recommendations
The Spectrum of Cervical Lymphadenopathy: From Mundane to Macabre

Education Exhibits
Location: NR Community, Learning Center

Participants
Chinmay Nagesh MBBS, MD : Nothing to Disclose
Rahul Ganapati Hegde MBBS, MD (Presenter) : Nothing to Disclose
Anagha Rajeev Joshi MD, MBBS : Nothing to Disclose
Hardik Uresh Shah MBBS, MD : Nothing to Disclose
Bhagya Sannanja MBBS, MD : Nothing to Disclose
Suleman Adam Merchant MD : Nothing to Disclose

TEACHING POINTS
To review the normal appearance of cervical lymph nodes on CT and MRI with emphasis on morphology and size criteria. To describe the morphological characteristics and enumerate enhancement patterns in order to reach more specific diagnoses, a spectrum from the usual to rare. To enumerate patterns of involvement at various levels in the neck with differing pathologies. To discuss the possible mimics of cervical lymph nodes.

TABLE OF CONTENTS/OUTLINE
Normal Cervical lymph nodes: appearance, size criteria and lymph node levels
Pathological lymph nodes: Imaging characteristics by aetiology Infectious : Cervical adenitis, Tuberculosis, HIV related lymphoepithelial lesions. Auto-immune / Quasimalignant: Castleman's disease, Kikuchi's disease, Kimura's disease. Neoplastic: Primary: Head and neck lymphomas Metastatic: Squamous cell carcinomas of head and neck, Thyroid carcinomas Mimics of cervical lymphadenopathy: Carotid body tumor, ectopic thyroid, soft tissue tumors such as hemangiomas, nerve sheath tumors. Conclusion: Cervical lymph nodes, as else where in the body, need to be assessed in terms of morphology (including the presence of calcification and necrosis), margins, enhancement characteristics and patterns of involvement by level and laterality.

What is your Diagnosis? Common and Uncommon Cystic Lesions of the Neck. A Case-based, Computer-interactive Tutorial

Education Exhibits
Location: NR Community, Learning Center

Participants
Jason Benjamin Mueller MD (Presenter) : Nothing to Disclose
Lindell R. Gentry MD : Nothing to Disclose
Deborah L. Reede MD : Nothing to Disclose
Wendy R. K. Smoker MD : Nothing to Disclose

TEACHING POINTS
1. Describe the imaging appearance of the most common cystic neck masses. 2. Learn less common cystic lesions that must also be considered in the differential diagnosis. 3. Learn the typical locations of these various cystic neck lesions.

TABLE OF CONTENTS/OUTLINE
Cystic neck masses can be a diagnostic challenge for the radiologist. It is important to consider both common and uncommon entities when faced with these lesions. One needs to consider congenital, neoplastic, and miscellaneous lesions. Reviewers are challenged with both common and uncommon cystic neck lesions utilizing a case-based, computer-interactive quiz format. Each case includes representative images that illustrate key diagnostic findings for the disease entity. A brief discussion highlighting salient clinical and imaging features follows each case. Cases include: Congenital lesions: thyroglossal duct, branchial cleft (II-IV), cervical bronchogenic, and thymic cysts, as well as venolymphatic malformations. Neoplastic lesions: nodal metastases, dermoid and epidermoid cysts, and cystic schwannomas. Miscellaneous lesions: abscesses and saccular cysts.

"What Lies Beneath?" - Imaging Assessment of the Submucosal Laryngeal Lesion

Education Exhibits
Location: NR Community, Learning Center

Participants
Neil Hemant Thakur MD (Presenter) : Nothing to Disclose
Nancy Jane Fischbein MD : Nothing to Disclose

TEACHING POINTS
Familizarize the reader with common and uncommon submucosal laryngeal lesions. Identify key imaging features that can help differentiate among the various neoplastic and non-neoplastic submucosal laryngeal lesions. Recognize potential 'don't touch' submucosal laryngeal lesions. Review next step in management of these lesions.

TABLE OF CONTENTS/OUTLINE
Essential laryngeal anatomy will be reviewed via diagrams and patient cross-sectional imaging studies. Through a number of CT and MRI cases from our institution the reader will be exposed to various submucosal laryngeal lesions including: benign and malignant neoplastic, infectious, inflammatory, vascular, congenital and traumatic. Key imaging features on CT and MRI, etiology, patient demographics, and next steps in management for the various lesions will be reviewed.
CT of the Postoperative Midfacial Skeleton Following Trauma: Review of Normal Appearances and Common Complications

Education Exhibits
Location: NR Community, Learning Center

Participants
Michael Jason Reiter DO (Presenter): Nothing to Disclose
Ryan Becton Schwope MD: Nothing to Disclose
Jonathan Kini: Nothing to Disclose
Jared Theler: Nothing to Disclose

TEACHING POINTS
The major teaching points of this exhibit are:
1. Repair of midfacial fractures is warranted to restore both form and function as the facial skeleton protects the brain and globes in addition to serving as a framework for soft tissues and as a site for muscular attachment
2. Le Fort fractures undergo plate and screw fixation, often at the ZMB, infraorbital rim and ZF suture, depending on the pattern
3. 2-point fixation for NOE fractures is at the piriform rim and nasofrontal junction; infraorbital rim may be plated as necessary
4. Sinus preservation is ideal following frontal sinus fractures but obliteration or cranialization are performed depending on the presence of outflow tract disruption or CSF leak
5. Failed repair due to improper alignment, mucocele formation, infection and temporal hollowing are potential complications

TABLE OF CONTENTS/OUTLINE
1. Indications for surgical intervention of midfacial fractures
   a. Le Fort
   b. Naso-orbital-ethmoidal (NOE)
   c. Frontal sinus
2. Operative approaches
   a. Le Fort
   b. NOE
   c. Frontal sinus
3. Goals of surgical repair and the desired CT appearance in the postoperative setting
   a. Overview
   b. Le Fort
   c. NOE
   d. Frontal sinus
4. Common complications
   a. Failed repair
   b. Infection
   c. Temporal hollowing

Don’t Lose Your Head: The Spectrum of Blunt Craniocervical Junction Injury at a Level I Trauma Center

Education Exhibits
Location: NR Community, Learning Center

Participants
Juveria Siddiqui MBBS, MRCS (Presenter): Nothing to Disclose
Tom Campion BMBCh, BA: Nothing to Disclose
Richard Jonathan Paul Smith MBChir, MA: Nothing to Disclose
Amit Roy MBBS, MRCS: Nothing to Disclose
Ashok Adams MRCP, FRCR: Nothing to Disclose

TEACHING POINTS
• Craniocervical junction (CCJ) injuries carry significant morbidity and mortality. • The normal bony, ligamentous and vascular anatomy of the CCJ • Examples of subtle and major osseous, ligamentous and vascular traumatic injuries to this region

TABLE OF CONTENTS/OUTLINE
CCJ injuries are common traumatic injuries of the skull base and cervical spine. Mechanisms may include hyperextension, hyperflexion, distraction and axial load injuries. The unique anatomy and biomechanics of the craniocervical junction give risk to characteristic injury patterns, which may be subtle to detect. This educational exhibit explains normal bony, ligamentous and vascular anatomy of the craniocervical junction. All CCJ injuries at our level I trauma center over the last 5 years were reviewed. Here we provide a method of assessment for the region, and highlight features not to be missed. We describe classification with relevance to further management. CT/MR imaging examples will include: • Osseous and ligamentous injuries: occipital condyle, atlas and axis fracture patterns and instability, C2-3 facetal injuries, as well as atlanto-occipital disassociation, and distraction injuries. • Non-osseous, non-ligamentous vascular injuries including transection, dissection, AV fistulae and pseudoaneurysms.

Head and Neck Trauma from Blast Injuries: Boston Marathon Bombing Experience

Education Exhibits
Location: NR Community, Learning Center

Participants
Ajay K. Singh MD (Presenter): Nothing to Disclose
Edward Kiho Sung MD: Nothing to Disclose
John Franklin Brunner MD: Nothing to Disclose
Karen Buch MD: Nothing to Disclose
TEACHING POINTS

This exhibit describes the imaging features of primary, secondary and tertiary blast wave injuries from Boston marathon bombing. Cases from Boston marathon bombing will be used to describe how a low detonation device can still cause significant injuries to the head and neck.

TABLE OF CONTENTS/OUTLINE


NRE295

Imaging of the Complications of Middle Ear Surgery: How Do I Keep my Favorite Surgeon away from Jail?

Education Exhibits

Location: NR Community, Learning Center

Participants

Aina Venkatasamy (Presenter): Nothing to Disclose
Marcela DE ALMEIDA CAVALCANTI : Nothing to Disclose
Sophie Anne Cahen Riehm MD : Nothing to Disclose
Francis P. Veillon MD : Nothing to Disclose

TEACHING POINTS

The most common surgical complications of middle ear surgery are facial nerve lesions, meningoencephalocele. For stapes surgery they may concern the middle ear, the inner ear or the oval window. These complications may be prevented by a precise and oriented analysis of the preoperative imaging.

TABLE OF CONTENTS/OUTLINE

1) Complications of middle ear surgery (cholesteatoma) 1.1 Facial nerve lesions 1.2 Meningoencephalocele 2) How to prevent these complications? 2.1 Facial nerve position Lowered VII-2 Dehiscent VII-2 canal, with or without inferior nerve herniation Anteriorized VII-3 2.2 Position of the sigmoid sinus 2.3 Height of the tegmen 2.4 Osteomatous otitis masking VII-2 or semicircular canal 3) Complications of stapes surgery (otosclerosis) 3.1 Middle ear Lateral displacement of the prosthesis Erosion of the long process of the incus 3.2 Oval window Perilymphatic fistula Hemorrhage (wound to a persistent stapedial artery) Granuloma/scarring tissue in the OW 3.3 Inner ear Pneumolabyrinth Intra vestibular displacement of the prosthesis or granuloma Infectious labyrinthitis Cophosis on Gusher ear 4) How to prevent these complications? 4.1 Position of the VII-2 4.2 Stenosis/congenital hypoplasia of the OW 4.3 Persistence of a stapedial artery 4.4 Associated inner ear malformations

NRE296

CT and MR Imaging of Aspergillosis in the Head and Neck: Typical and Atypical Manifestations

Education Exhibits

Location: NR Community, Learning Center

Participants

Ryutarou Ukiusu MD (Presenter): Nothing to Disclose
Yusuke Inoue MD, PhD : Nothing to Disclose
Takuro Yamane : Nothing to Disclose
Asami Otsuka : Nothing to Disclose
Rie Shimada : Nothing to Disclose

TEACHING POINTS

Head and neck aspergillosis occurs in both invasive and noninvasive forms, and the former is a major cause of morbidity and mortality in immunosuppressed patients. Diagnosis of aspergillosis is often complicated by the varied clinical presentation, however, the delay of prompt diagnosis can be life-threatening. The purpose of this exhibit is; 1) to know the typical and atypical manifestations of aspergillosis on CT/MR imaging; 2) to recognize radiologic-pathologic correlation in aspergillosis. By being familiar with this entity, the radiologist can contribute to early recognition that facilitates timely treatment of these potentially life-threatening disorders.

TABLE OF CONTENTS/OUTLINE

Introduction Etiology, Pathology, treatment and prognosis based on clinical classification Case presentation with /without complications A. Paranasal sinus 1) Mycetoma 2) Acute invasive aspergillosis i) bilateral IC occlusion, ii) pseudoaneurysm and iii) others 3) Chronic invasive aspergillosis i) blindness, ii) cerebral mycetoma mimicking brain neoplasm 4) Granulomatous invasive aspergillosis B. Temporal bone 1) Aspergillus otomastoiditis with dural sinus thrombosis 2) Malignant external otitis with brain abscess C. Neck 1) Deep neck space infections Summary

NRE299

Head and Neck Lesions in IgG4-related Disease - A Newly Recognized Systemic Inflammatory Condition

Education Exhibits

Location: NR Community, Learning Center
Participants

Maira Sarpi MD (Presenter): Nothing to Disclose
Regina Lucia Elia Gomes MD: Nothing to Disclose
Marcio Ricardo Taveira Garcia MD: Nothing to Disclose
Flavia I. Cevasco MD: Nothing to Disclose
Mauro Miguel Daniel MD: Nothing to Disclose
Eloisa Maria Santiago Gebrim MD: Nothing to Disclose

TEACHING POINTS

Literature review emphasizing head and neck manifestations of IgG4-related disease (a newly recognized clinical condition).
To highlight and exemplify imaging features and follow up findings using clinical cases. To aggregate this differential diagnosis in the evaluation of head and neck tumors.

TABLE OF CONTENTS/OUTLINE

IgG4-related disease has been recently recognized as an inflammatory condition, characterized by pseudotumoral lesions and particular histopathological findings. Recently the occurrence in diverse organs was linked, so previously recognized head and neck distinct lesions are now acknowledged as manifestations of this disease (inflammatory pseudotumors, Küttner's tumor, Mikulicz's syndrome, Riedel's thyroiditis, etc). In some patients it manifests in a single structure, and the differential diagnosis with tumors is important. Initially imaging features do not permit this distinction, but when clinical and histopathological data directs to an IgG4-related disease, imaging follow up demonstrates a characteristic significative response to treatment with glucocorticoids. Cases selected from our digital archive will demonstrate the manifestations in diverse head and neck structures (ptuitary gland, skull base, paranasal sinuses, parotid gland, parapharyngeal space and lymph nodes) and follow-up imaging findings.

NRE300

Orbital Inflammation & Infection: What Does the Clinician Need to Know?

Education Exhibits
Location: NR Community, Learning Center

Participants

Bethany Milliron MD (Presenter): Nothing to Disclose
Kristen Lloyd Baugnon MD: Nothing to Disclose
Hee Joon Kim MD: Nothing to Disclose
Hans Grossniklaus MD, MBA: Nothing to Disclose
Ashley Hawk Aiken MD: Nothing to Disclose

TEACHING POINTS

- Review orbital and periorbital anatomy
- Describe imaging features of orbital inflammatory and infectious processes
- Discuss pertinent findings important to clinician to direct diagnosis and biopsy

TABLE OF CONTENTS/OUTLINE

1. Review orbital and periorbital anatomy
   a. Structures within the orbits (globe, extraocular muscles, lacrimal glands, etc)
   b. Pertinent periorbital structures (paranasal sinuses, cavernous sinus)
2. Orbital infections
   a. Orbital cellulitis
   b. Complications of bacterial and invasive fungal sinusitis
3. Orbital inflammation
   a. Common causes
      i. Thyroid eye disease
      ii. Nonspecific orbital inflammation (pseudotumor)
   b. Uncommon causes
      i. Sarcoidosis
      ii. Wegener's granulomatosis
      iii. Lupus, scleroderma
      iv. IgG4
4. Management of orbital inflammation and infection
   a. When to biopsy and when can biopsy be avoided

NRE301

Sialadenitis: Spectrum of Imaging Findings at Multi-imaging Modalities

Education Exhibits
Location: NR Community, Learning Center

Participants

Ahmed Abdel Razek MD (Presenter): Nothing to Disclose
Suresh K. Mukherji MD: Nothing to Disclose

TEACHING POINTS

The purpose of this work is:
1-To review classification of sialadenitis
2-To review typical and atypical imaging appearance of sialadenitis at different imaging modalities
3-To discuss role of advanced MR imaging as MR Sialogram and diffusion MR imaging in diagnosis of sialadenitis

TABLE OF CONTENTS/OUTLINE

1. Updated classification of sialadenitis
2. Mertis and limitations of routine and advanced imaging modalities for diagnosis of sialadenitis
3. Imaging appearance of IgG4-related chronic sclerosing sialadenitis
4. Imaging appearance of obstructive sialadenitis
5. Imaging appearance of specific sialadenitis such as TB and HIV
6. Imaging biomarkers such as diffusion MR imaging for prediction of radiation induced sialadenitis
7. Imaging of radioiodine Sialadenitis
8. Diagnosis and grading of Sjögren's syndrome
9. Imaging findings suggestive of granulomatous sialadenitis
10. Imaging of 2D and 3D ultrasound elastography in the Differential Diagnosis of Parathyroid Lesions from

NRE302

2D and 3D Ultrasound Elastography in the Differential Diagnosis of Parathyroid Lesions from
Lymph Nodes and Posterior Thyroid Nodules

Education Exhibits
Location: NR Community, Learning Center

Participants
Vito Cantisani MD (Presenter): Speaker, Toshiba Corporation
Nicola Di Leo MD: Nothing to Disclose
daniele diacinti: Nothing to Disclose
Andrea Isidori: Nothing to Disclose
Ferdinando D’Ambrosio: Nothing to Disclose
Carlo Catalano MD: Nothing to Disclose
Elisa Giannetta: Nothing to Disclose
Hektor Grazhdani MD, PhD: Nothing to Disclose
Mattia Di Segni MD: Nothing to Disclose
Nicola Orsogna: Nothing to Disclose
antonello rubini MD: Nothing to Disclose
Cristina Fioravanti: Nothing to Disclose
Maria Rosignuolo: Nothing to Disclose

TEACHING POINTS
1. To describe elastographic features of parathyroid lesions, compared with color-Doppler US features, and differentiating signs from lymph nodes and deep thyroid nodules. 2. To inform about technical issues of 3D US elastography method and their application in the neck region. 3. To review issues of epidemiology, clinical presentation, state of the art work up, differential diagnosis and treatment options of parathyroid lesions.

TABLE OF CONTENTS/OUTLINE
1. Hyperparathyroidism: diagnosis and therapy. 2. State of the art imaging and issues in presurgical localization of parathyroid adenomas: literature review. 3. Qualitative elastography with Ueno score and semi-quantitative strain ratio measurements in parathyroid adenoma localization. 4. US features of parathyroid adenoma and differentiation from paratracheal lymph nodes and ectopic thyroid nodules. 5. Parathyroid lesions at 2D and 3D US elastography, with image review of representative cases from our cohort - 34 cases of parathyroid adenomas and 16 cases of hyperplasia, 4 carcinomas. 6. Stiffness and US 2-D and 3-D features correlated with parathyroid adenoma, differentiating it from reactive lymph nodes of chronic thyroiditis and benign posterior thyroid nodules. 7. Differential diagnosis and role of the various imaging modalities. 8. Conclusion.

NRE303
4D Parathyroid CT: A Pictorial Essay on How to Localize Parathyroid Adenomas

Education Exhibits
Location: NR Community, Learning Center

Participants
Melissa Mei Chen MD (Presenter): Nothing to Disclose
Wilson Altmeier MD: Nothing to Disclose
Erin Flaherty MD: Nothing to Disclose
Bundhit Tantiwongkosi MD: Nothing to Disclose
Darlene Fong Metter MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To describe the 4D CT technique in the evaluation of parathyroid adenomas.
2. To review the imaging characteristics of surgically proven parathyroid adenomas and correlation with imaging findings on ultrasound and sestimibi scintigraphy.

TABLE OF CONTENTS/OUTLINE
1. Description of the 4D CT technique Imaging characteristics of parathyroid adenomas on 4D CT.
2. Common pitfalls of diagnosing parathyroid adenomas, including anatomic variants.
3. CONCLUSION: Imaging, particularly 4D CT, has provided head and neck surgeons with a critical diagnostic tool in localizing parathyroid adenomas. Knowledge of anatomic variants and enhancement characteristics of the parathyroid adenoma are key in making the diagnosis.

NRE304
An Imaging Checklist and Algorithm for Accurate Staging of Laryngeal Squamous Carcinoma in the Era of Laryngeal Conservation: What Really Matters and Why?

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Supreeta Arya MD (Presenter): Nothing to Disclose
Ankur Pradeep Gupta MBBS: Nothing to Disclose
Hirofumi Kuno MD: Nothing to Disclose
Suresh K. Mukherji MD: Nothing to Disclose

TEACHING POINTS
To bring awareness of therapy options for various stages of laryngeal cancer in this era of multidisciplinary disease management.

1. To highlight the critical imaging information that can impact choice of therapy.
2. To review the role of various imaging methods to provide this information, describe pitfalls and suggest an imaging algorithm to maximize information from imaging.

TABLE OF CONTENTS/OUTLINE
Treatment goals in laryngeal cancers, conclusions of the major Phase III trials in laryngeal cancers and outline of stage based therapy in laryngeal cancers Imaging features of laryngeal cancers in various stages and the “key” features that can alter therapy plan. Review of literature to assess accuracy of imaging to predict the “key” features as well as to predict prognosis following definitive radiotherapy and chemo-radiotherapy Pitfalls in staging and a suggested imaging algorithm for clinical practice.

NRE305
Beyond Skin Deep: Role of CT and MR in the Evaluation of Cutaneous Malignancies of the Head and Neck

Education Exhibits
Location: NR Community, Learning Center

Participants
Marin Alisa McDonald MD, PhD (Presenter): Nothing to Disclose
Julie Bykowski MD : Nothing to Disclose

TEACHING POINTS
- CT and MRI serve important roles in the evaluation of locoregional spread of non-melanoma head and neck cutaneous malignancies.
- Accurate imaging diagnosis of recurrence requires understanding of local, lymphatic and perineural pathways and correlation with clinical symptoms.

TABLE OF CONTENTS/OUTLINE
Table of contents: Review of NCCN guidelines for surgical and/or adjuvant treatment of non-melanoma head and neck cutaneous malignancies based on stage and pathological grade. Case series illustrating the role of CT and MRI in the assessment of large, deeply invasive cutaneous malignancies, suspected recurrence, nodal metastasis, and suspected perineural spread. Specific cases will include: Direct soft tissue, parotid gland and osseous invasion Occipital and parotid nodal metastases Extracranial perineural extension (Fig 1-3) Intracranial perineural extension Dural invasion (Fig 4) Orbital extension and recurrence after exenteration (Fig 5) Recurrence presenting as non-healing soft tissue ulceration Osteoradionecrosis Presentation and recurrence in immunocompromised/immunosuppressed patients Brief self-assessment test to consolidate the basic principles and approach for successful diagnosis.

NRE306
Clinical Presentation and Imaging Findings of Chronic Sclerosing Sialadenitis for Smart Diagnosis and Therapy for IgG4-related Diseases

Education Exhibits
Location: NR Community, Learning Center
Certificate of Merit

Participants
Etsushi Iida MD (Presenter): Nothing to Disclose
Matakazu Furukawa MD : Nothing to Disclose
Takaaki Ueda : Nothing to Disclose
Masahiro Tanabe MD : Nothing to Disclose
Yoshie Kunihiro MD : Nothing to Disclose
Naofumi Matsunaga MD, PhD : Nothing to Disclose

TEACHING POINTS
This exhibit illustrates multimodal imaging findings of chronic sclerosing sialadenitis (CSS) with correlation of the clinical presentation and pathologic findings. CSS is one of IgG4-related diseases which involve various organs. Radiologists should know the clinical presentation and the imaging findings of the CSS to diagnose IgG4-related disease efficiently when the other critical organ might be involved in this entity, because the diagnostic biopsy of most of those affected organs is often invasive and difficult to perform without risk, while biopsy of the salivary gland is considered safe and less invasive way to the accurate diagnosis.

TABLE OF CONTENTS/OUTLINE
1. Introduce a history of chronic sclerosing sialadenitis from Küttner tumor in 1896 to recent concept of IgG4-related disease. 2. Review of clinical presentation of chronic sclerosing sialadenitis. 3. Review of CT, MR, PET-CT and ultrasonography of chronic sclerosing sialadenitis in comparison with resected specimens. 4. Differential diagnosis of chronic sclerosing sialadenitis. 5. Review of clinical presentation of the other IgG4-related diseases. 6. Review of CT, MR, PET-CT and ultrasonography of the other IgG4-related diseases. 7. Discussion the treatment of the IgG4-related diseases.

NRE307
Current Concepts in Molecular Genetics and Management of Thyroid Malignancies: An Update for Radiologists

Education Exhibits
Location: NR Community, Learning Center
Selected for RadioGraphics

Participants

**Participants**

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Tatiana Kelil MD</td>
<td>Presenter, Nothing to Disclose</td>
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<tr>
<td>Stephanie A., Howard MD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Michael Hayden Rosenthal MD, PhD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Katherine Margaret Krajewski MD</td>
<td>Research Grant, General Electric Company Spouse, Employee, Ironwood Pharmaceuticals, Inc</td>
</tr>
<tr>
<td>Nikhil H. Ramaiya MD</td>
<td>Nothing to Disclose</td>
</tr>
<tr>
<td>Sreeharsha Tirumani MBBS, MD</td>
<td>Nothing to Disclose</td>
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**TEACHING POINTS**

1. Epithelial thyroid malignancies are of follicular cell (follicular (FTC), papillary (PTC), Hurthle cell, anaplastic thyroid carcinoma) or c-cell (medullary thyroid carcinoma (MTC)) origin.
2. FTC is associated with mutations in the PTEN gene (PTEN-hamartoma).
3. FTC is associated with mutations in the PTEN gene (PTEN-hamartoma).
4. FTC is associated with mutations in the PTEN gene (PTEN-hamartoma).
5. Imaging plays a crucial role in early detection and accurate staging of thyroid cancer, and in detecting other syndrome-associated tumors.
6. Correlation with biochemical markers can help radiologists in interpreting images.
7. Prognostic factors in thyroid malignancies include anaplastic histology, tumor size, familial PTC; RET mutation in sporadic MTC and vascular invasion.

**TABLE OF CONTENTS/OUTLINE**

1. Describe WHO classification of thyroid malignancies.
2. Review molecular genetics of thyroid malignancies with emphasis on syndromes associated with them.
3. Illustrate the role of multimodality imaging (CT, MRI, PET/CT) in staging, evaluating treatment response and post treatment surveillance.
4. Elucidate advances in imaging techniques including new radiotracers.
5. Discuss advances in treatment including molecular targeted therapies.

NRE308

**Determination of Unresectability in Head and Neck Cancer with Imaging**

**Education Exhibits**

Location: NR Community, Learning Center

**Certificate of Merit**

Participants

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<tbody>
<tr>
<td>Hirofumi Kuno MD</td>
<td>Presenter, Nothing to Disclose</td>
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<tr>
<td>Hiroya Ojiri MD</td>
<td>Nothing to Disclose</td>
</tr>
<tr>
<td>Hiroaki Ōnaya MD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Kotaro Sekiya DDS, PhD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Satoshi Fujii MD, PhD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Masahiko Kusumoto MD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Ryuichi Hayashi MD, PhD</td>
<td>Nothing to Disclose</td>
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<td>Mitsuo Satake MD, PhD</td>
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**TEACHING POINTS**

Head and neck cancer, particularly potentially unresectable advanced lesions, should be accurately evaluated because the results strongly impact on a treatment planning and patient outcomes. Radiologists must carefully detect the presence of deep invasion that may upstage a tumor to stage T4b and predict inoperability in cases of lymph node metastases. The most common and crucial factors associated with unresectability are carotid encasement, prevertebral fascia involvement and nasopharyngeal extension. Understanding the advantages, limitations, and appropriate criteria of each imaging modality (CT/MRI) for detecting the factors that determine unresectability improves decision-making regarding treatment, thus ensuring optimal therapeutic outcomes.

**TABLE OF CONTENTS/OUTLINE**

Factors associated with unresectable head and neck cancer (mainly, oro/hypopharyngeal and laryngeal cancer). Cases illustrating various patterns of unresectability. Some of the information is presented as a quiz, followed by case presentations with the patients’ treatment choice/outcome and histopathological findings: Resectability issues for primary disease: carotid encasement, prevertebral fascia involvement and nasopharyngeal extension. Resectability issues for lymph node metastases: carotid encasement and invasion of the deep layer of the deep cervical fascia.

NRE309

**Elastography of Cervical Lymph Nodes: Which Index Can Predict Benignity or Malignancy?**

**Education Exhibits**

Location: NR Community, Learning Center

Participants

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<th>Name</th>
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<tr>
<td>Osmar Cassio Saito MD, PhD</td>
<td>Presenter, Nothing to Disclose</td>
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<tr>
<td>Igor Fontenele MD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Maria Cristina Chammas MD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Andrea Cavalanti Gomes MD</td>
<td>Nothing to Disclose</td>
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<tr>
<td>Yerma Fugikawa MD</td>
<td>Nothing to Disclose</td>
</tr>
<tr>
<td>Giovanni Guido Cerri MD, PhD</td>
<td>Nothing to Disclose</td>
</tr>
</tbody>
</table>

**TEACHING POINTS**

1. The purpose of this educational exhibit is to describe the imaging patterns of elastography in solid or cystic/solid benign and malign cervical lymph nodes; (2) To establish a mean index in the solid component of benign or malign cervical lymph nodes; (3) To compare elastography results with FNA or surgery findings; (4) To be able to reproduce the static elastography step by step after reading this presentation.

**TABLE OF CONTENTS/OUTLINE**

Factors associated with unresectable head and neck cancer (mainly, oro/hypopharyngeal and laryngeal cancer). Cases illustrating various patterns of unresectability. Some of the information is presented as a quiz, followed by case presentations with the patients’ treatment choice/outcome and histopathological findings: Resectability issues for primary disease: carotid encasement, prevertebral fascia involvement and nasopharyngeal extension. Resectability issues for lymph node metastases: carotid encasement and invasion of the deep layer of the deep cervical fascia.
Cervical lymph nodes are frequent and its cause usually is confirmed by FNA or surgery. Static elastography is a new ultrasound modality that provides information about tissue distortion under local pressure. Basically there are three sorts of elastography: static, share wave and ARFI. We used the static elastography. Hard nodes are supposed to be malign whereas benign ones are usually soft. We made a retrospective study with 64 cases and our results are similar to the worldwide experience. However there is no consensus regarding the elastography index concerning benignity or malignity nature. In our study benign nodules have an index mean of 1,6 whereas a mean index of 6,0 or more is certainly considered to be malign.

NRE310

Elastography of Thyroid Nodules: Which Elastography Index Can Predict Malignancy?

Education Exhibits
Location: NR Community, Learning Center

Cum Laude

Participants
Osmar Cassio Saito MD, PhD (Presenter): Nothing to Disclose
Maria Cristina Chammas PhD : Nothing to Disclose
Felipe Boschini Franco MD : Nothing to Disclose
Sandra M. Tochetto MD : Nothing to Disclose
Giovanni Guido Cerri MD, PhD : Nothing to Disclose

TEACHING POINTS
1. The purpose of this educational exhibit is describe the imaging patterns of elastography in solid or cystic/solid benign and malign thyroid nodules; (2) To establish a mean elastography index for benign and malign thyroid nodules; (3) To compare elastography results with fine needle aspiration (FNA) or surgery findings; (4) To be able to reproduce the active elastography step by step.

TABLE OF CONTENTS/OUTLINE
Thyroid nodules are frequent and its nature usually is not always an easy task for ultrasound or any other imaging method. The final nodule diagnosis is often confirmed by FNA. Elastography is a new ultrasound technology that provides information about tissue elasticity. There are three types of elastography, which includes: static, transient elastography and ARFI (acoustic radiation force impulse). This new technology is based on deformation under local probe pressure. Hard nodules are supposed to be malign whereas benign are often soft. We made a retrospective study with 128 cases and our results are similar to the worldwide literature. However there is no consensus regarding the elastography index for each sort of nodule. The elastography index is calculated by means of comparing the deformation percentage of nodule tissue and normal surround parenchyma. In our study benign nodules have an index of 1,2 whereas an index of 4,5 or more is considered malign.

NRE311

Evaluation of Oral Cavity Carcinomas: A Case-based, Computer-Interactive Tutorial

Education Exhibits
Location: NR Community, Learning Center

Participants
Mark Scott Van Tassell MD (Presenter): Nothing to Disclose
Lindell R. Gentry MD : Nothing to Disclose
Deborah L. Reede MD : Nothing to Disclose
Wendy R. K. Smoker MD : Nothing to Disclose

TEACHING POINTS
1. Review normal anatomy of the oral cavity. 2. Learn the AJCC criteria for staging of OCCa. 3. Gain an understanding of how to assess extent of lesions in the various oral cavity subsites.

TABLE OF CONTENTS/OUTLINE
Following a brief review of pertinent normal oral cavity anatomy and review of AJCC TNM criteria, we present multiple cases in quiz format of oral cavity carcinoma in each of the top five subsites on CT/MR, (1- lower lip; 2- oral tongue; 3- floor of mouth; 4- gingiva/retromolar trigone; and 5- hard palate.) We employ a computer-interactive checklist approach for systematic evaluation of tumors in the various sub sites and lead the reader through a step-by-step analysis of each tumor. This permits the reviewer to optimize his/her imaging reports by inclusion of both pertinent positive and negative findings, thus providing accurate information for appropriate clinical staging.

NRE312

Extension Patterns of Oral Cavity Carcinoma in the Mandible and Its Clinical Significance

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Kotaro Sekiya DDS, PhD (Presenter): Nothing to Disclose
Hirofumi Kuno MD : Nothing to Disclose
Satoshi Fuji MD, PhD : Nothing to Disclose
Takashi Kanda DDS, PhD : Nothing to Disclose
Masahiko Kusumoto MD : Nothing to Disclose
Ryuichi Hayashi MD, PhD : Nothing to Disclose
Masaaki Suzuki DDS, PhD : Nothing to Disclose
Mitsuo Satake MD, PhD : Nothing to Disclose
TEACHING POINTS
In patients with oral cavity carcinoma, preoperative evaluation of the extension of tumors (depth and range) in the mandible is crucial for planning surgical procedures and postoperative treatment. The extension of a tumor into/in the mandible has several patterns, and depends on the following factors: a. Primary location of the tumor (e.g. gingiva, retromolar trigone) b. Mandibular subsites for invasion c. Histological characteristics of the tumor d. Condition of the mandible (e.g. presence of teeth, dental or periodontal disease) e. Presence of perineural spread Furthermore, some dental and inflammatory diseases may influence bone marrow imaging of the tumor in the mandible, and may mimic the tumors on CT and MRI. This educational exhibit will show what radiologists need to know for accurately evaluating extension of tumors in the mandible based on clinical significance.

TABLE OF CONTENTS/OUTLINE
1. Key anatomy of the mandible for evaluating bone marrow invasion 2. Illustrations of various cases of carcinoma invading the mandibular bone marrow a. How to diagnose invasion to the mandibular bone marrow b. How to evaluate the extension of the tumor in the mandible based on surgical procedures c. How to determine when postoperative chemo-radiotherapy is required 3. Summary and classification of extension patterns of tumors

NRE313
Extranodal Lymphoma of the Head and Neck: A Multi-Modality Review
Education Exhibits
Location: NR Community, Learning Center

Participants
Sofia Otero MB Ch, FRCR (Presenter): Nothing to Disclose
Kanchana Rajaguru MD, FRCR: Nothing to Disclose
Monika Rowe MD, PhD: Nothing to Disclose

TEACHING POINTS
This education exhibit will: 1. Provide a structured review of the clinical, pathological, and imaging features (using a multi-modality approach that includes US, CT, MRI and PET) of extranodal lymphoma of the head and neck using a series of cases organised by their anatomical site. 2. Give a list of differential diagnoses for a lesion at each anatomical location. 3. Include cases that illustrate complications associated with these neoplasms, which have the potential to cause diagnostic ambiguity at presentation, namely infection.

TABLE OF CONTENTS/OUTLINE
Lymphoma is the second most common malignant neoplasm of the head and neck, and one of the most common sites for extranodal disease. This exhibit will describe the following features of lymphoma for each of the commonly affected extranodal sites within the head and neck: 1. Clinical features 2. Pathological features 3. Imaging features, using a multi-modality approach that includes US, CT, MRI and PET imaging 4. Differential diagnosis The anatomical sites to be described include: 1. Waldeyer's ring 2. Sinonasal passage 3. Oral cavity/palate 4. Salivary glands 5. Orbit 6. Face/soft tissues 7. Thyroid Some cases will be included to illustrate complications of these neoplasms, e.g. infection, which can cause diagnostic ambiguity in these patients at presentation.

NRE315
FDG PET/CT Evaluation of the Postoperative and Irradiated Head and Neck
Education Exhibits
Location: NR Community, Learning Center

Participants
Travis David Howard MD (Presenter): Nothing to Disclose
Christopher Harker Hunt MD: Nothing to Disclose
Geoffrey Bates Johnson MD, PhD: Nothing to Disclose
Stephen Michael Broski MD: Nothing to Disclose
Patrick James Peller MD: Speakers Bureau, General Electric Company

TEACHING POINTS
1. Review dedicated FDG PET/CT imaging of the head and neck 2. Briefly discuss the clinical role of FDG PET/CT imaging of the head and neck in the management of disease focusing on evaluation following therapy 3. Demonstrate imaging features that distinguish benign etiologies from malignancy 4. Illustrate mimics and pitfalls providing case examples and correlation with multimodality imaging

TABLE OF CONTENTS/OUTLINE
Dedicated FDG PET/CT imaging of the head and neck • Protocol and benefits of dedicated imaging of the head and neck • Illustration of the appropriate time intervals for imaging of the postoperative and irradiated head and neck II. Normal Uptake • PET/CT Anatomic review • Expected physiologic uptake in normal anatomic head and neck structures III. Roles and limitations of FDG PET/CT imaging for restaging head and neck malignancy • TNM staging • Clinical algorithm for staging head and neck malignancy IV. Mimics and Pitfalls of disease in the postoperative and irradiated head and neck • Inflammatory or reactive changes • Common and uncommon postoperative changes • False negative examination in the setting of necrotic nodes • Unexpected vascular uptake in bland thrombus • Exaggerated physiologic uptake and how to avoid it • Common artifacts in PET/CT and how to avoid them • Importance of multimodality imaging correlation

NRE316
Fine Needle Aspiration of Thyroid Nodules: Why, When and How to Do It
Education Exhibits
Location: NR Community, Learning Center

Participants
Steven Raeymaeckers (Presenter): Nothing to Disclose
Tim J.J. Vanderhasselt MD: Nothing to Disclose
Johan De Mey: Research Grant, General Electric Company
TEACHING POINTS
The learner should understand that thyroid nodules are frequent and incidental, thyroid cancer however is rare. Anatomopathological diagnosis is the golden standard, but performing FNA of all thyroid nodules is no option. The learner should know key alarm symptoms (pain, rapid growth, nodules in children...) and must understand the importance of ultrasonographic key-features of malignancy. The TIRADS-system as proposed in Radiology (Radiology, 2011, Vol.260: 892-899, 10.1148/radiol.11110206) is an easy and reproducible classification, it scores nodules based on 5 ultrasonographic features. This system allows for an adequate risk-assessment of malignancy and can help to select those nodules with the highest risk-profile for FNA. The learner will learn how to perform an adequate fine needle aspiration and what material to use.

TABLE OF CONTENTS/OUTLINE

NRE317
How to Assess and Report Upper Aerodigestive Tract Carcinomas: A Case-based Interactive Tutorial

Education Exhibits
Location: NR Community, Learning Center

Participants
Joel Ziegelbein MD, MS (Presenter): Nothing to Disclose
Wendy R. K. Smoker MD: Nothing to Disclose
Lindell R. Gentry MD: Nothing to Disclose
Deborah L. Reede MD: Nothing to Disclose

TEACHING POINTS
1. Review normal anatomy of the nasopharynx and oropharynx.
2. Learn the primary pathways of perineural and submucosal spread of tumors in these regions.
3. Learn the AJCC criteria for staging of nasopharyngeal carcinomas, how to assess extent of these lesions, and what to include in your report.
4. Learn the AJCC criteria for staging of oropharyngeal (tonsil and base of tongue) carcinomas, how to assess extent of these lesions, and what to include in your report.

TABLE OF CONTENTS/OUTLINE

NRE318
Imaging Findings of Benign Tumors and Tumor-like Lesions of the Nasal Cavity and Paranasal Sinuses: Implications for Endoscopic Surgery

Education Exhibits
Location: NR Community, Learning Center

Participants
Etsushi Iida MD (Presenter): Nothing to Disclose
Takefumi Mikuriya: Nothing to Disclose
Matakazu Furukawa MD: Nothing to Disclose
Masatoshi Kato: Nothing to Disclose
Naofumi Matsunaga MD, PhD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the clinical issues about benign tumors and tumor-like lesions of the nasal cavity and paranasal sinuses. 2. To demonstrate characteristic imaging findings on CT, MRI, PET-CT and angiography. 3. To highlight imaging findings that otolaryngologists want to know before the endoscopic nasal surgery.

TABLE OF CONTENTS/OUTLINE
This exhibit includes six benign tumors (papilloma, pleomorphic adenoma, schwannoma, juvenile angiofibroma, ossifying fibroma and lobular capillary hemangioma) and two tumor-like lesions (invasive fungal sinusitis and organized hematoma). 1. Summary of clinical presentation, demographics, natural history and prognosis. 2. Characteristic findings of diagnostic imaging with pathologic correlation. 3. Key points of practical preoperative imaging assessments for the endoscopic nasal surgery by otolaryngologist. 4. Role of follow up imaging after surgery: Complication, Recurrence.

NRE319
Imaging of Uncommon Nasal and Paranasal Malignant Tumors

Education Exhibits
Location: NR Community, Learning Center

Participants
Asari Sai (Presenter): Nothing to Disclose
TEACHING POINTS
Among nasal and paranasal malignancies, squamous cell carcinoma (SCC) is the most common histology. Other nasal and paranasal malignancies are diverse and relatively rare. However, it is important to understand their imaging features in order to differentiate among them and from benign lesions. Computed tomography (CT) and magnetic resonance (MR) imaging play an important role in characterization and in the assessment of the extent of the disease and involvement of adjacent and distant structures. Familiarity with the CT and MR imaging features of various nasal and paranasal malignancies will facilitate accurate diagnosis and staging. The purpose of this exhibit is: 1. To learn clinical characteristics and incidence of each uncommon nasal and paranasal malignant tumor 2. To review the imaging features of uncommon nasal and paranasal tumors 3. To learn how to differentiate among these uncommon malignancies and from benign lesions

TABLE OF CONTENTS/OUTLINE
General epidemiology of nasal and paranasal malignant tumors Clinical characteristics and CT/MR imaging features of common and uncommon nasal and paranasal malignant tumors -Malignant melanoma, olfactory neuroblastoma, solitary fibrous tumor, carcinosarcoma, rhabdomyosarcoma, etc. Differential diagnosis

NRE320
Imaging Parapharyngeal Tumors: A Holistic Approach and Imaging Checklist to Assist the Clinician

Education Exhibits
Location: NR Community, Learning Center
Cum Laude

Participants
Supreeta Arya MD (Presenter): Nothing to Disclose
Ashita Rastogi MBBS, MD : Nothing to Disclose
Nilesh Sable : Nothing to Disclose
Robert Hermans MD, PhD : Nothing to Disclose
Suresh K. Mukherji MD : Nothing to Disclose

TEACHING POINTS
1. To discuss the definition of parapharyngeal space as understood by most clinicians.
2. Discuss differential diagnoses of parapharyngeal neoplasms with level 1 evidence from literature.
3. Role of various imaging methods in a) establishing diagnosis and b) assisting optimal therapy

TABLE OF CONTENTS/OUTLINE
1. Anatomy of the parapharyngeal space including the prestyloid and poststyloid compartments.
2. Common differential diagnosis of parapharyngeal tumors with pictorial essay of imaging features
3. Unusual neoplasms that can confound diagnosis
4. Role of CT, MRI, angiography, FNAC and nuclear medicine in diagnosing parapharyngeal tumors
5. Imaging features that can impact therapy and various surgical approaches
6. A checklist for the optimal structured report.

NRE322
Odontogenic Tumors: Spectrum of Findings at Multi-imaging Modalities

Education Exhibits
Location: NR Community, Learning Center

Participants
Ahmed Abdel Razek MD (Presenter): Nothing to Disclose
Lamia Elsorogy MD, PhD : Nothing to Disclose
Hesham Elemam : Nothing to Disclose
Shefeek Abubacker MD, FRCR : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1-To review WHO classification, demographic and clinical presentations of odontogenic tumors. 2-To demonstrate typical and atypical imaging appearance of odontogenic tumors at multi-imaging modalities. 3-To discuss the role of advanced CT and MR imaging in assessment of odontogenic tumors.

TABLE OF CONTENTS/OUTLINE
1-Basic background about odontogenic tumors 2-Updated WHO classification of odontogenic tumors 3-Mertis and limitations of panorama, CT scan and MR imaging 4-Role of cone beam CT and dynamic contrast CT scan in assessment of odontogenic tumors. 5-Role of diffusion MR imaging, dynamic contrast MR imaging in characterization of odontogenic tumors. 5-Diagnostic approach and Interpretation of odontogenic tumors 6-CT and MR Imaging appearance of typical and atypical ameloblastoma 7-Imaging appearance of keratocystic odontogenic tumor and calcifying epithelial odontogenic tumor 8-Imaging of odontomas and cementomas 9-Imaging of fibro-osseous and other cystic lesions simulating odontogenic tumors 10-Imaging appearance of malignant odontogenic tumors 11-Imaging findings used to differentiate odontogenic tumors from simulating lesions

NRE323
Pediatric Head and Neck Nonrhabdomyosarcomatous Sarcomas (nonRMS): Imaging, Clinical and Pathological Assessment

Education Exhibits
Participants
Bing Wang MD (Presenter): Nothing to Disclose
Alfred Leo Weber MD: Nothing to Disclose
Paul Albert Caruso MD: Nothing to Disclose
Baiju Shah MD: Nothing to Disclose
Hugh D. Curtin MD: Nothing to Disclose

TEACHING POINTS
To demonstrate the clinical, imaging, and pathological findings of different head and neck nonRMS in children and adolescents.

TABLE OF CONTENTS/OUTLINE
Method: We evaluated 20 cases of nonRMS in 2-20 year-old. All cases were studied with CT and/or MRI, and in some cases PET-CT. Representative cases of different types of sarcomas were evaluated including osteosarcomas (3), chondrosarcomas (2), synovial sarcomas (3), the Ewing's sarcoma family of tumors (4), spindle cell sarcomas (undifferentiated) (2), alveolar soft part sarcomas (1), fibrosarcomas (2), and neurofibrosarcomas (4). Pertinent differential diagnosis of imaging findings will be presented with the illustrated cases. Results: On CT the densities were homogeneous with variable enhancement but usually low to medium. Calcification was encountered in osteosarcomas, chondrosarcomas, and in some large tumors with necrosis. MRI revealed low signal intensities (SI) relative to muscle on T1-WI, variable increased SI on T2-WI, and slight to moderate enhancement on post-Gadolinium images. Tumor necrosis was related to size of tumor and was observed in large tumors. Local lymph node metastases are less common than in carcinomas of the head and neck. Conclusion: We present the imaging findings of pediatric nonRMS and evaluated them for size, margins, location, bony erosion, and metastases.

NRE324
Seeing is Believing: Laryngeal Carcinoma Imaging and Laryngoscopy Correlation

Education Exhibits
Location: NR Community, Learning Center
Certificate of Merit

Participants
Michael Cathey MD (Presenter): Nothing to Disclose
Tabassum A. Kennedy MD: Nothing to Disclose
Greg Hartig: Nothing to Disclose
Paul M. Harari MD: Nothing to Disclose
Seth Dailey: Nothing to Disclose
Wendy R. K. Smoker MD: Nothing to Disclose
Deborah L. Reede MD: Nothing to Disclose
Lindell R. Gentry MD: Nothing to Disclose

TEACHING POINTS
Superficial neoplasms involving the surface of the vocal cords, cord fixation, and early transglottic extension can be difficult to recognize on CT/MR imaging. Laryngoscopy (ES) remains the gold standard for characterizing the extent of mucosal disease and vocal cord mobility in the setting of laryngeal neoplasia. It is important to correlate clinically apparent mucosal abnormalities with cross sectional imaging in order to correctly identify submucosal and deep spread of tumor. Ongoing advances in ES technology, such as narrow band imaging (NBI) and the ability to digitally record ES exams may help to improve diagnostic accuracy and help direct the radiologist’s approach for a given case. The radiologist should be familiar with findings at ES and how those findings might guide patient management and subsequent imaging. The purpose of this exhibit is to review normal anatomy at ES with an emphasis on case based radiology-laryngoscopy correlation which will enable the radiologist to more effectively approach the imaging evaluation of laryngeal neoplasms.

TABLE OF CONTENTS/OUTLINE
Review normal anatomy at ES. Revisit AJCC TNM staging system for laryngeal and hypopharyngeal cancer Imaging examples of laryngeal carcinoma with digital laryngoscopic correlation. Familiarize interpreters with advanced laryngoscopy imaging technology: NBI

NRE325
Solitary Fibrous Tumor of the Head & Neck and Spine. Imaging and Physiopathology Study. Our Experience in Nine Cases

Education Exhibits
Location: NR Community, Learning Center

Participants
Cristina Corbella MD (Presenter): Nothing to Disclose
Josep Lluis Dolz MD: Nothing to Disclose
Xavi Tarroch: Nothing to Disclose
Anna Unguetti: Nothing to Disclose
Javier Malz: Nothing to Disclose
Jose Angel De Marcos Izquierdo: Nothing to Disclose

TEACHING POINTS
1- To describe the clinical, physiopathology and imaging features of EXTRAPLEURAL Solitary Fibrous Tumors (SFT) based in 9 cases diagnosed and treated at our center. 2-To show the imaging and histological correlation. 3-To make a review of the literature.

TABLE OF CONTENTS/OUTLINE
1-Introduction about SFT. What we have to know? SFT is a rare spindle-cell neoplasm of mesenchymal origin that were first
described in the pleura. Is an uncommon tumor occurring in the intracranial and extra cranial head and neck regions. We reported nine cases in in the head&neck and spine regions. Correct diagnosis could be challenging as some other lesions can mimick these tumors. 2. Physiopathology and natural history of SFT and hemangioperytomas. Immunohistochemical study. 3-MR and CT features. Evaluation of location, margins, MR signal intensity, CT density, internal architecture, pattern of enhancement. Darker signal intensity on T2-weighted images represents a firmer fibrous tumor composed of abundant collagenous stroma. 4-Differential diagnosis. Mimicks lesions. 5-Comments about recurrences and metastasis. Most SFT are benign but exist local recurrences and invasive growth pattern and metastasis (lung, liver, bone). 5. Summary

NRE327

Ultrasound Elastography in the Differential Diagnosis of Benign and Malignant Parotid Lesions as Compared with CEUS and MRI or CT

Education Exhibits
Location: NR Community, Learning Center

Participants
Hektor Grazhdani, MD, PhD (Presenter): Nothing to Disclose
Vito Cantisani, MD: Speaker, Toshiba Corporation
Marco De Vincentis: Nothing to Disclose
Mattia Di Segni, MD: Nothing to Disclose
Nicola Di Leo, MD: Nothing to Disclose
Antonello Rubini, MD: Nothing to Disclose
Cristina Floravanti: Nothing to Disclose
Carlo Catalano, MD: Nothing to Disclose
Ferdinando D'Ambrosio: Nothing to Disclose

TEACHING POINTS

1. Description of elastographic features of various parotid masses, with definitive histological confirmation, in comparison with CDUS, contrast enhanced ultrasound (CEUS), and MRI findings. 2. Explanation of technical issues of various US elastography methods and their application in the parotid. 3. Review of epidemiology, clinical presentation, state of the art work up, differential diagnosis and treatment options.

TABLE OF CONTENTS/OUTLINE

1. Diagnostic issues of parotid masses. 2. State of the art imaging and literature review. 3. US techniques available for parotid lesion evaluation and their use in the malignant/benign differentiation: qualitative elastography with Ueno score, semi-quantitative strain ratio measurements and carotid artery in vivo compression (ECI index). 4. CEUS as an alternative to MRI for vascularization assessment. 5. Parotid masses at US elastography, CEUS and MRI in correlation with histopathology, with image review of representative cases from our cohort of 48 patients with parotid lesions (18 pleomorphic adenomas, 14 Warthin tumors, 8 intraparotid reactive lymph nodes, 4 carcinomas, 3 parotiditis, 1 lymphoma). 6. Qualitative and semiquantitative Stiffness and CEUS patterns correlating with malignancy. 7. Discussion on differential diagnosis and the role of the various imaging modalities. 8. Conclusion.

NRE328

Ultrasound Surveillance of the Thyroid Cancer Patient: Review of Technique and Common Pitfalls

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Philipose Getachew Mulugeta, MD (Presenter): Nothing to Disclose
Lisa Po-Lan Jones, MD, PhD: Nothing to Disclose
Jill Eve Langer, MD: Consultant, BioClinica, Inc

TEACHING POINTS

Ultrasonography (US) has become the modality of choice for surveillance of the neck following thyroidectomy for thyroid cancer. US detection of metastatic disease allows for image-guided biopsy when abnormal lymph nodes or thyroid bed findings are identified in the post thyroidectomy setting. The aim of the education exhibit is to: 1. Demonstrate US technique for adequate surveillance of the post thyroidectomy neck 2. Present expected and pathological post surgical findings

TABLE OF CONTENTS/OUTLINE


NRE330

Why Thyroid Surgeons Are Frustrated with Radiologists: Lessons Learned from Pre- and Postoperative Ultrasound

Education Exhibits
Location: NR Community, Learning Center

Cum Laude
Selected for Radiology
Participants
Sachin Shivaji Kumbhar MBBS (Presenter): Nothing to Disclose
Suresh Maximin MD : Nothing to Disclose
Carolyn Lee Wang MD : Nothing to Disclose
Ryan O'Malley MD : Nothing to Disclose
Neeraj Lalwani MD : Nothing to Disclose

TEACHING POINTS
After completing this exhibit, the learner will: 1. Gain background information regarding thyroid cancer and surgical management with specific attention to types of lymph node dissection. 2. Understand role of preoperative neck ultrasound (US) and how thyroid surgeons use it to guide management. 3. Review standardized US technique to optimize preoperative work-up and maximize detection of postoperative recurrence. 4. Observe standardized reporting to consistently assess key components of pre- and postoperative US evaluation.

TABLE OF CONTENTS/OUTLINE
Overview of thyroid cancer, sonographic detection, and diagnosis. Review of pertinent neck anatomy in the context of surgical management. Preoperative ultrasound: -Optimal sonographic technique and reporting format to consistently provide necessary information for surgeon’s preoperative planning. -Specific attention to cervical lymph node size, features, and location that may determine type of lymph node dissection. Postoperative ultrasound: -Normal post-thyroidectomy appearance. -Optimal sonographic technique to adequately assess areas of recurrence. -Specific suspicious features that suggest recurrent disease. -Sample reporting format that appropriately conveys key information to referring surgeon and endocrinologist (i.e. indicating a level of suspicion rather than just reporting sizes).

NRE331
You’re Getting on My Nerves – Imaging of Perineural Spread in Head and Neck Cancer

Education Exhibits
Location: NR Community, Learning Center

Participants
Michael Eric Stone MD (Presenter): Nothing to Disclose
Brent David Griffith MD : Nothing to Disclose
Suresh C. Patel MD : Nothing to Disclose

TEACHING POINTS
Perineural spread (PNS) is a well-recognized entity involving cancers of the head and neck, which has important diagnostic, prognostic, and treatment implications. Because the clinical presentation of PNS is often nonspecific, the radiologist plays an important role in patient work-up and staging. The purpose of this exhibit is to discuss: 1. Clinical implications of PNS, including impact on patient prognosis and treatment. 2. Common routes for PNS in the head and neck, including normal skull base and cranial nerve (CN) anatomy. 3. Imaging findings in PNS, including role of CT and MRI.

TABLE OF CONTENTS/OUTLINE
I. Etiologies and Implications of PNS a. Malignancies most commonly implicated in PNS, including adenoid cystic and squamous cell carcinoma, as well as potential mimics of PNS. b. Impact of PNS on staging, prognosis, and treatment. II. Imaging of PNS in the Head and Neck a. Strengths and weakness of CT and MRI. b. Normal skull base and CN anatomy, including skull base foramina, as well as course and branches of the most commonly involved CN’s (e.g., CN V and CN VII). c. Imaging findings of perineural spread, including: foraminal enlargement or destruction, nerve enlargement/enhancement, loss of perineural fat, muscle atrophy. d. Case review emphasizing "do not miss" findings of PNS that all radiologists should be aware of.

NRE332
“There Is More than Meets the Eye”. Everything Behind the Ocular Ultrasound

Education Exhibits
Location: NR Community, Learning Center

Participants
Marcela De la Hoz Polo MD (Presenter): Nothing to Disclose
Anna Torramilans : Nothing to Disclose
Oscar Pozuelo Segura : Nothing to Disclose
Stefano Pasetto MD : Nothing to Disclose
Sergi Sedo Fernandez : Nothing to Disclose
Albert Anguera : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To illustrate and describe the sonography anatomy of the eye. 2. To illustrate the main pathological conditions that affect the eye depicted by US, and its correlation with CT, MR and ophthalmoscopic image when available. 3. To describe the sonographic technical procedure.

TABLE OF CONTENTS/OUTLINE
1. Introduction: Ocular US plays an important role in the evaluation of the diseases that affect the eye, especially in those cases when is not possible to perform an appropriate ophthalmoscopy due to the opacification of transparent media resulting from cataracts, vitreous hemorrhage or extreme miosis. Nevertheless most radiologists are unfamiliar with ocular anatomy and the most prevalent ocular diseases that could be depicted sonographically. 2. Technique and Study Protocol. 3. Sonographic Normal Ocular Anatomy. 4. Imaging of the Pathologic Conditions: Ocular Globe Morphology, Vitreous Choroid Retina, Optic Disk and Optic Nerve. 5. Summary: Ocular US is an accurately diagnostic tool in the ophthalmologic examination. A proper knowledge of the sonographically anatomy and familiarity with the variety of multiple conditions that affect the eye may enhance our ability to get the most of this efficient and valuable technique.

NRE333
A “Window” into Temporal Bone Pathology: Imaging of the Normal Anatomy and Pathology of the Oval and Round Windows of the Temporal Bone

**Education Exhibits**
Location: NR Community, Learning Center

**Certificate of Merit**

**Participants**
Behroze Vachha MD, PhD (Presenter): Nothing to Disclose
Azita Sara Khorsandi MD : Nothing to Disclose
Gul Moonis MD : Nothing to Disclose

**TEACHING POINTS**
Pathology of the oval and round window may result in conductive and mixed hearing loss. Familiarity with the normal anatomy, appropriate technical procedures and imaging findings related to oval and round window pathology can optimize pre-clinical assessment and management of conductive and mixed hearing loss.

**TABLE OF CONTENTS/OUTLINE**
Imaging of the oval and round windows is important in the assessment of hearing loss, vertigo and tinnitus particularly in the context of congenital and acquired malformations, trauma, otosclerosis and chronic otitis media. We review the normal anatomy of the oval and round windows and the appropriate CT and MRI techniques for imaging them. MDCT and MRI features of the following oval and round window pathologies will be reviewed: 1. Trauma with and without fractures of the oval and round windows. 2. Otosclerosis of the oval and round windows. 3. Malformations (congenital and acquired) of the oval and round windows. 4. Post surgical complications related to the oval window such as dislocation of prosthesis into the vestibule through the oval window.

**NRE335**
Basic Approach for Characterization of Pathologic Cervical Lymph Node with Triplex Ultrasonography

**Education Exhibits**
Location: NR Community, Learning Center

**Participants**
Madan Mohan Omprakash Gupta MD (Presenter): Nothing to Disclose
Nandini Bahri MD : Nothing to Disclose

**TEACHING POINTS**
The purpose of this exhibit is: 1. To review the underlying pathologic changes that create the imaging appearances of malignant cervical lymph node at triplex ultrasonography. The neck status is the single most important indicator of prognosis in head and neck cancers and early detection of LN involvement has great therapeutic and prognostic implications and in order to prevent invasive diagnostic procedures. 2. To gain an awareness of the detection of pathologic lymph nodes, and learn the imaging appearances of malignant lymph nodes. 3. To learn optimal methods to detect pathologic cervical lymphnode with triplex ultrasonography.

**TABLE OF CONTENTS/OUTLINE**

**NRE337**
Dose Estimation of Patient and Operator in Swallowing CT Examination Performed with a 320-detector-Row Multislice CT

**Education Exhibits**
Location: NR Community, Learning Center

**Participants**
Masanao Kobayashi PhD, RT (Presenter): Nothing to Disclose
Yasuki Asada PhD : Nothing to Disclose
Kosuke Matsubara PhD : Nothing to Disclose
Yuta Matsuura RT : Nothing to Disclose
Ai Kawaguchi RT : Nothing to Disclose
Kazuhiro Katada MD : Consultant, Toshiba Corporation
Hiroshi Toyama : Nothing to Disclose
Kichiro Koshida PhD : Nothing to Disclose
Shouichi Suzuki PhD : Nothing to Disclose

**TEACHING POINTS**
Recently, attempts to develop new types of swallowing function analysis with 320-detector-row multislice CT (320-MDCT) have been reported. The present report addresses (1) patient exposure, (2) operator exposure, and (3) spatial dose distribution. For dose measurement, a human-body phantom in which 303 thermoluminescent dosimeter elements were inserted and a survey meter was used. Swallowing CT (SCT) was performed at 120 kV, 10 mA, 0.35sec/rot, 160mm/rot, and tilt angle of 22 (volume CT dose index displayed on the console 0.8 mGy, dose length product 12.1 mGy cm). The effective dose for the patient was 3.9 mSv. The conversion factor for obtaining the effective dose was 0.0066 mSv/mGy cm. The effective dose for the operator was 0.002 mSv. In the operator exposure measurement, the ambient dose equivalent H*(10), that would be produced by an expanded and aligned radiation field at a depth 10 mm in the International Commission on Radiation Units and Measurements sphere, was 0.012 mSv. In this report, the safety of SCT, which has become possible with the introduction of 320-MDCT, was evaluated by measurement of the exposure to the patient and operator.

**TABLE OF CONTENTS/OUTLINE**
Flaps in Head and Neck Oncology Surgery. How to Recognize the Normal Findings on CT

Participants
- Evelyn Claudia Montano Claure MD (Presenter): Nothing to Disclose
- Daniel Rodriguez Bejarano: Nothing to Disclose
- Lisbeth Valoyes Guerrero MD: Nothing to Disclose
- Lucia Aja MD: Nothing to Disclose
- Sonia Aixut: Nothing to Disclose
- Paloma Mora MD: Nothing to Disclose

TEACHING POINTS
- To review the most common flaps used in reconstructive head and neck oncology surgery.
- To recognize the normal CT findings in flaps, to achieve a proper postoperative interpretation in the follow up of these patients.

TABLE OF CONTENTS/OUTLINE
Immediate reconstruction of defects in the head and neck has evolved with the use of flaps. There are techniques to mobilize tissue with similar characteristics of tissue in the lost territory, looking for the best functional and cosmetic result for the patient.

In our work we describe the most common flaps used in head and neck reconstructive oncology surgery reviewing the radiological aspects of these techniques. We have retrospectively reviewed CT findings in 55 patients treated in our hospital from 2008 to 2011. This group of patients corresponds to 42 males and 13 females with a median age of 65 years (range 33-87). Table 3 summarizes the types of flaps in our series.

High-Resolution and Quantitative MR Imaging of the Temporomandibular Joint

Participants
- Monica Tafur MD (Presenter): Nothing to Disclose
- Reni Biswas: Nothing to Disclose
- Kyu-Sung Kwack MD, PhD: Nothing to Disclose
- Won Chol Bae PhD: Nothing to Disclose
- Robert Healey: Nothing to Disclose
- Sheronda Statum: Nothing to Disclose
- Jiang Du PhD: Nothing to Disclose
- Christine B. Chung MD: Nothing to Disclose

TEACHING POINTS
The objectives are to review the anatomy of the Temporomandibular joint (TMJ) using high-resolution MRI with ultrashort time-to-echo (UTE) techniques; to quantify MR properties of the disc using conventional and UTE quantitative MRI (qMRI) techniques; and to correlate MR with histochemical properties of the disc.

1. High-resolution MRI demonstrate the anatomy of osseous and soft tissues of TMJ.
2. High-resolution UTE MRI allows visualization of tissues with short T2 components in TMJ such as the fibrocartilage in the disc, mandibular condyle and articular eminence of temporal bone, not provided by the standard clinical sequences.
3. The disc of the TMJ is composed mostly by short T2 components such as fibrocartilaginous matrix and collagen network with an average T2* value of 17.3ms. The main contrast available in the TMJ is obtained from T2* contrast.
4. MR properties of the TMJ articular disc correlate with the collagen organization and the degree of GAG staining. UTE T1rho showed stronger correlation as compared with T2 and T2* techniques.

Imaging Features in Proptosis: What the Radiologist Should Look for?

Participants
- Mina Boussalah MS (Presenter): Nothing to Disclose
NRE342

Imaging Impact for Facial Aging “Clinical Application”: Utilize of CT/MRI for a Clinical Understanding of the Facial Aging

Education Exhibits
Location: NR Community, Learning Center

Participants
Itsuko Okuda MD (Presenter): Nothing to Disclose
Keichi Akita MD, PhD : Nothing to Disclose
Katsuhiko Abe : Nothing to Disclose
Masahiro Irimoto MD : Nothing to Disclose
Yukio Shirakabe MD : Nothing to Disclose
Yasuo Nakajima MD : Nothing to Disclose

TEACHING POINTS
1. To review the clinical facial aging manifestations and factors that it occurs in.
2. To learn the facial structures involved in facial aging.
3. To demonstrate anatomic-radiological correlations of the facial structures.
4. To emphasize the clinical impact of the facial aging and anti-aging using CT/MRI.

TABLE OF CONTENTS/OUTLINE
1. Clinical manifestations of the facial aging 2. Clinical - imaging correlation of facial aging features 3. Classify aging changes of the facial structures according to age on CT/MRI Facial muscles Superficial musculoaponeurotic system (SMAS) Retinacula cutis (RC) Fat layers 4. Clinical usage of CT and MRI for facial aging and anti-aging Baggy eyelid Nasolabial fold Cheek sagging 5. Summary: 1) Morphological features of facial aging can be assessed by CT/MRI clinically. 2) It is important to understand the clinical, anatomic and radiological correlations for facial aging analyses. 3) This knowledge could contribute to facial anti-aging treatments.

NRE343

Lub-dub within the Ear: A Review of Pulsatile Tinnitus

Education Exhibits
Location: NR Community, Learning Center

Participants
Tina Mistry MBBS, FRCR (Presenter): Nothing to Disclose
Dominic St Leger MBBS, BMedSc : Nothing to Disclose
Ravi K. Lingam MRCP, FRCR : Nothing to Disclose

TEACHING POINTS
1. To review the anatomy of the middle ear highlighting the intimate relationships to local structures. 2. Describe the pathological entities responsible for pulsatile tinnitus. 3. Review the multi-modality (US/CT/MRI) imaging applications and findings in pulsatile tinnitus. 4. What do the surgeons need to know - providing a guide to structured reporting to aid in the patient’s management. ‘Quick review notes’ for the general radiologist and radiology trainee.

TABLE OF CONTENTS/OUTLINE
Participants
- Joao Rafael Terneira Vicentini MD (Presenter): Nothing to Disclose
- Danilo Giorgio Oliveira Azevedo Medrado MD: Nothing to Disclose
- Marcio Ricardo Taveira Garcia MD: Nothing to Disclose
- Maria Cristina Chammas MD: Nothing to Disclose
- Eloisa Maria Santiago Gebrim MD: Nothing to Disclose
- Regina Lucia Elia Gomes MD: Nothing to Disclose

TEACHING POINTS
- Recognize parathyroid lesions appearance in different imaging methods - Display the advantages and disadvantages of each imaging modality - How new techniques and protocols can help radiologists to study these diseases

TABLE OF CONTENTS/OUTLINE
- Review of the radiological findings related to parathyroid diseases in ultrasound, nuclear medicine scans, computed tomography (CT) and magnetic resonance (MRI) - Practical tips to find parathyroid glands in different imaging studies, particularly using the polar artery, showed by ultrasound and four-dimensional CT (4DCT) - Sample of cases with typical and atypical presentations and ectopic locations - The differential diagnosis of parathyroid lesions - Literature review and report of our center experience with ultrasound and 4DCT protocol

NRE345
Radial-VIBE with GRASP: Understanding the Physics and Its Applications in Head and Neck Radiology

Education Exhibits
Location: NR Community, Learning Center

Participants
- Lev Bangiyev DO (Presenter): Nothing to Disclose
- Maria Camilla Rossi Espagnet MD: Nothing to Disclose
- Mari Hagiwara MD: Nothing to Disclose
- Kai Tobias Block PhD: Nothing to Disclose
- Xin Wu MD: Nothing to Disclose
- Eugene Yu MD, FRCPC: Nothing to Disclose
- Girish Manohar Fatterpekar MBBS: Editor, Reed Elsevier

TEACHING POINTS
Radial-VIBE (Radially acquired Volume Interpolated GRE) with GRASP (Golden-angle RAdial Sparse Parallel) is a novel contrast-enhanced T1Wgradient-echo sequence • Unique k-space sampling and data acquisition parameters • Excellent fat-suppressed motion robust images with exquisite illustration of the anatomy • Excellent spatial resolution allows assessment of structural permeability characteristics • An overview of the physics of Radial-VIBE and GRASP, compare it to conventional T1W-images and evaluate its role in assessing head and neck pathology

TABLE OF CONTENTS/OUTLINE
- Overview of Radial-VIBE physics and discuss its permeability characteristics
- Discuss its role in evaluating orbital anatomy and commonly seen pathology such as vascular malformations, optic neuritis and meningoasms, as well as hitherto unexplored conditions such as vitreits
- Assess its role in evaluating skull base lesions due to its inherent fat-suppressed characteristics and excellent spatial resolution
- Discuss its role in evaluating parathyroid pathology obviating the need for dynamic CT acquisition
- Demonstrate unique permeability patterns of the normal structures in head and neck
- Discuss our early experience in assessing primary head and neck cancers utilizing permeability maps
- Distinguish normal and metastatic lymph nodes utilizing permeability patterns

NRE347
The Route to Expression, Taste and Salivation: The Journey of the Facial Nerve

Education Exhibits
Location: NR Community, Learning Center

Participants
- Tina Mistry MBBS, FRCR (Presenter): Nothing to Disclose
- Dominic St Leger MBBCh, BMmedSc: Nothing to Disclose
- Ravi K. Lingam MRCP, FRCR: Nothing to Disclose

TEACHING POINTS
In this educational exhibit we aim to provide: 1. A comprehensive anatomical review of the route of the facial nerve. 2. Discuss the large range of pathological problems it faces at every point in its journey. 3. Describe the best imaging modalities and findings of these pathological processes. 4. Provide a problem solving checklist to aid accurate and concise reporting.

TABLE OF CONTENTS/OUTLINE
1. The anatomical course of the Facial nerve divided into the following segments: Intracranial Meatal Labyrinthine Tympanic Mastoid Extra-temporal 2. Pathology affecting the Facial nerve and relevant imaging modalities and techniques used in their diagnosis: Infections Acute otitis media Chronic otitis media Cholesteatoma Herpes Zoster Traumatic Temporal bone fracture Iatrogenic injury Avulsion Neoplastic Facial/vestibular schwannoma Haemangioma Lipoma Glomus tumours Parotid malignancy Congenital Vascular Infarction Idiopathic Bell Palsy Multiple sclerosis Sarcoidosis Inflammatory Guillain-Barre 3. Provide a summary checklist for the clinical presentations of suspected facial nerve pathology, highlighting the anatomical site of pathology along with the likely cause.
Thyroid Elastography. How We Do It

Participants
- Zoi Antoniou BMedSc : Nothing to Disclose
- Athanasios N. Chalazonitis MD, MPH : Nothing to Disclose
- Christina Gkali MD : Nothing to Disclose
- Andromachi Zourla : Nothing to Disclose
- Ioanna Tzovara MD (Presenter): Nothing to Disclose

TEACHING POINTS
1. To review the technique of both Strain Elastography (SE) and Acoustic Radiation Force Impulse Imaging (ARFI). 2. To suggest an appropriate thyroid SE and ARFI imaging examination protocol. 3. To demonstrate the elastographic imaging findings in benign and malignant thyroid nodules. 4. To review the potential elastography pitfalls. 5. To suggest an appropriate reviewing method.

TABLE OF CONTENTS/OUTLINE
Thyroid nodules were examined with SE and ARFI imaging in more than 50 consenting patients and can be displayed in details as a pictorial essay. All cases were paired with cytological or/and histological confirmation. Both SE and ARFI imaging were performed in benign and malignant thyroid nodules in order to depict the hardness of the examined lesion. SE provides qualitative assessment of the tissue hardness. Strain ratio consist a quantification of this qualitative type of elastography. ARFI imaging is divided into two types: a) Virtual Touch Tissue Imaging (VTI) which provides the relative stiffness in qualitative way in the selected region of interest on a gray scale image and b) Virtual Touch Tissue Quantification (VTQ) which expresses the shear wave speed in solid materials as numeric values and describes quantitatively the hardness of tissue.

NRE349
Ultrasound of the Major Salivary Glands: Anatomy and Pathology

Participants
- Jose Daniel Samper Wamba MD (Presenter): Nothing to Disclose
- Uxia Sobrino Castro DiplPhys : Nothing to Disclose
- Sebastian Molnar Fuentes : Nothing to Disclose
- Ana Maria Fernandez Martinez MD : Nothing to Disclose

TEACHING POINTS
High frequency US allows a detailed study of the anatomy of the major salivary glands and their relationships. Neoplasms, sialolithiasis and inflammation are the most common pathologies of these glands. US as an initial study of the major salivary glands reduces the differential diagnosis and allows interventional techniques in a fast, cheap and without radiation process.

TABLE OF CONTENTS/OUTLINE
In Europe and Asia ultrasound (US) is the first step in the study of pathology of the major salivary glands. It is a radiation-free method, accessible and cheap, which will allow us to narrow the differential diagnosis and sometimes even give us a definitive one. In addition we can carry out eco-guided interventional techniques. Although there are some features that can guide us to suspect if a nodule is a pleomorphic adenoma, a Warthin tumor or a malignant lesion, US is not very specific to determine benignity or malignancy. However, US will allow us to distinguish true glandular nodes or lesions in other locations, such as pilomatrixomas or epithelial cysts. Inflammatory pathology can be also studied, lithiasis and expanded salivary ducts in sialolithiasis can be distinguished. Other diseases such as Sjogren’s syndrome, cysts or lymphomatous involvement of the glands can be assessed.

NRE352
Back Pain from an Urban Perspective: The Many Faces of Spinal Infections

Participants
- Karen Buch MD (Presenter): Nothing to Disclose
- Kira Melamud MD : Nothing to Disclose
- Jean Paul Colon-Pons MD : Nothing to Disclose
- Bindu Setty MD : Nothing to Disclose

TEACHING POINTS
1. To describe the pathogenesis and patterns of dissemination of commonly encountered infectious agents involving the osseous and soft tissues of the spine. 2. To review the capabilities of multiple available imaging techniques, with emphasis on MR imaging. 3. To describe key imaging features of early to late manifestations of spondylodiscitis and complications based on infectious agent. 4. To review soft tissue complications of spondylodiscitis, as well as imaging features of primary soft tissue infections of the spine.

TABLE OF CONTENTS/OUTLINE
1. Introduction: discussion of modes of dissemination of most common typical and atypical infectious pathogens encountered in an urban setting, with emphasis on intravenous drug users. 2. Review of advantages and disadvantages of available imaging modalities in spinal imaging, with emphasis on optimizing MR imaging protocols in the setting on infectious workup. 3. Pictorial review of typical and atypical pathogens that cause spinal infections, with emphasis on classic and unusual imaging features. 4. Discussion of differential diagnoses and common imaging pitfalls in recognition of early spinal infections. 5. Conclusion: An awareness of typical and atypical imaging manifestations of spinal infections is crucial in preventing diagnostic delay and avoiding unnecessary procedures.
NRE353
Charcot Spine: What Radiologists Need to Know to Make a Difficult Diagnosis
Education Exhibits
Location: NR Community, Learning Center
ecer Laude
Selected for RadioGraphics

Participants
Luke N. Ledbetter MD (Presenter): Nothing to Disclose
Richard Kent Sanders MD: Nothing to Disclose
Karen Lisa Salzman MD: Consultant, Amirsys, Inc Stockholder, Amirsys, Inc
Lubdha Mahavir Shah MD: Nothing to Disclose

TEACHING POINTS
1) Review pathophysiology and associations with Charcot spine. 2) Review imaging techniques for the evaluation of Charcot spine. 3) Review classic imaging features. 4) Discuss differential diagnosis of Charcot spine. 5) Explore advanced imaging applications to differentiate Charcot spine from other differential processes.

TABLE OF CONTENTS/OUTLINE
1) Pathophysiology and associations with Charcot spine 2)Appearances of Charcot spine Radiography CT MRI Nuclear Medicine 3) Differential Diagnosis Discitis-Osteomyelitis Atypical Infections Severe degenerative disc disease Tumor 4) Advanced Imaging Applications Diffusion weighted imaging

NRE354
Common and Rare Intramedullary Spinal Cord Neoplasms and Their Mimics
Education Exhibits
Location: NR Community, Learning Center

Participants
Jennifer Trinh MD (Presenter): Nothing to Disclose
Rajul Parimal Pandit MD: Nothing to Disclose
Mahesh Ramu Patel MD: Stockholder, Novartis AG

TEACHING POINTS
Intramedullary spinal cord tumors are rare and constitute 4-10% of all CNS tumors. Although they constitute only 20% of intraspinal tumors in the adult and 35% in the pediatric population, the majority are malignant. It is important to understand the characteristic imaging features of each intramedullary lesion that provide support towards a specific diagnosis. Additionally, one needs to be aware of lesions that mimic intramedullary spinal cord neoplasms.

The purpose of this exhibit is to:
1. Describe the essential imaging features of common and rare intramedullary spinal cord lesions
2. Identify characteristic imaging features of each intramedullary spinal cord lesion
3. Recognize and differentiate mimics of intramedullary spinal cord neoplasms

TABLE OF CONTENTS/OUTLINE
Cases will be presented in quiz format. Key differential diagnostic points will be highlighted in the discussion of each case. The list of cases include:
- Myxopapillary ependymoma
- Schwannoma mimicking an ependymoma
- Spinal syrinx hematoma mimicking an ependymoma
- Astrocytoma
- Hemangioblastoma
- Meningioma
- Metastasis
- Brainstem glioma extending into the cervical spine
- Nitrous oxide toxicity
- Surfer's myelopathy
- Infectious myelitis from coccidioidomycosis
- Intraspinal neurocysticercosis
- Severe transverse myelitis
- Spinal dural AVF

NRE356
Imaging of Idiopathic Spinal Cord Herniation
Education Exhibits
Location: NR Community, Learning Center

Participants
Ajay Agarwal MD (Presenter): Nothing to Disclose

TEACHING POINTS
To demonstrate characteristic imaging findings seen in ventral cord herniation.

TABLE OF CONTENTS/OUTLINE
Etiopathogenesis: The etiopathogenesis of idiopathic spinal cord herniation is not firmly established, but the presence of a dural defect is considered a sine qua non for the development of the condition. Clinical presentation: Clinical findings are nonspecific and patients usually present with slow progression of Brown-Sequard syndrome or paraplegia. Imaging findings: We will demonstrate MR imaging findings in four patients with surgically confirmed spinal cord herniation. The thoracic spine is commonly involved between the T4 and T7 vertebrae. Characteristic MRI findings include dural defect through which ventral displacement of thoracic spinal cord occurs with enlargement of the dorsal subarachnoid space. "Nuclear trail" sign is also described as the characteristic sign on CT. Differentials: It is important to exclude a dorsally located cystic lesion (eg, an intradural arachnoid cyst), which may mimic a cord herniation. Conclusion: Idiopathic spinal cord herniation is rare but is an increasingly recognized cause of progressive and potentially curable thoracic myelopathy. An early and correct diagnosis allows prompt treatment, which may reverse any neurologic deficits.
NRE357

Imaging of the Instrumented Spine

Education Exhibits

Location: NR Community, Learning Center

Participants
Banafsheh Salehi MD (Presenter): Nothing to Disclose
Farbod Asgarzade MD: Nothing to Disclose
Allie Kieran Blackburn MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1) Review the structure of spine surgical hardware, function of the hardware expected post surgical changes, and possible postoperative complications in a case-based review. 2) Explain the practical clinical relevance of imaging findings and address the questions that the spine surgeon might have in postoperative spine imaging. Delineate the role of imaging in diagnosis of post-surgical complications. 3) Provide some pearls for postoperative spine imaging.

TABLE OF CONTENTS/OUTLINE
- Pictorial review of spinal surgical instrumentation, providing photographs of the hardware, as well as applicable imaging modalities including intraoperative fluoroscopy, radiography, CT and MRI. The instruments reviewed will include but not limited to: - Anterior plates and screws - PEEK rods - Laminoplasty - AxiaLIF hardware - Cortical, pedicle and lateral mass screws - Interspinous devices - Prosthetic discs - Occipitocervical constructs - Transverse process hooks - How to report postoperative spine imaging: What does spine surgeon want to know? - Post surgical complications

NRE358

Kyphoplasty and Percutaneous Vertebroplasty: An Overview for the Non-Interventionalist

Education Exhibits

Location: NR Community, Learning Center

Participants
Jayant Boolchand MD (Presenter): Nothing to Disclose
Cody Jackson Morris MD: Nothing to Disclose
John Farrell Holbrook MD: Nothing to Disclose

TEACHING POINTS
1. Diagnostic radiologists play a key role in evaluating the spine both before and after kyphoplasty and percutaneous vertebroplasty. 2. Imaging helps predict both the success of kyphoplasty and percutaneous vertebroplasty as well as subsequent complications. 3. Complications following kyphoplasty and percutaneous vertebroplasty include cement extrusion into the spinal canal, fracture of adjacent vertebral bodies, and cement pulmonary embolism.

TABLE OF CONTENTS/OUTLINE

NRE359

Longitudinal Extensive Transverse Myelitis - A Pattern Based Approach

Education Exhibits

Location: NR Community, Learning Center

Participants
Diego Andre Eifer PhD (Presenter): Nothing to Disclose
Angela Faistauer MD: Nothing to Disclose
Marcio Alessio Bezerra Cavalcanti MD: Nothing to Disclose
Leonardo Vedolin MD, PhD: Nothing to Disclose
Juliano Adams Perez MD: Nothing to Disclose
Fernando Araujo Leiria MD: Nothing to Disclose
Juliana Duarte: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. Understand longitudinal extensive transverse myelitis (LETM) definition, how it differentiates from acute partial transverse myelitis and acute complete transverse myelitis.
2. Review the differential diagnosis of extensive T2 signal in the spinal cord, highlighting the classic signs and MRI findings.
3. Utilize a pattern based approach to narrow the diagnostic possibilities
4. Learn what questions must be done and what labs should be sought to further abbreviate the diagnostic conundrum.

TABLE OF CONTENTS/OUTLINE
The spinal cord
- Axial and sagittal anatomy
Longitudinal extensive transverse myelitis (LETM)
- Definition
- Diagnostic criteria
- Clinical Findings
- How it is different from short segment Acute transverse myelitis
- Differential diagnosis
- Neuromyelitis optica
- Multisystem autoimmune inflammatory disease
  - Multiple sclerosis
  - ADEM
- Infectious causes
- Neoplastic disorders
- Vascular causes
  - Acute spinal cord infarction
  - Arteriovenous shunts
- Metabolic causes
  - B12 deficiency
  - Eosinophilic myelitis

Pattern based approach (fluxogram)
- Localization
- Gray and/or white matter
- Acute X chronic
- Multiple lesions or solitary
- Brain findings

Laboratory and clinical workout

Teaching points

NRE360

Magnetic Resonance Imaging in the Evaluation of Non-compressive Myelopathy

Education Exhibits

Location: NR Community, Learning Center

Participants
- Joshieta Singh, DMRD (Presenter): Nothing to Disclose
- Rajas Deshpande: Nothing to Disclose
- Rahul Kulkarni: Nothing to Disclose
- Rustom Wadia: Nothing to Disclose

TEACHING POINTS
1. To illustrate the various spectrum of etiologies for non-compressive myelopathy.
2. To illustrate the radiological features and utility of magnetic resonance imaging in management of non-compressive myelopathy.

TABLE OF CONTENTS/OUTLINE

Myelopathy is the clinical state of neurological deficit localized to the cord and can be consequent to compressive or non-compressive etiologies. Magnetic resonance imaging (MRI) plays a crucial role in the evaluation of myelopathy as it forms the first investigation to rule out compressive etiologies and aids in the differential diagnosis of non-compressive etiologies. In this exhibit, we cover the radiological feature of various causes of non compressive myelopathy such as transverse myelitis, demyelinating conditions like multiple sclerosis, neuromyelitis optica etc, a large spectrum of infective etiologies ranging from viral to bacterial, myelopathy associated with systemic conditions such as systemic lupus erythematosus, sarcoidosis etc, vascular causes like cavernous angioma and ischemia/infarction to toxic/metabolic insults such as subacute combined degeneration and thermal injury. MRI is critical in localizing the level of cord insult in myelopathy, in narrowing down its differential diagnosis and in documenting response to therapy.

NRE361

MR Imaging of Non Compressive Myelopathy

Education Exhibits

Location: NR Community, Learning Center

Certificate of Merit

Participants
- Garima Agrawal, MD (Presenter): Nothing to Disclose
- Adam Landon Sipe, MD: Nothing to Disclose
- Aseem Sharma, MBBS: Stockholder, General Electric Company

TEACHING POINTS
1. To provide a case based pictorial review of non compressive myelopathy.
2. To understand clinical presentation of various myelopathies.
3. To develop an approach by means of MRI imaging features that can help generate a reasonable differential diagnosis and guide further management.

TABLE OF CONTENTS/OUTLINE

1. MR imaging in excluding compressive myelopathy and establishing intrinsic cord abnormality and excluding intrinsic cord neoplasm.
2. Case based review of clinical presentation and MR imaging features of non compressive myelopathy under following broad categories:
   - Inflammatory: Transverse myelitis
   - Infectious myelitis: HIV/CMV/viral/bacterial/fungal
   - Granulomatous diseases: sarcoidosis
   - Radiation myelitis
   - Vascular: Arterial infarction
   - Venous: Cavernous malformation
NRE362

Multiple Peripheral Nerve Sheath Tumours: Diagnostic Approach

Education Exhibits
Location: NR Community, Learning Center

Participants

Rene Leandro Magalhaes Rivero MD, PhD (Presenter): Nothing to Disclose
Mateus Alves Benjamin MD : Nothing to Disclose
Timoteos Rong Guang Wu : Nothing to Disclose
Alan Timoteo Rodrigues Reis : Nothing to Disclose
Gabriel Lacerda Fernandes : Nothing to Disclose
Marcelo D'Andrea Rossi MD : Nothing to Disclose
Renato Adam Mendonca MD : Nothing to Disclose

TEACHING POINTS

Patients with a multiple peripheral nerve sheath tumours represent an imaging dilemma for the radiologist. Possible differential diagnosis are NF1 (classic or spinal neurofibromatosis variant), NF2 and schwannomatosis.

Aim of this review is:
To discuss MRI characteristics of these multiple tumours with radiologic pathology correlation
To learn which clinical and imaging points are more important to formulate a diagnosis.

TABLE OF CONTENTS/OUTLINE

Overview of the nerve sheath tumours origin with radiologic pathology correlation
Review the diseases of NF1 with multiple neurofibromas, NF2 and schwannomatosis. Discuss the more relevant clinical data and MRI findings in patients in order to establish the most likely diagnosis, which is confirmed with histopathological analysis and even gene mapping.

NRE363

Return of the Back Pain: Postoperative Complications of Lumbar Decompression Surgery

Education Exhibits
Location: NR Community, Learning Center

Participants

David Rodriguez MD (Presenter): Nothing to Disclose
Robert Jeffrey Freed MD : Nothing to Disclose
Vikas Agarwal MD : Nothing to Disclose

TEACHING POINTS

Low back pain is a major cause of morbidity and disability, and lumbar spinal surgery is routinely performed in the efforts of relieving such people from their suffering. As with any surgery, there are risks associated with the procedure, and this presentation will review the common postoperative complications, specifically regarding lumbar decompression. Multiple CT and MR examples will be presented to demonstrate the pertinent findings a neuroradiologist must be familiar with when interpreting a postoperative exam. There will then be a brief overview of the different ways and urgencies in which these complications are managed.

TABLE OF CONTENTS/OUTLINE

Overview of surgical causes of low back pain
Highlight the pros and cons of spine surgery
Describe the role of lumbar decompression in the treatment of low back pain
Review imaging findings of common postoperative complications, which include:
  - Misplaced hardware
  - Epidural collection/hematoma
  - Recurrent herniation vs epidural fibrosis
  - Arachnoiditis

NRE365

Spinal Cord Vascular Lesions: Imaging and Angiography Correlation

Education Exhibits
Location: NR Community, Learning Center

Participants

Wilmarie Rivera Hernandez MD (Presenter): Nothing to Disclose
Luis Ernesto Garcia MD : Nothing to Disclose
Luis Roberto Burgos-Anaya MD : Nothing to Disclose
Laura Cristina Figueroa Diaz BS : Nothing to Disclose
Manuel Betancourt Torres BS : Nothing to Disclose

TEACHING POINTS

Review essential spinal cord anatomy. Review spinal cord vascular supply. Discuss the three major categories of spinal vascular
Review essential spinal cord anatomy. Review spinal cord vascular supply. Discuss the three major categories of spinal vascular lesions, which include: neoplastic vascular lesions such as hemangioblastomas and cavernous malformations, spinal aneurysms, and spinal cord arteriovenous lesions, which are divided into arteriovenous fistulas and arteriovenous malformations (AVMs). Illustrate common imaging characteristics of spinal cord vascular lesions and their angiographic correlation. Discuss common clinical presentations and their management. Acknowledge the importance of imaging in the diagnosis and management of spinal cord vascular lesions.

**TABLE OF CONTENTS/OUTLINE**
Magnetic resonance imaging is the most useful radiological modality for detection and characterization of spinal cord vascular lesions before performing digital subtraction angiography. We will review the major categories of spinal vascular lesions, which include neoplastic vascular lesions, spinal aneurysms, and spinal arteriovenous lesions. This exhibit will describe characteristic radiological findings and angiographic correlation of hemangioblastomas, cavernous malformations and spinal aneurysms, as well as arteriovenous fistulas and malformations.

**NRE366**
Spinal Ligamentous Injuries MRI Evaluation

*Education Exhibits*
Location: NR Community, Learning Center

Certificate of Merit

**Participants**

Vijay Shridhar Pande MD (Presenter): Nothing to Disclose
Richard Ian Gray MD: Nothing to Disclose
Rafal M. Kedzierski MD, PhD: Nothing to Disclose
Shridhar sankar: Nothing to Disclose
Geoffrey Schaeffer Goodin MD: Nothing to Disclose

**TEACHING POINTS**

1) Recognition of various spinal ligamentous injuries. 2) Clinical significance and therapeutic implication of spinal ligamentous injuries.

**TABLE OF CONTENTS/OUTLINE**
1) MRI anatomy of spinal ligaments. 2) Mechanisms and Patterns of spinal ligamentous injuries. 3) Traumatic disc abnormalities. 4) Other traumatic abnormalities seen in association with spinal ligamentous injuries.

**NRE367**
Spinal Meningeal Cysts: What Are They and Why Should I Care? An Interactive, Case-based Tutorial

*Education Exhibits*
Location: NR Community, Learning Center

Cum Laude

**Participants**

Nicholas Ralph Turman MD (Presenter): Nothing to Disclose
Wendy R. K. Smoker MD: Nothing to Disclose
Lindell R. Gentry MD: Nothing to Disclose

**TEACHING POINTS**

Goals/Objectives: 1. Become acquainted with this anatomic classification of spinal meningeal cysts 2. Identify the various types of meningeal cysts 3. Recognize various meningeal cyst mimics

**TABLE OF CONTENTS/OUTLINE**
Spinal meningeal cysts are classified into 3 categories based upon location and presence or absence of nerve root fibers. There are a number of important differential diagnostic lesions that need to be considered. In this interactive, case-based, interactive tutorial, the reviewer is presented with a variety of intraspinal cystic lesions and led to the correct diagnosis through a step by step analysis.

**NRE368**
Spinal Subdural and Epidural Hematomas: Etiologies, Imaging Techniques, Characteristics and Pitfalls

*Education Exhibits*
Location: NR Community, Learning Center

**Participants**

Haatal B. Dave MD, MS (Presenter): Nothing to Disclose
Claire Kaufman: Nothing to Disclose
David Durand MD: Nothing to Disclose
Vivek Bihari Kalra MD: Nothing to Disclose
Ajay Malhotra MD: Nothing to Disclose

**TEACHING POINTS**

1. Spinal subdural and epidural hematomas are rare neurologic emergencies which can result from several different etiologies and have devastating neurologic sequelae. 2. Common etiologies for both subdural and epidural spinal hemorrhage include trauma, lumbar puncture, spinal surgery and spinal anesthesia.
### TABLE OF CONTENTS/OUTLINE

Anatomy: • Pia, Arachnoid, Dura • Epidural and subdural spaces • Epidural venous plexus and fat MRI: • Aging of blood products- hyperacute, acute, early and late subacute, chronic • Use of gradient echo with hyperacute hemorrhage Spinal Subdural Hemorrhage: • Pathophysiology • Presentation • Etiologies with MR example of each: trauma, lumbar puncture, spinal anesthesia, spine surgery, bleeding diathesis, anticoagulation therapy, vascular malformations, non-accidental trauma, posterior fossa decompressive surgeries • MR imaging techniques and features • MR pitfalls • Complications Spinal Epidural Hemorrhage: • Pathophysiology • Etiologies with MR example of each: spontaneous, trauma, spinal anesthesia, spine surgery • Presentation • MRI imaging techniques and features • MR pitfalls • Complications

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### NRE369

**T2 Hyperintense Lesions of Spinal Cord- Myelitis, Myelomalacia and More...MRI Pattern Recognition**

*Education Exhibits*

Location: NR Community, Learning Center

ゝ Certificate of Merit

**Participants**

Zarina Abdul Assis MBBS, MD (Presenter): Nothing to Disclose  
Sunitha P Kumaran MBBS, MD : Nothing to Disclose  
Sanjaya Viswamitra MD : Nothing to Disclose

**TEACHING POINTS**

1. A systematic MRI pattern recognition approach is presented towards T2 hyperintense cord lesions. 2. Viewers will learn differential diagnosis of various T2 hyperintense lesions of spinal cord with emphasis on MRI features and clinical presentation. 3. Viewers will learn specific radiological signs to narrow down the differentials of cord lesions.

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### NRE370

**The Injured Spinal Cord – Problem Solving with Advanced MRI Techniques**

*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

Sadaf Fatima Zaidi MD (Presenter): Nothing to Disclose  
Mahmud Mossa-Basha MD : Nothing to Disclose  
Ken Flors Linnau MD, MS : Speaker, Siemens AG Royalties, Cambridge University Press  
Quynh Nguyen : Nothing to Disclose  
Sherif Osman MD : Nothing to Disclose

**TEACHING POINTS**

After reviewing this exhibit the reader will: • Be familiar with MR anatomy and MR imaging appearance of spinal cord injuries. • Be able to tailor an optimal MR protocol for suspected spinal cord trauma. • Have developed a diagnostic approach to acute and chronic spinal cord injuries and be able to facilitate clinical decision making and management in patients with spinal cord trauma.

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### NRE371

**The RBC's of Spinal Headaches: A Review of the Autologous Epidural Blood Patch**

*Education Exhibits*

Location: NR Community, Learning Center

**Participants**

William Alfred Moore MD (Presenter): Nothing to Disclose  
Harold David Scott MD : Nothing to Disclose  
Victor Omar Lopez MD : Nothing to Disclose  
David Paul Chason MD : Nothing to Disclose  
Edward Justin Stehel MD : Nothing to Disclose

**TEACHING POINTS**

Blood patch is an effective therapy for the treatment of headaches due to spinal CSF leaks with low complication rate. Review
Blood patch is an effective therapy for the treatment of headaches due to spinal CSF leaks with low complication rate. Review the indications, contraindications, technical methods, imaging, clinical results, and potential complications of the epidural blood patch. An empiric injection in the lumbar spine can potentially treat an occult spontaneous CSF leak arising from the thoracic spine. Image-guided blood patch may be of particular advantage over the blind "loss of resistance" technique in the setting of prior spinal surgery, complex anatomy, obese patients, or advanced degenerative change.

**TABLE OF CONTENTS/OUTLINE**

A. Introduction: Review of the history of post-dural puncture headaches and blood patch as a treatment
B. Review of indications/contraindications for blood patch including clinical features of spinal headaches, etiologies, and possible alternative methods to treat spinal headaches
C. Review of pertinent anatomy
D. Detailed review of the procedure a. Pre-procedure assessment b. Review of equipment needs c. Positioning d. Detail of technical steps with imaging examples
E. Outcomes: Potential procedural pitfalls, complications, and expectations for headache resolution

**NRE372**

**Ultrasound of the Spine in Newborns: A Great Screening Tool for Assessment of Anatomy, Normal Variants and Congenital Spinal Anomalies**

**Education Exhibits**

**Location:** NR Community, Learning Center

* Magna Cum Laude

**Participants**

- Carlos Hernando Torres MD (Presenter): Nothing to Disclose
- Roy Riascos MD: Nothing to Disclose
- Julie Hurteau MD: Nothing to Disclose
- Claudia Cotes MD: Nothing to Disclose

**TEACHING POINTS**

- The purpose of this exhibit is:
  1. To describe the ultrasound (US) technique used for the assessment of the spine in newborns.
  2. To demonstrate the normal anatomy and the anatomical variants that the radiologist should recognize when imaging the spine of the newborn with high resolution US.
  3. To demonstrate the strength of this modality as a screening tool for detection of spinal abnormalities in newborns.
  4. To present a variety of cases of closed spinal dysraphism with and without a subcutaneous mass as well as disorders of midline notochordal integration and disorders of notochordal formation.

**TABLE OF CONTENTS/OUTLINE**

1. Review the technique used to scan the spinal canal in pediatric patients, demonstrating:
   - Normal anatomy
   - Anatomical variants that could mimic pathology such as transitory dilation, ventriculus terminalis, pseudo arachnoid cyst and pseudo mass of the cauda equina.
   - 2. Review the up to date classification of skin covered spinal dysraphism:
     - with subcutaneous mass
     - without a subcutaneous mass
     - disorders of midline notochordal integration
     - disorders of notochordal formation
   3. Sample cases
   4. Summary

**NRE373**

**Uncommon Manifestations of Disc Pathology**

**Education Exhibits**

**Location:** NR Community, Learning Center

* Certificate of Merit
  * Selected for RadioGraphics

**Participants**

- Felix E. Diehn MD (Presenter): Nothing to Disclose
- Timothy J. Kaufmann MD: Nothing to Disclose
- Patrick H. Luetmer MD: Nothing to Disclose
- Vance Lehman MD: Nothing to Disclose
- Kent Ronald Thielen MD: Consultant, Nevro Imaging, Inc
- Carrie M. Carr MD: Nothing to Disclose
- Jonathan Michael Morris MD: Nothing to Disclose
- Amy Louise Kotsenas MD: Nothing to Disclose
- Timothy P. Maus MD: Nothing to Disclose
- John Thomas Wald MD: Nothing to Disclose

**TEACHING POINTS**

- 1. Intervertebral disc pathology can have unusual manifestations which interpreting radiologists may encounter and should be able to recognize.
  2. The differential diagnosis of an intraspinal extradural cyst includes a discal cyst.
  3. Intradural disc herniation, spinal CSF leak due to disc/osteophyte, and ventral cord herniation at a disc level: a spectrum of disease with similar pathology.
  4. The contour and position of thoracic cord should always be scrutinized to exclude ventral spinal cord herniation, a treatable cause of myelopathy.
  5. The differential diagnosis of a dorsal epidural mass includes a migrated/sequestered dorsal disc fragment.
  6. Disc herniations in unusual locations/varieties typically peripherally enhance (intradural, dorsal epidural, extreme lateral, discal cyst).

**TABLE OF CONTENTS/OUTLINE**

- Atypical disc pathology
- Discal cyst
- Disc-origin fibrocartilaginous embolism causing spinal cord infarct
- Atypical disc herniations
- Extreme lateral (retroperitoneal, prevertebral, intraneural)
- Dorsal epidural
- Spectrum of...
  - Intradural disc herniation
  - Calcified disc/osteophyte causing CSF leak
  - Transdural spinal cord herniation at disc level
  - Miscellaneous: giant thoracic (calcified);
  - calcified pediatic; massive lumbar; gas-containing; FDG avid Acute intravertebral (Schmorl's node)
  - Differential diagnosis: metastasis

**NRE374**

**Bilateral Inferior Petrosal Sinus Sampling (BIPSS) in Diagnostic Evaluation of ACTH-dependent Cushing Syndrome (CS): A Pictorial Review**
Participants

Daniel Rodriguez Bejarano MD (Presenter): Nothing to Disclose
Lucia Aja MD: Nothing to Disclose
Juan Jose Sanchez Fernandez MD: Nothing to Disclose
Evelyn Claudia Montano Claure MD: Nothing to Disclose
Lara Farras: Nothing to Disclose
Lisbeth Valoyes Guerrero MD: Nothing to Disclose

TEACHING POINTS

ACTH-dependent CS is a diagnostic challenge. The goal is to distinguish pituitary from ectopic ACTH secretion; BIPSS is sensitive and specific in the diagnosis of this entity and helps in location of the adenoma. An adequate knowledge of venous anatomy and a proper technique are essential to avoid complications with interpretable results.

TABLE OF CONTENTS/OUTLINE

CS is an uncommon endocrine disorder associating increased morbidity and mortality. Endogenous CS is mostly due to ACTH-secreting pituitary adenomas. Features of pituitary and ectopic ACTH-dependent CS (carcinoid tumors...) are undistinguishable. BIPSS is the gold standard to identify the source of ACTH secretion. Knowledge of pituitary venous drainage is essential for a bilateral approach. Our protocol includes a bilateral femoral venous access (SF sheath in each femoral vein). When catheters are placed, we start to sample ACTH from peripheral blood and from both IPS at baseline, and after CRH stimulation (3, 5, 15, 30 minutes). After samples are obtained, both femoral sheaths are removed. To interpret results, the ratio of IPS/peripheral ACTH level is calculated. It’s a safe procedure, if it’s done by experienced personal. The most frequent complication is groin hematoma; neurologic complications are rare.

NRE375

Characterization of Dural Arteriovenous Fistulas of the Spine by MR and DSA: A Pictorial Review

Participants

Lucia Aja Rodriguez MD (Presenter): Nothing to Disclose
Juan Jose Sanchez MD, PhD: Nothing to Disclose
Daniel Rodriguez Bejarano MD: Nothing to Disclose
Evelyn Claudia Montano Claure MD: Nothing to Disclose
Angels Camins MD: Nothing to Disclose
M. Angels De Miquel: Nothing to Disclose

TEACHING POINTS

To review imaging features and the spectrum of dural arteriovenous fistulas of the spine by MR and intraarterial angiography. To optimize technical parameters to establish an early, accurate and reliable diagnosis.

TABLE OF CONTENTS/OUTLINE

We retrospectively reviewed 23 patients with dural arteriovenous fistulas treated in our center between January 2010 and January 2014. All patients underwent MR, because of different clinical conditions and AVF was suspected. MR proved to be good in guiding the angiographic study. Procedure was shorter, less contrast media was administrated, less radiation dose was necessary and a lower rate of complications was noticed in these patients if compared with those without a previous MR study. Imaging features of fistulas were similar in MR and DSA in most cases. MR is more available, less invasive and cheaper than angiography. DSA confirms the diagnosis and allows to perform endovascular treatment.

NRE376

CT and MR of the Carotid Artery Plaque Remodelling

Participants

Luca Saba MD (Presenter): Nothing to Disclose
Roberto Montisci MD: Nothing to Disclose
Michele Porci MD: Nothing to Disclose
Roberto Sanfilippo MD: Nothing to Disclose
Pierleone Lucatelli MD: Nothing to Disclose
Eytan Raz MD: Nothing to Disclose

TEACHING POINTS

The concept of “plaque remodelling” indicates the morphological and ultra-structural variation of a plaque in the time. Several investigations have demonstrated that the carotid artery plaques change and it is possible that some determinants of instability are transitory. Moreover, some drugs (such as statins, apolipoprotein) change the composition of the plaque by increasing or reducing its volume. In this exhibit our purpose was to understand the physiopathology of plaque remodelling and to review CT and MR imaging findings of this phenomenon.

TABLE OF CONTENTS/OUTLINE

1) To review the concept of carotid artery plaque remodelling 2) Histology of the plaque according the AHA classification. 3) The histological and immunohistochemical effect of plaque eccentricity 4) MR, CT, and US imaging findings of carotid artery plaque follow-up that demonstrates the plaque remodelling. 5) Limits and potentialities of MR, CT and US in the follow-up of the carotid artery plaque 6) The drug-effect: how the therapies may change the plaque in terms of regression and progression. 7) Presentation of
NRE377

Direct Carotid Cavernous Sinus Fistulas: Evolving Endovascular Therapeutic Techniques

Education Exhibits
Location: NR Community, Learning Center

Participants
William Pedersen MD (Presenter): Nothing to Disclose
Malaykumar Manilal Patel MD: Nothing to Disclose
J. Scott Williams MD, PhD: Nothing to Disclose
Steven Thomas Reed MD: Nothing to Disclose

TEACHING POINTS
1. Review of historic and current endovascular therapies
2. Selecting the optimal endovascular treatment

TABLE OF CONTENTS/OUTLINE
Introduction: First treated surgically in early nineteenth century with carotid artery ligation, initial evolution of CCF treatment was limited to advancements in open surgical techniques. The innovation of modern endovascular techniques in the 1970s revolutionized treatment, reducing morbidity and mortality. The treatment of CCFs has evolved as catheter directed techniques have continued to advance. Pathophysiology: An arteriovenous fistula between the highly pressurized ICA and low pressure cavernous sinus results in hypertension in the cavernous sinus and the structures it drains, principally the orbit. Angiography: Initial angiography defines the anatomy and clarifies high-risk features such as cortical venous drainage, pseudoaneurysm, cavernous sinus varix and dangerous collateral pathways. Endovascular therapy: Obliteration of the fistula can be achieved by parent vessel sacrifice, embolization of the fistulous communication using a variety of materials and approaches, or through the use of an arterial covered stent. Conclusion: Endovascular intervention has evolved dramatically and is the most viable treatment option for CCF.

NRE378

Epidural Blood Patches: Review of the Technique, Applications, and Complications

Education Exhibits
Location: NR Community, Learning Center

Participants
Shamar Justin Young MD (Presenter): Nothing to Disclose
Tina S. Sanghvi MD: Nothing to Disclose
Ronald G. Quisling MD: Nothing to Disclose

TEACHING POINTS
• Understand the indications for performing an epidural blood patch, the primary treatment modality for intracranial hypotension (ICH).
• Learn proper epidural blood patch procedural techniques and identify different approaches utilized.
• Identify possible complications and pitfalls associated with the procedure.
• Review pre and post epidural blood patch imaging demonstrating objective radiologic improvement in findings of ICH after treatment and discuss factors suggesting that repeat treatment should be considered.

TABLE OF CONTENTS/OUTLINE
• Brief review of intracranial hypotension (ICH), with an emphasis on clinical presentation and radiologic findings.
• Discussion of ICH etiologies (see images 1 and 2 demonstrating dural tears/leaks in an idiopathic case of ICH) and review of pre-procedural selection criteria.
• Review epidural blood patch procedural techniques with illustrative imaging (see figure 2 which is an intra-procedural image).
• Discuss possible complications and pitfalls of the procedure.
• Review published success rates of the procedure and discuss factors which potentially limit treatment success.
• Discuss when a repeat epidural blood patch should be considered.

NRE379

Imaging of Carotid Artery Vulnerable Plaque

Education Exhibits
Location: NR Community, Learning Center

Participants
Luca Saba MD (Presenter): Nothing to Disclose
Max Wintermark MD: Research Grant, General Electric Company Research Grant, Koninklijke Philips NV
Bruce A. Wasserman MD: Nothing to Disclose
Michele Anzidei MD: Nothing to Disclose
Roberto Montisci MD: Nothing to Disclose

TEACHING POINTS
Carotid plaque morphology and composition play an important role in the embolic risk and should be considered as key parameters for the choice of the therapeutical approach. Nowadays, imaging techniques can identify and characterize a carotid vulnerable plaque and in particular the use molecular imaging and multi-spectral CT imaging allows to precisely distinguishing plaque components and characteristics. A "vulnerable plaque" is considered an atherosclerotic plaque with a tendency to rupture, resulting in embolization or thrombosis. In this exhibit our purpose was to understand the physiopathology of vulnerable plaque and to review CT, MR, US and Nuclear Medicine (NM) imaging findings of carotid vulnerable plaque with histological correlation.

TABLE OF CONTENTS/OUTLINE
1) Classification of plaque type
2) Elements associated to the plaque instability: type of plaque, thrombus, intra-plaque haemorrhages, ulcerations, fissured fibrous caps
3) MR, CT, US and NM imaging findings with histological comparison of carotid
vulnerable plaque. 4) Limits and potentialities of MR, CT, US and NM. 5) Algorithm for the automated plaque analysis 6) Presentation of advanced techniques like molecular imaging and multi-spectral CT imaging. 7) Diagnostic flow chart in the assessment of carotid vulnerable plaque

NRE381
Multimodality Imaging of Vertebrobasilar Dolichoectasia, Clinical Presentations and Imaging Spectrum: Current Status and Further Prospect

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit
Selected for RadioGraphics

Participants
Mohammad M. Samim MD, MRCS (Presenter): Nothing to Disclose
Alan Goldstein MD: Nothing to Disclose
Michele Hackley Johnson MD: Committee member, Boston Scientific Corporation

TEACHING POINTS
The major teaching points of this educational exhibit are: 1. To review the current diagnostic criteria of vertebrobasilar dolichoectasia utilizing CT, MR, and angiography (DSA) and discuss their limitations 2. To demonstrate the significance and different presentations of VBD 3. To review how to optimize imaging protocols 4. To review available treatment options and future prospects

TABLE OF CONTENTS/OUTLINE
The current and available diagnostic criteria, including "Smoker criteria" The technique of high resolution CT and MR pulse sequences and angiography tailored for evaluation of VBD and the imaging interpretation Multimodality imaging features of compressive and vascular complication How to recognize imaging points of critical importance for treatment planning How to optimize imaging modalities Cases of patients: various clinical presentations: compressive symptoms, including hydrocephalus and cranial nerve palsies, for example vertigo, hearing loss, facial palsy, and trigeminal neuralgia, neurovascular symptoms such as transient ischemic attack, ischemic stroke, or hemorrhagic stroke Imaging pitfalls related to thrombus, calcification and flow disturbances for imaging optimization

NRE382
Reversible Cerebral Vasoconstriction Syndrome: Clinical and Imaging Features and Controversies in Diagnosis and Management

Education Exhibits
Location: NR Community, Learning Center

Participants
Aaron Betts MD (Presenter): Nothing to Disclose
Aaron Grossman MD: Nothing to Disclose
Joseph Serrone MD: Nothing to Disclose
Achala Sameer Vagal MD: Research Grant, F. Hoffmann-La Roche Ltd Investigator, F. Hoffmann-La Roche Ltd

TEACHING POINTS
The purposes of this exhibit are: 1. Review the various clinical presentations that encompass the broad diagnostic spectrum of reversible cerebral vasoconstriction syndrome (RCVS). 2. Present CT, MRI, and angiographic imaging findings of various clinical entities that are categorized as variants of RCVS. Image findings will be discussed and examples will be provided in a case-based format. Examples of post-therapeutic imaging will also be presented. 3. Discuss controversies in the diagnosis and management of RCVS. 4. Discuss potential complications of intra-arterial therapy in RCVS.

TABLE OF CONTENTS/OUTLINE
Conditions categorized under spectrum of reversible cerebral vasospasm - Spontaneous (Call-Fleming, benign angiopathy of the CNS, thunderclap headache with reversible vasospasm) - Related to use of vasoactive drugs - Post-partum angiopathy - Migrainous vasospasm - Other associations - Associations with PRES Complications of RCVS Imaging features - CT - MRI/MRA - Angiography Diagnosis Management Complications of treatment

NRE383
Revisiting The Cryptic Asymptomatic Parasellar High Flow on Magnetic Resonance Angiography (MRA)

Education Exhibits
Location: NR Community, Learning Center

Certificate of Merit

Participants
Santhosh Raj Seela Raj MD, FRCR (Presenter): Nothing to Disclose
Ivan Ho Mien MBBS, PhD : Nothing to Disclose
Jamie Ho : Nothing to Disclose
Louis Elliot McAdory MD, PhD : Nothing to Disclose
Winston Eng-Hoe Lim : Nothing to Disclose
Ling Ling Chan MBBS, FRCR : Nothing to Disclose

TEACHING POINTS
Address and present prevalence of asymptomatic high parasellar flow on MRA in the literature and our institution Review origin
of these incidental and false positive signs for dural arteriovenous fistulas (DAVFs), and illustrate MRA signs suggesting benignity, including modification of MRA presaturation pulses and use of 4D MRA, from our local experience. Contrast with MRA signs indicative of aggressive DAVFs based on existing classification systems. Formulate work-flow algorithm to manage the clinical conundrum and better select patients needing further 4D MRA or invasive angiography.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Anatomy of the Cavernous Sinus
3. Causes of Parasellar High Signal Intensity on MRA of The Circle of Willis
4. Origin of Asymptomatic Parasellar High Flow Signal
5. Dural Arteriovenous Fistulas and Their Classification
6. Imaging Findings and Techniques
7. Resolving False Positive Parasellar High Flow Signal Versus Benign and Aggressive Dural Arteriovenous Fistulas
8. Workflow Algorithm

NRE385
Vascular Anomalies of the Spine: A Simplified Approach

Education Exhibits
Location: NR Community, Learning Center

Participants
Neda Isabel Sedora-Roman MD (Presenter): Nothing to Disclose
Sachin Pandey MD: Nothing to Disclose
Ajith Thomas MD: Data Safety Monitoring Board, Boston Biomedical Associates
Gul Moonis MD: Nothing to Disclose

TEACHING POINTS
Upon completion of this educational exhibit, participants will be able to: 1. Review and describe typical imaging features of spinal vascular anomalies. 2. Review their classification, pathophysiology and treatment.

TABLE OF CONTENTS/OUTLINE

I. Background: Spinal vascular malformations represent a heterogeneous group of vascular anomalies. The clinical presentation of these malformations can be nonspecific, leading to underdiagnosis. If not treated in a timely fashion, these lesions may lead to progressive spinal cord symptoms, myelopathy and irreversible neurologic disability. The neuroradiologist is often the first to suggest this diagnostic possibility and as such a clear understanding of the classification and imaging presentation of each of these lesions is crucial. II. Spinal vascular anatomy review III. Types & classifications of spinal vascular anomalies: These lesions consist of congenital cavernomas, arteriovenous malformations and acquired arteriovenous fistulas. The literature on spinal vascular malformations contains multiple different classification systems based on anatomic location, angiography architecture and morphology. Current classification schemes used in the description of spinal vascular anomalies will be reviewed. IV. Review of Imaging Findings a. MRI/MRA b. Conventional angiography V. Sample cases VI. Summary

SPSP01
Nuevos Horizontes en Diagnostico por Imagen Desde el CIR: Sesión del Colegio Interamericano de Radiología (CIR) en Español/New Horizons in Diagnostic Imaging from CIR: Session of the Interamerican College of Radiology (CIR) in Spanish

Special Courses

AMA PRA Category 1 Credits ™: 3.75
ARRT Category A+ Credits: 4.00
Sat, Nov 29 1:00 PM - 5:00 PM Location: E451A

LEARNING OBJECTIVES

1) To review advances or new horizons in imaging in major subspecialties from experts from different CIR (Interamerican College of Radiology) countries. 2) To use a practical approach including case-based learning. 3) To seek audience participation with presentation of unknown clinical examples related to the organ system presentations.

Sub-Events

SPSP01A Introducción/Opening Remarks
Gloria Soto Giordani MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01B Primera Parte/Part 1
Moderator Pablo Riera Ros MD, PhD: Medical Advisory Board, Koninklijke Philips NV Medical Advisory Board, KLAS Enterprises LLC Medical Advisory Committee, Oakstone Publishing Departmental Research Grant, Siemens AG Departmental Research Grant, Koninklijke Philips NV Departmental Research Grant, Sectra AB Departmental Research Grant, Toshiba Corporation

LEARNING OBJECTIVES
LEARNING OBJECTIVES

1) To become familiar with the traditional biochemical/genetic markers of astrocytomas and how their presence or absence correlate with imaging findings. 2) To understand the biological changes, as reflected by MR advanced imaging techniques, that astrocytomas go through when malignant transformation occurs.

ABSTRACT

In this lecture we will use advanced MR imaging techniques, perfusion (both contrast enhanced and arterial spin labelled), permeability, diffusion, and spectroscopy to understand the biological behavior of astrocytomas. Low grade astrocytomas may not show high choline on MRS but show high myoinositol which correlates with low perfusion values. Anaplastic astrocytomas produce metalloproteases and thus VEGF and PDGF can stimulate angiogenesis resulting in high perfusion with gadolinium and ASL. Lastly, hypoxia induces formation of permeability factors leading to edema and contrast enhancement in glioblastomas. Necrosis, seen as lipids on MRS is a marker of glioblastoma. Presence of MGMT promoter and alterations in the IDH1 gene (present in most secondary glioblastomas) confer a better survival pattern to glioblastoma patients and these findings are seen predominantly in temporal and deep tumors and in those with little contrast enhancement and high signal on T2 and DWI images. Thus, the initial transformation in all low grade astrocytomas is ischemia that can be seen as the presence of lactate on MRS, while markers of higher grades such as angiogenesis, permeability, and necrosis can be identified with perfusion, K-trans maps, and MR spectroscopy. Lack of myoinositol on MRS indicates its consumption for production of metalloproteases and thus it is also an early marker of angiogenesis. Many of these changes occur before anatomical images may suggest them.

URL

https://sites.google.com/site/castilloneuroradiology/

Active Handout

http://media.rsna.org/media/abstract/2014/14002958/SPSP01C sec.pdf
Resonance Findings in Lung Parenchymal Disease

Arthur Soares Souza MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To show the value of thoracic MRI for assessment of parenchymal lung disease. 2) To demonstrate the value of diffusion weighted MRI (DWI) for differentiating benign from malignant lung neoplasms.

ABSTRACT

In this lecture we will show the clinical ability of thoracic MRI to depict the most common patterns of parenchymal lung diseases, and do the correlation with CT findings. MRI seems to be a valuable tool, without radiation exposure, for management of parenchymal lung disease. We will, also, address the importance of diffusion weighted MRI (DWI) for differentiating benign from malignant lung lesions.

URL

http://www.ultrax.com.br/chest

SPSP01G

Conferencia del Colegio Interamericano de Radiología/Interamerican College of Radiology Lecture

Dante R. Casale Menier MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01H

Segunda Parte/Part II

Moderator Miguel E. Stoopen MD: Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

N/a

URL

www.webcir.org

SPSP01I

Musculoskeletal: Advanced Imaging of the Articular Cartilage and Bone Marrow Chemical Shift Imaging

Gonzalo Javier Delgado MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01J

Abdomen e Hígado: Contrastes Hepatoespecíficos y Elastografía por Resonancia Magnética/Abdomen and Liver: Liver Specific Contrast Agents and Hepatic MR Elastography

Luis Antonio Sosa MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01K

Próstata: Resonancia Magnética de 3T y PET/CT con Colina/Prostate: 3T MRI and Choline PET/CT

Daniela Stoisa MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
PURPOSE

Limited studies have explored the relationship between atherosclerosis and cognitive impairment. We sought to determine associations between subclinical atherosclerosis, cognitive screening, and white matter hyperintensities on MRI, a predictor of cognitive function.

METHOD AND MATERIALS

The study consisted of 1903 participants from the XXXXX Heart Study (mean age 44 ± 10 years, 56% female) without cardiovascular disease who underwent carotid and brain MRI at 3 Tesla. Semi-automated techniques were used to define wall contours of the internal and common carotid arteries (ICA and CCA) and white matter hyperintensity volume (WMH). Subjects also underwent Montreal Cognitive Assessment (MoCA) testing and multidetector CT for measurement of coronary artery calcium (CAC) using the Agatston method. A MoCA score less than 26 was used to indicate the presence of at least mild cognitive impairment. Large WMH was defined as greater than 1 SD above the age-specific median. We related CAC and carotid wall areas to WMH and MoCA scores using Spearman correlation and multivariable linear and logistic regression models after adjusting for traditional risk factors, including age, ethnicity, male sex, diabetes mellitus, hypertension, smoking, and body mass index.

RESULTS

ICA and CCA wall areas correlated with WMH and MoCA score (all p<.001) in unadjusted models. After adjusting for traditional risk factors, ICA wall area remained associated with MoCA (β = -0.02, p<.05), and CCA wall area remained associated with WMH (β = 0.002, p = 0.04). Increasing ICA wall area predicted MoCA score <26 (OR 1.12 per SD change, 95% CI 0.99-1.26, p = 0.04) after multivariable adjustment, but increasing CCA wall area did not predict MoCA score <26 (p = 0.5). After adjusting for traditional risk factors, CAC was associated with WMH (β = 0.013, p = 0.0008). Increasing CAC score predicted large WMH (OR 1.19 per SD change, 95% CI 1.03-1.38, p = 0.02).

CONCLUSION

Subclinical coronary and carotid atherosclerosis are predictors of poorer cognitive function as measured by MoCA score and white matter hyperintensity volume on MRI.

CLINICAL RELEVANCE/APPLICATION

Subclinical atherosclerosis may predict cognitive decline independent of traditional cardiovascular risk factors.
Subclinical atherosclerosis may predict cognitive decline independent of traditional cardiovascular risk factors. Different sites and measures of atherosclerosis may have different sensitivities for predicting cognitive dysfunction.

**SSA15-02**

**Neuropathologic Correlates of Brain Atrophy: An MRI – Pathology Study in a Community Cohort of Older Adults**

Aikaterini Kotrotsou PhD : Nothing to Disclose, David A. Bennett MD : Nothing to Disclose, Julie A. Schneider MD : Nothing to Disclose, Sue Leurgans : Nothing to Disclose, Tom Golak : Nothing to Disclose, Konstantinos Arfanakis PhD (Presenter): Nothing to Disclose

**PURPOSE**

Brain atrophy is a hallmark of aging and neurodegenerative diseases. To determine the macrostructural signatures of age-related neuropathologies, MRI findings must be combined with pathology. Only a few studies have examined the association of brain volumes with neuropathology, and those studies suffered from low numbers of participants, long intervals between imaging and death, and low detail in terms of the spatial patterns of brain atrophy. The objective of this study was to determine the neuropathologic correlates of regional brain volumes by combining ex-vivo MR volumetry and pathology on a large cohort of older persons.

**METHOD AND MATERIALS**

Cerebral hemispheres were obtained from 166 deceased participants of two longitudinal, clinical-pathologic cohort studies of aging. All hemispheres were imaged ex-vivo, while immersed in 4% formaldehyde solution, on a 3T MRI scanner. A multi-atlas approach was used to segment ex-vivo MRI data into white and gray matter; 34 cortical and 8 subcortical regions. All volumes were normalized by the height of the participants. Following imaging, the hemispheres underwent neuropathologic examination. The pathologies considered in analyses were: Alzheimer’s disease (AD) pathology, Lewy bodies, hippocampal sclerosis (HS), gross and microscopic chronic infarcts, and cerebral amyloid angiopathy. Multiple linear regression was used to investigate the association between volumes and age-related neuropathologies across participants, controlling for age at death, sex, education, postmortem interval to fixation and to imaging. False Discovery Rate was used to correct for multiple comparisons.

**RESULTS**

Fig. 1 shows brain regions with significant negative correlation (p

**CONCLUSION**

This study provides detailed spatial patterns of brain regions with volumes that are negatively correlated with age-related neuropathologies. These patterns may allow development of MR biomarkers of AD and HS. To our knowledge, this is the largest MR volumetry pathology investigation to date, and the only assessing a high number of brain regions.

**CLINICAL RELEVANCE/APPLICATION**

This study provides information on the neuropathologic correlates of regional brain volumes, and may assist in the detection of AD pathology and hippocampal sclerosis in-vivo.

**SSA15-03**

**ASL Predicts Cognitive Deterioration in Healthy Elderly Individuals**


**PURPOSE**

To explore whether arterial spin labeling (ASL) imaging in cognitively intact elderly individuals may predict subsequent early neuropsychological decline.

**METHOD AND MATERIALS**

The local ethics committee approved this prospective study and written informed consent was obtained from all participants. We included 148 consecutive controls, 75 of whom remained stable (sCON, mean age 75.9 ± 3.4 years, 43 females), and 73 who deteriorated cognitively at 18 months clinical follow-up (dCON, 76.8 ± 4.1 years, 44 females) and 65 mild cognitive impairment (MCI, 76.2 ± 6.1 years, 25 females). 2-D pulsed ASL was performed at baseline visit. Image analysis included voxel-wise analysis of the ASL relative cerebral blood flow (reICBF) data and receiver operator characteristics (ROC) analysis.

**RESULTS**

The voxel-wise comparison of ASL revealed decreased reICBF in dCON compared to sCON notably in the posterior cingulate cortex (PCC). MCI versus sCON revealed slightly more extensive decreased reICBF in PCC as well, while the comparison of dCON versus MCI revealed no significant differences. ROC analysis of the reICBF in the PCC discriminated dCON (p

**CONCLUSION**

Reduced ASL in PCC at baseline is associated with the development of subsequent subtle neuropsychological deficits in healthy elderly controls. At a group level, dCON display similar ASL patterns than MCI at baseline indicating that these cases may initially maintain their cognitive status via the mobilization of their neurocognitive reserve at baseline, yet are prone to develop subsequent subtle cognitive deficits.

**CLINICAL RELEVANCE/APPLICATION**
Deteriorating controls and MCI have similar ASL patterns indicating that deteriorating controls already have perfusion alterations at baseline imaging despite apparent normal cognition, due to mobilization of the neurocognitive reserve. The cut-off value of 56.5 ml/100g/min in the posterior cingulate may predict subsequent very early cognitive with a sensitivity of 58.9 % and a specificity of 65.3 %.

**SSA15-04**

**Impacts of KIBRA and ApoE Variants Associated with Alzheimer’s Disease on the Functional Connectivity Density in Young Adults**

Ningnannan Zhang PhD (Presenter): Nothing to Disclose, Qiuhui Wang: Nothing to Disclose, Zhang Zhang: Nothing to Disclose, Chun-Shui Yu: Nothing to Disclose

**PURPOSE**

Recent research has suggested that Alzheimer’s disease (AD) is associated with KIBRA rs17070145 polymorphism, in addition to the hallmark risk gene ApoE ε4. The effects of the polymorphism in the KIBRA or ApoE gene on brain function has been documented separately in AD and aging brain, while the interaction effect of the two has not been well studied. We investigated the main and interaction effects of these genetic variants on the resting-state fMRI using functional connectivity density (FCD).

**METHOD AND MATERIALS**

A total of 267 young healthy subjects (22.8±2.4 years old; 149 women) were included. MR images were acquired using a Signa HDx 3.0 Tesla MR scanner (General Electric, Milwaukee, WI, USA). Resting-state fMRI data were obtained using the Single-Shot Echo-Planar Imaging (SS-EPI, TR/TE = 2000/30 ms; FOV = 240 mm × 240 mm; matrix = 64 × 64; FA = 90°, slice thickness = 4 mm; no gap; 40 interleaved transversal slices; 180 volumes). The global FCD (gFCD) was calculated by using a voxel-wise data-driven approach in the home made script. Both the main and interaction effect of genotype were calculated and compared using a full factorial analysis of covariance.

**RESULTS**

The main effect of KIBRA gene was in the superior occipital cortex, but no significant main effect of ApoE genotype was found. Significant KIBRA and ApoE interaction effect was found in the gFCD of the bilateral dorsolateral prefrontal cortex (DLPFC). Post hoc tests showed a nonlinear relationship between the KIBRA and ApoE genotypic subgroups on gFCD.

**CONCLUSION**

Our results suggest that KIBRA and ApoE risk genotypes in healthy young subjects exert differential impacts on the bilateral DLPFC, which is may sustain attention and working memory. The complex interactions between KIBRA and ApoE should be considered when investigating the impact of these two genetic variants on the brain.

**CLINICAL RELEVANCE/APPLICATION**

Comprehensive understanding of the KIBRA and ApoE genetic variants may provide additional information for AD early diagnosis.

**SSA15-05**

**Periventricular vs. Deep White Matter Hyperintensity in Normal Aging**

Soham Banerjee BS (Presenter): Nothing to Disclose, Kevin S. King MD: Nothing to Disclose, Roderick McColl PhD: Nothing to Disclose, Anthony R. Whitemore MD: Nothing to Disclose, Keith Hulsey: Nothing to Disclose, Ronald M. Peshock MD: Nothing to Disclose

**PURPOSE**

To map the spatial distribution of white matter hyperintensity (WMH) related to normal aging in the absence of hypertension, diabetes, and hypercholesterolemia.

**METHOD AND MATERIALS**

MRI brain images were acquired from a population based study. An automated algorithm generated each participant’s WMH distribution registered onto the MNI-152 standard template. A cohort of 827 participants (age range 18-83; 337 males, 490 females) without hypertension, diabetes, or hypercholesterolemia was identified. This cohort was divided into two groups: 702 participants <=55 years and 125 participants >55 years, based on previous studies demonstrating a tenfold increase in WMH volume after age 55. Logistic regression was performed at every voxel determining the voxel WMH probability. The two age groups predicted probabilities were compared, to create a probability ratio map representing the age effect on WMH at each voxel. The distance of each WMH voxel from the lateral ventricles was calculated and compared with its probability ratio using double log linear regression analysis.

**RESULTS**

Individual analysis was performed for each of the 216694 voxels that comprised the entire population's WMH distribution. On average, the older age group had predicted probabilities 6.2 times greater than the younger group at each voxel. Double log linear regression revealed a positive association (r²=0.23 with >75000 data points, slope p<0.0001) between probability ratio and distance from the lateral ventricles, suggesting that aging is associated with WMH further away from the ventricles. In comparison, in voxels directly adjacent to the lateral ventricles, age was only associated with a 1.06 times increased probability.

**CONCLUSION**
Normal aging had the highest impact on the prevalence of deep WMH and lowest impact on periventricular WMH.

**CLINICAL RELEVANCE/APPLICATION**

The disparate impact of normal aging on periventricular and deep WMH may assist in evaluating the relative contributions aging and treatable cardiovascular pathology make towards WMH in these regions.

### SSA15-06

**Changes in Brain Microstructure Predict Cognitive Decline in Elderly Subjects at Risk of Vascular Disease**

Michiel Sala (Presenter): Nothing to Disclose, Albert De Roos MD: Nothing to Disclose, Gerard-Jan Blauw: Nothing to Disclose, Huib A. Middelkoop PhD: Nothing to Disclose, Mark A. Van Buchem MD, PhD: Research Consultant, Medis Medical Imaging Systems, Inc, Ton de Craen: Nothing to Disclose, Jeroen Van Der Grond: Nothing to Disclose

**PURPOSE**

To investigate whether magnetic resonance imaging markers of brain microstructure predict cognitive decline in elderly subjects at risk of vascular disease.

**METHOD AND MATERIALS**

520 nondemented elderly subjects (296 men, mean age 74 ± 3 years) at risk of vascular disease were included. We used linear regression analysis to assess cross-sectional associations between mean magnetization transfer ratio (MTR), normalized MTR histogram peak height (PH), and z scores of cognition. Models were adjusted for age, gender, depressive symptoms, education level, individual white matter lesion volume, and brain atrophy. In 193 subjects with complete imaging and cognition data at baseline and follow up, we compared difference in cognition at baseline versus 3.3-year follow-up across tertiles of baseline MTR PH using one-way analysis of variance.

**RESULTS**

In the adjusted models, high MTR PH was associated with better cross-sectional performance on the STROOP-III test (mean test score, lower versus upper tertile, 61.9 versus 52.3 seconds, p=0.002). Likewise, both PH and mean MTR were positively associated with the delayed Picture Word Learning (PWL) test (p=0.008 and p=0.032, respectively) and the Letter Digit Coding (LDC) test (p=0.001 and p=0.007, respectively). Subjects with low baseline MTR PH demonstrated worse performance at follow-up as compared to baseline on the STROOP-III test (p=0.008), immediate PWL test (p=0.044), and delayed PWL test (p=0.003). On the contrary, in subjects with intermediate or high MTR PH height, cognitive performance was maintained after 3.3 years.

**CONCLUSION**

In the elderly, MTR measures appear to be not only a general marker for cognition cross-sectionally, but especially MTR-peak height values seem also predictive for cognitive changes over time.

**CLINICAL RELEVANCE/APPLICATION**

MTR histogram peak height may be considered as MRI marker of cognition in future clinical intervention studies.

### SSA15-07

**Gray Matter and White Matter Microstructural Change in Nondemented Elderly Persons with CLU Gene**

Lihua Qiu PhD, MD (Presenter): Nothing to Disclose, Yong He: Nothing to Disclose, Hehan Tang BS: Nothing to Disclose, Yi Zhou: Nothing to Disclose, Zhengyan Li: Nothing to Disclose, Weimei Zhang: Nothing to Disclose, Lanlan Wang: Nothing to Disclose, Qiyong Gong: Nothing to Disclose, Ling Zou MD: Nothing to Disclose

**PURPOSE**

To clarify the gray matter and white matter integrity changes in nondemented elderly subjects with AD risk gene of C allele in clusterin, and their correlation with cognitive performance.

**METHOD AND MATERIALS**

Thirty-one subjects with AD risk gene of clusterin C (CLU-C) allele carriers and 15 subjects with non C/C (TT+TC) genotype were recruited in our study. High resolution 3D brain structure, DTI data and cognitive measurements(measured by using the Mini-Mental State Exam (MMSE), Alzheimer's Disease Assessment Scale (ADAS), Wechsler Memory Scale and Montreal Cognitive Assessment (MoCA)) were available for all subjects. By using voxel-based analysis, gray matter volume (GMV), gray matter concentration (GMC) and fractional anisotropy (FA) were compared between C/C genotype and non C/C genotype subjects with a two-sample t test and were tested for correlation with cognitive measurements.

**RESULTS**

There was no significant difference in age, sex, handedness and cognitive measurements between the two groups. Compared with the non C/C genotype carriers, the C/C genotype carrier group also showed decreased FA in left external capsule and increased GMC in the left parahippocampal gyrus (PHC), right middle frontal gyrus and right temporal middle gyrus as well as increased GMC in left middle frontal gyrus, right fusiform and increased GMV in left middle frontal gyrus (p=0.001). The C/C genotype carrier group also showed decreased FA in left external capsule and increased FA value in left temporal sub-gyrus and left anterior cingulate sub-gyrus. Furthermore, the GMC of left PHC was
negatively associated with MoCA score ($r=-0.564$, $p=0.045$) and positively related with the ADAS ($r=0.753$, $p=0.003$) in non C/C genotype carrier group while the FA value in left external capsule were positively related with the MMSE score ($r=0.531$, $p=0.003$), digit span score ($r=0.377$, $p=0.044$) and language proficiency score ($r=0.415$, $p=0.025$) in C/C genotype carrier group.

CONCLUSION

CLU-C allele carrier showed function related GMV, GMC and white matter integrity alteration in brain regions implicated in AD patients, which may testify the CLU-C allele to be a valid genetic risk factor for late-onset AD.

CLINICAL RELEVANCE/APPLICATION

Our findings provide the possible pre-clinical neuroimaging phenotype of AD, add the understanding of the genetics of AD pathology and the necessity of targeted preventive and therapeutic strategies in particular subpopulation with AD risk.

**SSA15-08**

**Epicentral Disruption of Structural Connectivity in Alzheimer’s Disease**

Carlo Augusto Mallio MD (Presenter): Nothing to Disclose, Ruben Schmidt: Nothing to Disclose, Fabrizio Vernieri: Nothing to Disclose, Bruno Beomonte Zobel MD: Nothing to Disclose, Carlo Cosimo Quattrocchi MD, PhD: Nothing to Disclose, Martijn P. Van den Heuvel: Nothing to Disclose

**PURPOSE**

To test whether structural connectivity impairment is centered on enthorinal cortex and hippocampus in Patients with diagnosis of alzheimer’s disease (AD) and amnestic mild cognitive impairment (aMCI).

**METHOD AND MATERIALS**

Fifteen healthy controls (HC), 14 amnestic mild cognitive impairment (aMCI), 13 mild, and 15 moderate AD patients, participated in this study. Images were acquired using a 1.5 Tesla MRI system (Avanto B13, Siemens, Erlangen, Germany), including a T1 weighted MPRAGE (Magnetization Prepared Rapid Acquisition with Gradient Echo) and DTI obtained using b values of 0 and 1000 mm2/s and gradients applied in 12 different directions. White matter pathways were reconstructed for each subject, using the Fiber Assignment by Continuous Tracking (FACT) algorithm. We a priori selected the enthorinal cortex and the hippocampus as disease epicenter and calculate the percentage of affected connections directly linking to the epicenter (first ring) and to nodes with topological distance = 2 from the epicenter (second ring). Connections with a lower average strength (t-test, $p < 0.05$, uncorrected) in the patient group compared to the HC group were labeled as affected. For each of the three patient groups, the analysis was repeated for 10,000 random permutations of group assignments (i.e., HC or patient) to test for significance of the findings.

**RESULTS**

The analysis of number of streamlines yielded 5.2% of affected connections in the first ring ($p = 0.1013$) and 2.9% in the second ring ($p = 0.1739$) for aMCI; 20% of affected connections in the first ring ($p = 0.0001$) and 10.6% in the second ring ($p = 0.0001$) for mild AD; 37.9% of affected connections in the first ring ($p < 0.0001$) and 17.5% in the second ring ($p < 0.0001$) for moderate AD.

**CONCLUSION**

The results of this study show epicentral disruption of structural connectivity in aMCI and AD. Enthorinal cortex and hippocampus together form a good target to be considered as epicenter of structural connectivity impairment in aMCI and AD.

**CLINICAL RELEVANCE/APPLICATION**

The pathways linking to nodes with lowest topological distance from the epicenter are prone to the most structural damage also reflecting disease progression from aMCI to moderate AD.

**SSA15-09**

**Neural Correlates of Apathy and Disinhibition in FrontoTemporal Dementia**

Sheela Kumari R MSc (Presenter): Nothing to Disclose

**PURPOSE**

The frontal variant FTD is defined by the presence of behavioural manifestations such as apathy, disinhibition and executive disinhibition, but their neuroanatomical correlates are still not clearly defined.

**METHOD AND MATERIALS**

Patients with a clinical diagnosis of FTD in the SCTIMST Memory Clinic were included in the study. Study was performed after getting approval from the Institutional Ethics Committee. We administered Frontal system behavioural scale (FrSBe) to 20 patients with FTD and 20 normal control (NC) subjects. All the subjects were underwent a high resolution T1 weighted Volumetric Magnetic Resonance Imaging (MRI) sequence in 1.5 Tesla Siemens scanner. Voxel Based Morphometry (VBM) was used to explore the pattern of GM atrophy in apathy and disinhibition profiles as measured by FrSBe. By using VBM, subject brains were segmented into GreyMatter (GM), White Matter (WM) and Cerebrospinalfluid(CSF). Segmented images were then smoothed with an isotropic Guassian kernel of 12 mm Full Width Half Maximum (FWHM). The smoothed images were used to compare the GM density between FTD patients and controls. A two sample t test comparison by setting up a voxel-wise General Linear Model (GLM) was performed between FTD and NC to provide an overall indicator of pattern atrophy in FTD patients. For multiple comparison age, sex and TIV were included as covariates in the design matrix. Apathy and disinhibition scores were entered as disease factors in the design matrix. A level of significance of $p<0.001$, uncorrected was accepted for the multiple comparison of whole brain analysis.

**RESULTS**
Compared with a group of controls, FTD patients revealed a wide spread atrophy in the frontal and the anterior temporal lobes. Apathy profile in FTD is correlated with atrophy in right prefrontal cortex, right rectal gyrus, anterior cingulate and right Rolandic operculum regions. Disinhibited profile is correlated with atrophy in right Heschl gyrus, right hippocampus, right insula and olfactory regions.

**CONCLUSION**

Atrophy in frontal and temporal regions associated with apathetic and disinhibited profile. The correlation analysis between regional atrophy and corresponding symptoms in FTD was successfully validated by VBM.

**CLINICAL RELEVANCE/APPLICATION**

Our study may help in the better understanding of the neural correlates of this dreaded dementing disease as well as facilitate the understanding of human brain.
SSA16-02

Comparative Cadaver Study of MDCT and C-Arm CT Imaging of the Temporal Bone before and after Cochlear Electrode Implantation: Image Quality and Dose Distribution

Tabassum A. Kennedy MD (Presenter): Nothing to Disclose, Timothy Peter Sczytkowicz PhD: Equipment support, General Electric Company Research Grant, Siemens AG, Sara Rademacher Nace MD: Nothing to Disclose, Kevin Royalty MS, MBA: Employee, Siemens AG, Sebastian Schafer: Consultant, Siemens AG, Samuel P. Gubbels MD: Nothing to Disclose, Brian Gartrell MD: Nothing to Disclose

PURPOSE

There have been substantial developments in C-Arm CT acquisitions (CACT), particularly in the setting of implantable devices and focusing on small volume, high contrast targets. The purpose of this study was to image the temporal bone and compare the image quality and relative radiation dose to the ocular lens between multidetector CT (MDCT) and CACT using a cadaveric model before and after cochlear electrode (CE) implantation.

METHOD AND MATERIALS

Four cadaveric heads were scanned on a C-Arm biplane system with CT capability, and on a clinical 64-slice MDCT. Each head was scanned with 2 different CACT modes: a small field of view (FOV) and full FOV mode. The small FOV mode utilized 6.5 cm x 11 cm coverage, 0.154 mm detector pitch and 0.2mm slice thickness. The full FOV mode utilized 6.5 cm x 38 cm coverage, 0.308 mm detector pitch and 0.2 mm slice thickness. For MDCT scans, a clinical temporal bone protocol was used with a 0.531 pitch, noise index 6.7, acquisition slice thickness 2.5 mm, and axial bone reconstructions of 0.625 mm. Dose measurements were performed using thermoluminescent dosimeters (TLDs). The relative dose to the lens was measured with TLD chips placed under the eyelids of whole cadaver heads. Separate scans were acquired of each cadaver head both before and after CE implantation. Image quality was qualitatively evaluated by a panel of experienced neuroradiologists including the position of the implanted CE.

RESULTS

The image quality of MDCT and CACT temporal bone images was judged to be equivalent for clinical evaluation prior to CE implantation. CACT was superior to MDCT in localizing the intracochelar position of the CE. The radiation dose to the lens was 15 times lower in small FOV CACT compared to MDCT and 1.9 lower in full FOV CACT compared to MDCT. There was no significant difference in radiation dose between the pre and post implant acquisitions.

CONCLUSION

Due to the geometry of the scan range and collimation of the CACT system, a substantial dose reduction was observed for CACT over MDCT for the lens. Our data suggests equivalent spatial resolution for clinically relevant temporal bone structures prior to CE implantation and improved visibility of intracochleal position of the CE after implantation.

CLINICAL RELEVANCE/APPLICATION

Future applications of C-arm CT systems include intraoperative cochlear implant staging from delivery under fluoroscopic guidance to post-delivery assessment of surgical position.

SSA16-03

Initial Results of a 3rd Generation Dual Source CT System Using Only an In-Plane Comb Filter for Ultra-high Resolution Temporal Bone Imaging

Mathias Meyer (Presenter): Nothing to Disclose, Holger Haubenreisser: Nothing to Disclose, Sonja Sudarski MD: Nothing to Disclose, Florian Lietzmann: Nothing to Disclose, Lothar R. Schad PhD: Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Thomas Henzler MD: Nothing to Disclose

PURPOSE

To prospectively evaluate radiation dose and image quality of a third generation 2x192 slice dual-source CT (DSCT) without z-axis filter behind the patient and a 0.4x0.5mm2 focal spot for temporal-bone CT.

METHOD AND MATERIALS

Forty-five patients were either scanned on a 1st, 2nd or 3rd generation DSCT in an ultra-high-resolution (UHR) temporal-bone imaging mode. Detector collimation on the first two generation DSCTs was 16x0.6 mm using a z-axis UHR filter, leading to an effective collimation of 16x0.3 mm and a reduced z-axis radiation dose efficiency of approximately 50%. On the 3rd generation DSCT system the tighter focal spot of 0.2mm2 allows to omit the necessity for an additional z-axis filter. 0.4 mm images were reconstructed using standard filtered-back-projection (FBP) or iterative reconstruction (IR) technique for the first two generations of DSCT and a novel model based IR algorithm for the 3rd generation DSCT. Objective image quality was evaluated for identical regions-of-interest and subjective image quality was evaluated on a 5-point Likert scale. Radiation dose parameters were assessed and compared between the three DSCT systems. Comparisons between the groups were analyzed with two-way ANOVA or Wilcoxon-Rank-Sum Test depending on the distribution of the data.

RESULTS

The statistically significantly highest subjective and objective image quality was found for the 3rd generation DSCT when compared to the 1st or 2nd generation DSCT systems (subjective image quality: 3rd generation DSCT 5[5-5], 2nd generation DSCT 4[4-4], 1st generation DSCT 3[2-3] all p<0.0001). Total effective dose was 63%/39% lower for the 3rd generation system when compared to the 1st and 2nd generation DSCT (0.25±0.04 mSv vs. 0.67±0.04 mSv and 0.41±0.04 mSv; p<0.0001 respectively).

CONCLUSION

Future applications include using only an in-plane UHR filter for temporal-bone imaging on the third generation DSCT.
SSA16-04

Three Dimensional Reconstruction of the Inner Ear Using High Resolution MR-Imaging before Cochlear Implantation: Does the Volume of the Cochlea and Inner Ear Affect the Results of Speech Recognition Outcome after Implantation?

Nagy Naguib Naeem Naguib MD, MSc (Presenter): Nothing to Disclose, Ahmed Fathy Emam MBCh : Nothing to Disclose, Constanze Hey : Nothing to Disclose, Nour-Eldin Abdelrehim Nour-Eldin MD, MSc : Nothing to Disclose, Marc Harth : Nothing to Disclose, Iris Burck MD : Nothing to Disclose, Boris Bodelle MD : Nothing to Disclose, Thomas Lehnert MD : Nothing to Disclose, Thomas Josef Vogl MD, PhD : Nothing to Disclose

PURPOSE

To test whether the volume of the inner ear and cochlea measured using three dimensional (3D) reconstruction of the high resolution MRI sequence affect the speech recognition outcome following cochlear implantation.

METHOD AND MATERIALS

The study was retrospectively performed on 36 patients (17 males and 19 females) with a mean age of 53.58 year +/- 22.1. All patients suffered from longstanding sensorineural hearing loss and received unilateral cochlear implantation. High resolution MRI was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D reconstructions and pre-operative volume measurements were performed using an advantage workstation for diagnostic imaging. Speech recognition (SR) was tested using the Freiburger Monosyllabic Words (MSWT) and Numbers tests (NT) preoperatively, postoperatively, at 3, 6 and 12 month follow-up. Speech Recognition tests and Volume assessment were performed in a double blinded fashion. The correlation between the Speech Recognition test results and inner ear and cochlear volume measurements in 3D were tested for statistical significance using the Spearman’s rank correlation test.

RESULTS

The mean 3D volume of the inner ear was 0.48 cm3 (Standard deviation: 0.08, Range: 0.31 - 0.7) and the mean 3D volume of the cochlea was 0.16 cm3 (Standard deviation: 0.03, Range: 0.1 - 0.22). The mean percentages of the SR-MSWT were 5.4, 25.19, 38.54, 46.04 and 53.85 in the preoperative, postoperative, 3, 6 and 12 month follow-up respectively. The mean percentages of the SR-NT were 30.4, 66.15, 81.6, 82.5 and 87.6 in the preoperative, postoperative, 3, 6 and 12 month follow-up respectively. There was no significant correlation (p > 0.05) between the preoperative volume of the inner ear and cochlea and the results of the SR assessment at any time point of the study.

CONCLUSION

The preoperative volume of the inner ear and the volume of the cochlea do not correlate significantly with the outcome of the speech recognition tests following cochlear implantation.

SSA16-05

Cochlear Implants: Electrode Migration and its Implications

Mariano Sturla MD (Presenter): Nothing to Disclose, Alejandro Gomez RT : Nothing to Disclose, Eduardo Galli MD : Nothing to Disclose, Natalia A. Hiriart MD : Nothing to Disclose

PURPOSE

Show the usefulness and implications of electrode position detection in cochlear implant patients.

METHOD AND MATERIALS

68 patients with cochlear implants were studied with CT after surgery and in the followup (5 years period). In all of them electrodes were placed in the Scala Tympani at surgery. We used a 4 row scanner Philips MX8000Quad. Scan parameters were 0.5mm thickness, 0.5 reconstruction index and 0.5 pitch. To determine the exact position, we perform reconstructions(MPR, cMPR and 4D) and to determinate implant functionality we performed functional tests (voice perception, interpretation and discrimination) in all patients.

RESULTS

In 68 patients (75 implants) were imaged after surgery, 71 implants were followed up within a period of 5 years. Exact position of electrodes was identify in 97,1% (69/71). 2 implants (2,9%) were impossible to determinate due to strike artifact. We had two main types of migration; one occurs towards the tympanic box and the other inside the cochlea(scalar migration). 95,7% implants (66/69) were located at the Scala Tympani. All patients had normal functional tests for voice perception, interpretation and word discrimination. Only one showed abnormal tests and was proved to be a software calibration issue. In 4,3%(3 of 69) implants we discovered migration. In 2 of this 3 patients( 2,8% of total) the electrode was identified at Scala Vestibuli beyond de basal turn of the cochlea, confirmed by CT. No one had impaired hearing functional tests. The other patient showed electrode migration within the middle ear towards the tympanic cavity (1,5%) of
presenting abnormal tests.

CONCLUSION
Computed Tomography is a reliable method to determine the electrode position and migration. Electrodes localization is a relevant information to the surgeon and must always be reported. This preliminary results suggest that the existence of middle ear migration is more associated with hearing loss than the scalar migration. Scalar migration is more frequent beyond the basal turn of the cochlea. We believe that a larger series of patients is needed to confirm this preliminary results.

CLINICAL RELEVANCE/APPLICATION
Electrode position and location plays an important role in the post-operative followup providing critical information to the surgeon.

SSA16-06
Auditory Brainstem Implant: Computer Tomography Assessment of Electrodes Dislocation
Nico Cardobi (Presenter): Nothing to Disclose, Roberto Cerini: Nothing to Disclose, Federica Spagnoli: Nothing to Disclose, Marco Barillari MD: Nothing to Disclose, Marco Carner: Nothing to Disclose, Vittorio Colletti MD: Nothing to Disclose

PURPOSE
The main goal of our study was to evaluate the contribution of the Computed Tomography to demonstrate Auditory Brainstem Implant (ABI) electrodes dislocation.

METHOD AND MATERIALS
From 2008, out of 75 patient with ABI implant positioned in our Hospital, 7 patients with malfunctioning ABI were selected and retrospectively revised. CT examination was performed on our 64 slices CT scanner (Philips Brilliance 64, Philips Eindhoven, The Netherlands) at implant activation, usually 15 days after surgery and repeated later to verify any electrodes dislocations. Implant dislocation was defined as electrodes array rotation and/or translation. Rotation was defined as change in angulation, measured in degrees, of electrodes plate in each plane examined, between the CT examination performed at the ABI activation and subsequent follow-up CT. Translation was defined as displacement in millimetres of electrodes plate's iso-center, in each plane examined, between the CT examination performed at the ABI activation and subsequent follow-up CT. Electrodes translation and rotation were measured on fusion CT image in each plane and then compared to number of active electrodes of the array.

RESULTS
CT was able to identify electrodes plate rotation and/or dislocation in all patients. In 3/7 patients there were electrodes plate rotation and translation. In 2/7 patients there was only electrodes plate translation. Maximum rotation measured was 44.9°; maximum dislocation was 3.6 mm.

CONCLUSION
CT was able to identify electrodes plate rotation and/or dislocation in all patients.

CLINICAL RELEVANCE/APPLICATION
Computer tomography is a useful tool to detect ABI dislocation and should be used in case of decrease ABI performance over time.

SSA16-07
Volumetric Assessment of the Inner Ear in Patients Presenting with Meniere Disease
Ahmed Fathy Emam MBBCh (Presenter): Nothing to Disclose, Nagy Naguib Naeem Naguib MD, MSc: Nothing to Disclose, Nour-Eldin Abdelrehim MD, MSc: Nothing to Disclose, Mohammed Ahmed Alsubhi BMBS: Nothing to Disclose, Katrin Eichler MD: Nothing to Disclose, Thomas Lehnert MD: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose

PURPOSE
To assess the volume of the Cochlea and Vestibular Labyrinth in patients presenting with Meniere Disease and to compare with the volume of normal inner ears using 3D reconstruction of MR-Imaging.

METHOD AND MATERIALS
A retrospective study was performed on 135 inner ears (79 females and 56 males) with a mean age of 48.9 year (standard deviation: 25.4, range: 5 month - 88 year). Of the 135 inner ears 75 inner ear (37 right and 38 left inner ears) presented with Meniere and 60 inner ears (32 right and 28 left inner ears) diagnosed as morphologically normal. High resolution MR-Imaging was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D reconstructions were performed using Advantage WorkStation for diagnostic imaging. The difference between the volumes in patients with and without Meniere was tested using the Mann-Whitney test.

RESULTS
Right sided Meniere: semicircular canals mean volume was 0.290 mm (SD: 0.06, Range: 0.190 - 0.430 mm3),
vestibule's mean volume was 0.086 mm\(^3\) (SD: 0.02, Range: 0.060 - 0.160 mm\(^3\)) and Cochlea's mean volume was 0.180 mm\(^3\) (SD: 0.02, Range: 0.120 - 0.260 mm\(^3\)). Normal right inner Ear: semicircular canals mean volume was 0.290 mm\(^3\) (SD: 0.05, Range: 0.190 - 0.350 mm\(^3\)) and Cochlea's mean volume was 0.170 mm\(^3\) (SD: 0.02, Range: 0.120 - 0.260 mm\(^3\)). Left sided Meniere: semicircular canals mean volume was 0.290 mm\(^3\) (SD: 0.05, Range: 0.200 - 0.410 mm\(^3\)), vestibule's mean volume was 0.080 mm\(^3\) (SD: 0.02, Range: 0.060 - 0.150 mm\(^3\)) and Cochlea's mean volume was 0.180 mm\(^3\) (SD: 0.02, Range: 0.140 - 0.260 mm\(^3\)).

There was a statistically significant difference between the semicircular canal volume, vestibular volume and cochlear volume in inner ears affected with Meniere Disease in comparison with normal inner ears. (P value ranging between 0.002 and 0.045).

**CONCLUSION**

Patients presenting with Meniere Disease show a statistically significant larger volume of the semicircular canals, vestibule and cochlea compared to patients without Meniere disease.

**CLINICAL RELEVANCE/APPLICATION**

An increased volume of the inner ear might be responsible for Meniere disease.

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**SSA16-08 Reproducibility of Volumetric Assessment of the Inner Ear using Three Dimensional Reconstruction of the High Resolution MRI Sequence**

Nagy Naguib Naeem Naguib, MD, MSc (Presenter): Nothing to Disclose, Ahmed Fathy Emam, MBBCh: Nothing to Disclose, Nour-Eldin Abdelrehim, MSc: Nothing to Disclose, Tatjana Gruber-Rouh: Nothing to Disclose, Boris Bodelle, MD: Nothing to Disclose, Marc Harth: Nothing to Disclose, Thomas Lehner, MD: Nothing to Disclose, Thomas Josef Vogl, MD, PhD: Nothing to Disclose

**PURPOSE**

To assess the reproducibility of the volumetric assessment of the inner ear using three dimensional (3D) reconstruction of the high resolution MR-Imaging (HR-MRI) sequences.

**METHOD AND MATERIALS**

The study was retrospectively performed on 50 patients (F=27, M=23) with a mean age of 53.3 years. Patients were referred for MRI due to different disorders of the inner ear. HR-MRI was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D reconstructions were performed using Advantage Workstation. Assessed were the volumes of both inner ears together, of each side alone, of the cochlea and of the vestibular system. All volume measurements were performed twice. To avoid possible Bias the time interval between both measurements was 1 year and the previous results were not accessible during the second evaluation (blinded). The agreement between both results was tested using intra-class correlation (ICC) test.

**RESULTS**

For the first assessment the mean volume of both inner ears together was 1.01 cm\(^3\) +/-0.13 (Range: 0.69-1.33), of each inner ear alone 0.5 cm\(^3\) +/-0.07 (Range: 0.32-0.71), of the cochlea 0.17 cm\(^3\) +/-0.024 (Range: 0.13-0.23) and of the vestibular system 0.33 cm\(^3\) +/-0.06 (Range: 0.19-0.49). For the second assessment the mean volume of both inner ears together was 0.99 cm\(^3\) +/-0.11 (Range: 0.79-1.27), of each inner ear alone 0.5 cm\(^3\) +/-0.06 (Range: 0.38-0.66), of the cochlea 0.17 cm\(^3\) +/-0.025 (Range: 0.13-0.26) and of the vestibular system 0.33 cm\(^3\) +/-0.05 (Range: 0.23-0.45). ICC analysis showed a statistically significant (p<0.0001) excellent agreement for volumetric assessment of both inner ears together (ICC-Coefficient=0.82, Confidence Interval (CI) 95%) and of the cochlea (ICC-Coefficient=0.88, CI 95%). A statistically significant (p<0.0001) substantial agreement for volumetric assessment of each side alone (ICC-Coefficient=0.79, CI 95%) and of the vestibular system (ICC-Coefficient=0.7, CI 95%) was noted.

**CONCLUSION**

Volumetric assessment of the inner ear using 3D reconstruction of HR-MRI is a reproducible method with statistically significant excellent agreement for volumetric assessment of both sides together and cochlea and substantial agreement for each side alone and vestibular system.

**CLINICAL RELEVANCE/APPLICATION**

The reproducibility of the volumetric assessment makes it possible to introduce 3D volume assessment of the inner ear as one of the MRI assessment parameters for patients presenting with inner ear disorders.
Sub-Events

SSA17-01  Plaque Echolucency and Stroke Risk in Asymptomatic Carotid Stenosis: A Systematic Review and Meta-Analysis

Hediyeh Baradaran MD (Presenter): Nothing to Disclose, Kartik Kesavabhotla: Nothing to Disclose, Edward E. Mtui MD: Nothing to Disclose, Diana Delgado MS: Nothing to Disclose, Ashley Giambrone PhD: Nothing to Disclose, Ajay Gupta MD: Nothing to Disclose

PURPOSE

Among methods to further risk-stratify patients with asymptomatic carotid stenosis, carotid artery plaque echolucency on ultrasound (US) has been identified as a noninvasive imaging marker for future stroke risk. We performed a systematic review and meta-analysis to evaluate the association between echolucent plaque identified on US and future ischemic events in asymptomatic patients with carotid atherosclerotic disease.

METHOD AND MATERIALS

We performed a comprehensive literature search evaluating the association of US-based characterization of carotid plaque with ischemic events. The included studies were prospective observational studies examining plaque echolucency on US in asymptomatic patients with mean follow-up of at least 1 year assessing for development of ipsilateral ischemic event. A meta-analysis with assessment of study heterogeneity and publication bias was performed. Results were summarized using a random or fixed-effects model.

RESULTS

Of the 5409 manuscripts screened, 7 met eligibility for systematic review and meta-analysis. A total of 7727 patients with a mean age of 72.1 were included. Because no significant heterogeneity was found between studies, a fixed effects model was used. The relative risk (RR) for ipsilateral stroke in patients with echolucent plaque was 3.00 (95% CI, 1.858-4.852; p = 0.00). In a subset analysis, the RR for ipsilateral stroke in patients with >50% carotid artery stenosis and echoluent plaque was 2.56 (95% CI, 1.275-5.137; p = 0.01). No statistically significant publication bias was found between studies.

CONCLUSION

In this meta-analysis of 7727 patients, we found that the presence of echoluent plaque on carotid artery US increases the risk of future ipsilateral stroke in asymptomatic patients with carotid atherosclerotic disease.

CLINICAL RELEVANCE/APPLICATION

US imaging routinely acquired for carotid artery stenosis screening can also be used to classify plaque echolucency and potentially offers a simple tool to further risk stratify asymptomatic patients with carotid atherosclerotic disease.

SSA17-02  A Population-based Study on MRI-based Automated Segmentation of Carotid Atherosclerotic Plaque Burden

Mariana Selwaness MD (Presenter): Nothing to Disclose, Reinhard Hameeteman MSC: Nothing to Disclose, Oscar H. Franco: Nothing to Disclose, Aad Van Der Lugt MD, PhD: Nothing to Disclose, Jolanda J. Wentzel PhD: Nothing to Disclose, Meike Willemijn Vernooij MD: Nothing to Disclose

PURPOSE

The extent of carotid atherosclerosis is considered a potentially relevant risk marker for stroke. In a large stroke-free population, we identified cardiovascular risk factors and carotid plaque components associated with carotid plaque burden and lumen volume.

METHOD AND MATERIALS

Within The Rotterdam Study, we performed prescreening of carotid arteries with ultrasound to select participants with carotid plaques >=2.5 cm. On 1.5-Tesla carotid MRI scanning, plaque composition and luminal stenosis were visually assessed. Inner and outer wall of the carotid arteries were bilaterally segmented using a validated automated method in order to measure plaque burden. We analyzed sex-specific standardized relations of cardiovascular and imaging risk factors to plaque burden and luminal volumes using regression analysis.

RESULTS

In 1562 participants (mean age 72.7±9.2 years, 46% women), we automatically segmented 2821 carotid atherosclerotic plaques. Women had larger plaque burden (50.7±7.8% vs. 49.2±7.7%, p

CONCLUSION

Several cardiovascular risk factors as well as plaque composition, in particular IPH, are associated with plaque burden. Carotid IPH is a strong risk factor for luminal stenosis.
Feasibility of High-resolution MR Imaging for the Diagnosis of Intracranial Vertebrobasilar Artery Dissection

Miran Han MD (Presenter): Nothing to Disclose, Jin Wook Choi MD: Nothing to Disclose, Young Keun Sur MD: Nothing to Disclose, Seon Young Park MD: Nothing to Disclose, Sun Yong Kim MD: Nothing to Disclose

PURPOSE
To evaluate the feasibility of HR-MR imaging to diagnose intracranial vertebrobasilar artery dissection (VBD) and to find most useful imaging findings suggesting dissection

METHOD AND MATERIALS
We retrospectively reviewed 55 patients suspected of having intracranial VBDs and underwent HR-MR imaging between March 2012 and October 2013. Two neuroradiologists independently reviewed the HR-MR images. The diagnosis based on only HR-MR imaging was compared with final diagnosis by the consensus among neuroradiologists, neurointerventionist and neurologist after reviewing all clinical and paraclinical investigations available at hospital discharge (initial CT, MR, DSA images and etiologic work-ups) and follow up. Two neuroradiologists also looked for indications of dissection (mural hematoma, dissection flap, outer diameter enlargement on T2WI of steno-occlusive lesion on angiography) on each sequence of HR-MRI. Interobserver agreement for diagnosing the VBD and inter- and intraobserver agreement for detecting evidence of dissection were estimated using the Cohen's kappa coefficient

RESULTS
5 patients were excluded because scanning range of HR-MR imaging did not fully cover the affected segment. Among the 50 study population, 33 patients were finally diagnosed with VBD by consensus of various specialists. Diagnosis based on HR-MR imaging corroborated the final diagnosis in 47 (94%, 31 VBD and 16 No VBD) patients. A mural hematoma was best detected on T1WI and CE-T1WI (54.3%). Dissection flaps were seen in almost all cases on CE-T1WI (91.4%) and secondly detected on T2WI (68.6%). Outer-diameter enlargement of the steno-occlusive lesions on angiography was detected in more than half of cases (62.86%). The two reviewers showed substantial to almost perfect agreement for diagnosis of VBD and detecting dissection signs on every sequence.

CONCLUSION
HR-MR imaging could be a useful and non-invasive diagnostic tool for intracranial VBDs and dissection flap on CE-T1WI is most confident sign for suggesting dissection

Intraplaque Hemorrhage

Tina Binesh Marvasti (Presenter): Nothing to Disclose, Navneet Singh MD: Nothing to Disclose, Mariam Afshin : Nothing to Disclose, Tishan Maraj : Nothing to Disclose, Pascal N. Tyrrell PhD: Nothing to Disclose, Alan Rowland Moody MD: Nothing to Disclose

PURPOSE
Intraplaque hemorrhage (IPH) -a component of late-stage atherosclerotic plaque- is a source of free hemoglobin (Hb) that binds the haptoglobin (Hp) protein and forms a complex cleared by tissue macrophages. There are three Hp genotypes: Hp1-1, Hp2-2 and Hp1-2. The Hb-Hp2-2 complex has a lower binding affinity for macrophages, resulting in retention of vascular Hb and oxidative burden. Studies have shown a higher risk of CV events in Hp2-2 individuals. We hypothesized that Hp2-2 patients' failure to clear Hb results in a greater prevalence and progression of MRI depicted IPH (MRIPH). We aimed to identify a biomarker (Hp) for routine testing of individuals at risk of IPH.

METHOD AND MATERIALS
Patients with non-surgical carotid artery disease (30-95% stenosis) underwent 3T carotid MRI (Philips Achieva) of both carotids annually from 2010 to 2014. MRIPH uses a T1weighted inversion recovery fat suppressed 3D Fast Field Echo sequence in the coronal plane to detect IPH which appears of high signal due to methemoglobin. IPH was defined as a signal intensity 1.5x the adjacent sternocleidomastoid muscle. IPH volume was quantified using VesselMass software. Hp genotypes were identified using an established PCR protocol. Descriptive statistics and mixed effects model longitudinal regression analyses were performed.

RESULTS
The study cohort consisted of 80 patients (mean age, 72.8 years; range 52-100) with 160 carotid images. Patients homozygote for the Hp2 allele had a significantly higher prevalence of IPH at baseline (BL) compared to those carrying an Hp1 allele (57%vs.34%, OR=2.52, 95%CI=1.23-5.144, p=0.01). IPH volume at BL did not differ significantly between the two groups (0.27vs.0.23 mL respectively, p=0.836). Longitudinal analysis of 18 IPH positive carotids with two years follow up data indicated a significant progression of IPH volume over time (β=0.12, SE=0.04, p<0.01) and regression of IPH volume in patients carrying an Hp1 allele (β=-0.09, SE=0.03, p=0.01).
CONCLUSION
Patients homozygote for the Hp2 allele had a significantly higher prevalence of carotid BL-IPH at which worsened over a two year follow up period.

CLINICAL RELEVANCE/APPLICATION
Detection of pre-symptomatic vascular disease allows for prevention of CV events. Hp genotype is a biomarker of high risk vascular disease (IPH) that when detected using simple genotyping methods can identify at-risk populations for more targeted imaging investigations.

The Carotid Plaque Imaging in Acute Stroke (Capias) Study: Baseline and 3-month Follow-up Data
Tobias Saam MD (Presenter): Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG , Anna Bayer-Karpinska : Nothing to Disclose , Tobias Boech-Behrens : Nothing to Disclose , Andreas Schindler MD : Nothing to Disclose , Andreas Dietrich Helck MD : Nothing to Disclose , Holger Poppert : Nothing to Disclose , Florian Schwarz MD : Nothing to Disclose , Dirk-Andre Clevert MD : Speaker, Siemens AG Speaker, General Electric Company Speaker, Toshiba Corporation Speaker, Koninklijke Philips NV Speaker, Bracco Group , Konstantin Nikolaou MD : Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG , Frank Wollenweber : Nothing to Disclose , Martin Dichgans MD : Nothing to Disclose

PURPOSE
In up to 40% of patients with ischemic stroke no definite etiology can be established. A significant proportion of these cryptogenic stroke cases may be due to non-stenosing atherosclerotic plaques or low grade cervical artery stenosis not fulfilling common criteria for atherothrombotic stroke. The purpose of the Capias trial is to determine the frequency, characteristics and clinical long-term consequences of ipsilateral complicated American Heart Association lesion type VI (AHA-LT6) carotid artery plaques in patients with cryptogenic stroke compared to patients with defined stroke etiology.

METHOD AND MATERIALS
300 patients (age >49 years) with unilateral DWI-positive lesions in the anterior circulation and non- or moderately stenosing (< 70% NASCET) internal carotid artery plaques will be enrolled in the prospective multicenter study Capias. Carotid plaque characteristics will be determined by high-resolution black-blood carotid MRI at baseline and 12 month follow up.

RESULTS
The study started on February 15th 2011. So far, clinical and radiological baseline data of 115 patients have been analyzed. Table 1 demonstrates the baseline characteristics and the prevalence of AHA-LT6 in each stroke subtyping using the TOAST criteria. An initial analysis of primary endpoint data showed a significantly higher prevalence of complicated AHA-LT6 plaques in cryptogenic stroke patients ipsilateral (32%) than contralateral (5%) to the ischemic stroke (p < 0.001, McNemar). 3-month follow-up data was available in 101 patients and 5 cerebrovascular events (1 TIA, 4 strokes) occurred. 4 out of 5 events (80%) occurred in patients with AHA-LT6 plaques.

CONCLUSION
Baseline data of the Capias trial suggests that arterio-arterial embolism from non-stenotic carotid atherosclerotic plaques play a role in the pathogenesis in a subset of subjects previously diagnosed with a cryptogenic stroke. The majority of recurrent strokes occurred in patients with AHA-LT6, suggesting that AHA-LT6 could be an important imaging biomarker to assess risk of stroke recurrence.

CLINICAL RELEVANCE/APPLICATION
Depending on the results of CAPIAS, this study may have important implications for diagnostic decision making and provide the basis for the planning of targeted interventional studies.

Artery of Superior Orbital Fissure: An Undescribed Branch from the Pterygopalatine Segment of the Internal Maxillary Artery to the Cavernous Sinus through the Superior Orbital Fissure
Hiro Kiyosue MD (Presenter): Nothing to Disclose , Shuichi Tanoue MD : Nothing to Disclose , Ryuichi Shimada MD : Nothing to Disclose , Hiromu Mori MD : Nothing to Disclose

PURPOSE
Artery of foramen rotundum is thought to be a sole arterial branch of the pterigopalatine segment of the internal maxillary artery to the cavernous sinus. However, we found another undescribed branch, provisionally-named artery of superior orbital fissure (SOF), from pterigopalatine segment of the internal maxillary to the cavernous sinus via the SOF in some cases of parasellar hypervascular lesions. In this paper, we investigated the frequency and course of the artery of SOF in cases with parasellar hypervascular lesions.

METHOD AND MATERIALS
We retrospectively reviewed biplane and 3D angiography of external carotid artery undergone from June 2010 to December 2013 in 17 patients with parasellar hypervascular lesions, including 13 cases of cavernous sinus dural arteriovenous fistulas and 4 cases of parasellar meningiomas. 3D angiographic images were reviewed by 2 experienced neuroradiologists with particular interest to the artery of SOF.
RESULTS

The artery of SOF was identified in 7 of 13 cases of cavernous sinus dural arteriovenous fistulas and 2 of 4 cases of parasellar meningioma. It arose at the pterygopalatine segment of the internal maxillary artery, either singly or by a common trunk with the artery of foramen rotundum, and run upward to reach the SOF, and then turned posteriorly to the cavernous sinus with acute angle and fed the AVFs or tumors. In one case, the artery of SOF communicated with lachrymal branch of the ophthalmic artery at the orbital apex.

CONCLUSION

Although it has not been described in anatomic paper, the artery of SOF could be observed approximately half of the cases of parasellar hypervascular lesions

CLINICAL RELEVANCE/APPLICATION

This study demonstrates an arterial branch of the external carotid artery, artery of superior orbital fissure (SOF), which has not been recognized. The artery of SOF can feed the cavernous sinus dural AVFs and hypervascular tumor. Special attention should be paid for embolization of the artery of SOF because it potentially anastomose with ophthalmic artery and anterior branch of the inferolateral trunk of the internal carotid artery.

SSA17-08

Finding the Optimal Parameter for the DSA Time Density Curve When Evaluating Flow Changes in Patients with Carotid Stenosis


PURPOSE

Cerebral circulation time provides instantaneous intravascular flow measurement from the time density curve (TDC) in digital subtraction angiography (DSA) series and accurately predicts flow changes in stenotic occlusive vessels. The purpose of our study was to compare the effectiveness of three major TDC variables for detecting flow changes in stenotic patients: relative time to maximum concentration (rTmax), maximum slope (MS), and area under curve (AUC).

METHOD AND MATERIALS

Seventy cases of unilateral carotid stenosis (group A) and 56 normal controls (group B) were retrospectively enrolled. Fixed contrast injection protocols and acquisition parameters were used in all angiographic series. The middle cerebral artery (M1), sigmoid sinus (SS), and internal jugular vein (JV) in the AP (anterior-posterior) view, and second branch of the middle cerebral artery (M2), parietal vein, and superior sagittal sinus (SSS) in the lateral view were chosen. rTmax, MS, and AUC of the TDC in individual ROIs were compared between the two groups using a DSA analyzer prototype.

RESULTS

rTmax in M1, SS, JV, M2, PV and SSS were significantly prolonged in group A compared to group B. Among all AUCs, only the AUC in SSS was significantly larger in group A than in group B. For the MSs, M1, M2, and SS showed significant decreases in group A compared to group B. The AUC for the SSS demonstrated the best single diagnostic performance at the optimal cutoff value of 536 with sensitivity 71% and specificity 64.5%.

CONCLUSION

Only the MSs for M1, M2, and the AUC for the SSS showed equivalent diagnostic performance with rTmax in differentiating carotid stenosis. rTmax thus remains the preferred measurement for all ROIs in routine DSAs.

CLINICAL RELEVANCE/APPLICATION

Using rTmax alone in different ROIs provides sufficient, rapid in-room assessment of intravascular hemodynamic and thus improves patient safety in endovascular treatments.

SSA17-09

Extracranial Carotid Artery Stenting Followed by Intracranial Stent-based Thrombectomy for Acute Tandem Occlusive Disease

John Moshe Gomori MD (Presenter): Consultant, Medymatch Technology Ltd, Ronen Leker MD : Consultant, Medymatch Technology Ltd, Roni Peter Eichel MD : Nothing to Disclose, Jose Enrique Cohen MD : Nothing to Disclose

PURPOSE

Acute tandem occlusions of the extracranial internal carotid artery (ICA) and a major intracranial artery respond poorly to intravenous tissue plasminogen activator (IV-tPA) and present an endovascular challenge. We describe our experience with emergent stent-assisted ICA angioplasty and intracranial stent-based thrombectomy of tandem occlusions.

METHOD AND MATERIALS
Procedures were performed from 3/2010-12/2013. National Institutes of Health Stroke Score (NIHSS) and Alberta Stroke Program Early CT Score (ASPECTS), occlusion sites, collateral supply, procedural details, and outcomes were retrospectively reviewed with IRB waiver of informed consent.

**RESULTS**

24 patients, mean age 66 years, mean admission NIHSS score 20.4, and mean ASPECTS 9 were included. Occlusion sites were proximal ICA-MCA trunk in 17 patients, proximal ICA-ICA terminus in six, ICA-MCA-anterior cerebral artery (ACA) in one. Stent-assisted cervical ICA recanalization was achieved in all patients, with unprotected pre-angioplasty in 24/24, unprotected stenting in 16/24 (67%), and protected stenting in 8/24 (33%), followed by stent-thrombectomy in 25 intracranial occlusions. There was complete recanalization/complete perfusion in 19/24 (79%), complete recanalization/partial perfusion in 2/14 (13%), and partial recanalization/partial perfusion in 2/24 (8%) with no procedural morbidity/mortality. Mean time to therapy was 3.8 hours (range 2-5.5). Mean time to recanalization was 51 minutes (range 38-69). At 3-month follow-up, among 17/22 surviving patients (77%), 13/17 (76%) presented mRS 0-2 and 3/17 (18%) were mRS 3.

**CONCLUSION**

In acute tandem ICA-MCA/distal ICA occlusions, extracranial stenting followed by intracranial stent-based thrombectomy appears feasible, effective, and safe. Further evaluation of this treatment strategy is warranted.

**CLINICAL RELEVANCE/APPLICATION**

With newer techniques, acute tandem carotid - intracranial occlusive disease is now amenable to treatment with high success and low complication rates.
body motion correction techniques in improving cord/CSF conspicuity and gray/white matter definition.

METHOD AND MATERIALS

DTI data was collected for five healthy pediatric subjects on a Siemens Verio 3T MRI scanner using an inner field of view EPI sequence with 2DRF excitations. Imaging parameters were: TE = 110 ms, TR = 7900 ms, Voxel 0.8 x 0.8 x 6 mm³, 20 diffusion directions, 3 av, 6 b0, b = 800 s/mm². Prior to correction, a mask was applied to the center of the image to eliminate data beyond the spinal canal. First, b0 acquisitions were co-registered by rigid body transformation and averaged to create a mean b0 using SPM8. All DW images were registered to the mean b0 image using a rigid body registration method implemented in the ACID toolbox. For each subject, ROIs were drawn on FA maps for 3 adjacent axial slices to include lateral and posterior white matter and exclude gray matter. FA values were examined for both corrected and uncorrected images.

RESULTS

Clear improvements were visible in cord/CSF delineation and in gray/white matter definition in FA maps after motion correction. In some cases, improvement was dramatic, making initially unusable data clear. In all cases, corrected images showed higher FA values for white matter ROIs compared with uncorrected, ranging from 3-38% increases.

CONCLUSION

Rigid body motion correction led to an increase in FA values for white matter ROIs in the corrected data of the pediatric spinal cord. Additionally, there was improved definition of cord/CSF interface and gray/white matter differentiation.

CLINICAL RELEVANCE/APPLICATION

Rigid body motion correction showed an increase in FA values for white matter ROIs and improved cord/CSF interface and gray/white matter differentiation in DTI of the healthy pediatric spinal cord.

Imaging Findings of Limited Dorsal Myeloschisis: Comparison with Congenital Dermal Sinus

So Mi Lee MD (Presenter): Nothing to Disclose, Jung-Eun Cheon MD: Nothing to Disclose, Younghun Choi MD: Nothing to Disclose, In-One Kim MD: Nothing to Disclose, Woo Sun kim MD: Nothing to Disclose, Hyun-Hae Cho MD: Nothing to Disclose, Ji Young Kim MD: Nothing to Disclose, Su-Mi Shin MD: Nothing to Disclose, Ji Young Kim MD: Nothing to Disclose, Sun Kyoung You MD: Nothing to Disclose

PURPOSE

Limited dorsal myeloschisis (LDM) is characterized by fibroneural stalk that links the midline cutaneous lesion to the underlying cord. That is a distinctive form of spinal dysraphism, similar radiologic appearances with congenital dermal sinus (CDS). The aim of this study was to compare the neuroimaging findings between these two disease entities.

METHOD AND MATERIALS

We retrospectively reviewed the MR and US findings in 22 patients (12 LDM and 10 CDS) with surgically proven LDM (M: F = 2: 10, age range 15 days - 4 years) and CDS (M: F = 6: 4, age range 7 days - 16 months) from January 2012 to March 2014. The following imaging features were evaluated: location of the skin lesion, visibility of the tract along its subcutaneous and intrathecal course, ending point of the tract in the spinal canal, change in the cord location and shape, and presence of an intradural abscess or a dermoid-epidermoid tumor.

RESULTS

All of the skin lesions in both groups were located at the lumbosacral region. In ten (83%) of twelve patients with LDM, both subcutaneous and intrathecal portion of the tract were clearly visualized, while in nine (90%) of ten patients with CDS, the tract was indistinct in the intrathecal portion. In all 12 LDM patients, the tracts ended with attachment to the spinal cord just above the conus, while in eight patients with CDS, the tract ended within the spinal canal; dermoid-epidermoid tumors (n=5), filum terminale (n=1), conus medullaris (n=2). In the remaining two patients with CDS, the tract did not extend into the spinal canal; ended at the dura without passing through it (n=1), end blindly in the subcutaneous fat layer (n=1). In the LDM group, the conus medullaris was lying below L2 in nine (75%) patients and the cord showed dorsal tenting at the level of the tract attachment in ten (83%) patients. The level of the conus medullaris in the CDS was obscured by an intraspinal abscess or an infected dermoid-epidermoid in four (40%) patients and was low-lying in three (30%) patients with CDS. None of the LDM patients had an intradural infection or a dermoid-epidermoid tumor.

CONCLUSION

LDM showed a clearly visible intrathecal tract that was attached to the spinal cord just above the conus and dorsal tenting of the cord at the tract attachment site. LDM was not associated with an intradural infection or a dermoid-epidermoid, unlike CDS.

CLINICAL RELEVANCE/APPLICATION

MRI can be helpful in differential diagnosis of LDM and CDS.
Amide Proton Transfer (APT) Imaging of Brain Infection in Children

Hong Zhang MD (Presenter): Nothing to Disclose, Na Xu Zhao PhD: Nothing to Disclose, Jinyuan Zhou PhD: Nothing to Disclose, Yun Peng MD: Nothing to Disclose

PURPOSE

The study was performed with the aim of characterizing infectious lesions of different aetiology using protein-based APT imaging.

METHOD AND MATERIALS

Children with brain infection [one with tuberculous abscess (TA), one with pyogenic abscess (PA); and three with viral encephalitis (VA)] that were diagnosed on the basis of laboratory, clinical, and radiologic findings were recruited in this study. MRI data was acquired using a Philips 3T MRI scanner, including multiple MRI scans, T1-weighted, T2-weighted, isotropic apparent diffusion constant (ADC), Gd-T1w, and APT-weighted. APTw MR imaging was based on the single-slice, single-shot TSE (saturation time = 800 ms; saturation power = 2 μT). The APT effect was quantified using an MT-ratio asymmetry analysis at the offset of 3.5 ppm: MTRasym(3.5ppm), and displayed using a window of -4% to 4%. The Gd-T1w image was used as the reference of ROI analysis.

RESULTS

Both TA and PA demonstrated clear gadolinium enhancement. The APTw signal was high in the gadolinium-enhancing rim of the lesion (2.30±0.07% in TA and 2.27±0.17% in PA), compared to peripheral edema (0.58±0.07% in TA and 0.91±0.02% in PA) and contralateral normal-appearing brain tissue (0.37±0.03% in TA and 0.45±0.03% in PA). This hyperintense rim on APTw MRI may be due to the inflammatory cellular infiltrate and granulomas, leading increased content of cellular proteins and peptides. Most non-enhancing areas on T1w may be liquifactive necrosis of the lesion, showing APTw iso-intensity. The portion inside the center of the lesion showing an APTw hyperintensity may be due to a large amount of neutrophils and proteins, which are released in the necrotic cavity. For VE, T2w showed a symmetric hyperintense lesion in the basal ganglia. The lesion shows no enhancement on Gd-T1w and iso-intensity on APTw, which may mainly be associated with vasogenic/interstitial collection of fluid. Thus, APT-MR imaging may help better distinguish the heterogeneous portions of infectious lesions.

CONCLUSION

These initial data show that APT-MR imaging is an important technique for the detection and characterization of infectious lesions of different aetiology.

CLINICAL RELEVANCE/APPLICATION

APT-MRI may be a more sensitive biomarker in pediatric brain infection.

Evaluation of the Hippocampus in Survivors of Bilirubin Encephalopathy

Li-tal Pratt MD (Presenter): Nothing to Disclose, Prakash Muthusami MBBS, MD: Nothing to Disclose, Aideen Moore: Nothing to Disclose, William Halliday: Nothing to Disclose, Adrian James: Nothing to Disclose, Blake Papsin: Nothing to Disclose, Susan I. Blaser MD: Nothing to Disclose

PURPOSE

Abnormal signal and volume loss within globi pallidi and subthalamic nuclei reflective of neuronal apoptosis are present on MRI studies of chronic bilirubin encephalopathy (BE) patients. Although hippocampal signal changes and atrophy are uncommonly reported, we noted that the hippocampus is frequently abnormal as well. We retrospectively evaluated MRI studies of patients with chronic BE, providing qualitative/quantitative in vivo hippocampus assessment and imaging/pathologic specimens illustrations. We also assessed interval volumetric MRI hippocampal measurements between neonatal and post-neonatal periods.

METHOD AND MATERIALS

We reviewed 79 MRI studies of 44 children with a history of neonatal BE. The patients were divided into two groups: (1=acute disorder) Neonates (<1 month old) with increased bilirubin levels or encephalopathy (mean/SD age, 39/3 weeks GA) and (2=chronic disorder) Infants (≥1 month old) and children imaged for movement disorders or auditory neuropathy in whom features of BE were found (mean/SD age, 27/30 months). Imaging studies were evaluated qualitatively for hippocampal size and signal by two reviewers (consensus for final results); and quantitatively, by performing volumetric measurements of the hippocampi using a computerized segmentation method (Analyze 11.0). Comparison of hippocampal volumetric measurements was performed with 61 age-matched control patients imaged for unrelated skin lesions or headaches.

RESULTS

Hippocampal atrophy was observed in 34/57 (60%) of group 2 patients. Abnormal T2 hyperintense hippocampal signal was observed in 31/57 (54%), while hippocampal signal was normal in 26 patients. Hippocampal volumes in group 1 neonates were similar to age-matched controls (mean/SD 939/201 and 983/185 respectively, P=0.35). Comparison between group 2 patients and age-matched controls measurements over time demonstrated a decrease in hippocampal volume (mean/SD 1559/446 and 2360/522, respectively, P<0.01).

CONCLUSION
Hippocampal involvement in BE is common, leading to sclerosis (chronic volume loss and signal abnormalities) in group 2 patients, suggesting progression of hippocampal atrophy over time in this population.

**CLINICAL RELEVANCE/APPLICATION**

Bilirubin encephalopathy (BE) has an impact on learning and memory, quantitative and qualitative hippocampal assessment on MRI studies may provide additional tools for cognitive evaluation in BE survivors.

### VSPD11-08

**Glutamate, Aspartate and GABA are Reduced during Therapeutic Hypothermia in Neonates with Hypoxic-ischemic Encephalopathy**

Roberto Llorens Salvador (Presenter): Nothing to Disclose, Stefan Bluml PhD : Nothing to Disclose, Jessica Lee Wisnowski PhD : Nothing to Disclose, Tai-Wei Wu : Nothing to Disclose, Aaron Jordan Reitman DO : Nothing to Disclose, Robert Giesler RN : Nothing to Disclose, Claire McLean : Nothing to Disclose, Phillip Friedlich : Nothing to Disclose, Eugenia Ho MD : Nothing to Disclose, Ashok Panigrahy MD : Nothing to Disclose, Marvin Dale Nelson MD : Nothing to Disclose, Istvan Seri MD, PhD : Grant, Covidien AG

**PURPOSE**

Therapeutic hypothermia (TH) aims to mitigate the effects of hypoxic-ischemic injury (HIE) in neonates by exerting favorable effects on multiple pathways contributing to brain injury such as energy metabolism and excitatory amino acid metabolism. Here we explored (a) the feasibility of quantifying excitatory and inhibitory neurotransmitters in patients undergoing TH in vivo and (b) the impact of TH on neurotransmitter concentrations.

**METHOD AND MATERIALS**

15 newborns (mean gestational age = 38.9±1.9) with moderate (m)-HIE (n=12) and severe (s)-HIE (n=3), based on Sarnat staging, were examined by MR spectroscopy (MRS) during and after TH. The study during TH typically occurred between 24-48 h into 72 hours of hypothermia treatment at 33.5 °C. Hypothermia was maintained using a Blanketrol system (CSZ Medical; modified with extension tubing) and continuously monitored with a rectal temperature probe. Post-HT studies were carried out 3-5 days after rewarming. MR spectra were obtained using a single voxel PRESS sequence (echo time =35ms, repetition time =2000ms) with regions of interest localized to the basal ganglia, thalamus and medial parietal grey matter. Absolute concentrations were quantitated using LCModel (V6.3-1C, Stephen Provencher Inc.). All studies were performed on a Philips 3.0T Achieva scanner using a neonatal SENSE coil. Paired t-tests were used to compare concentrations during and after TH while non-parametric tests (Mann-Whitney U) were used to compare neonates with s-HIE and m-HIE (SPSS v.21, IBM Corporation).

**RESULTS**

Spectra of high quality during and after TH were obtained for all patients. Glutamate, aspartate and GABA concentrations were reduced by 20%, 11% and 24%, respectively during TH compared to afterwards (all p < 0.05). However, aspartate was reduced by 17% among neonates with s-HIE (p < 0.02). Glutamine was elevated to 178% during TH among neonates with s-HIE (p < 0.02).

**CONCLUSION**

Therapeutic hypothermia, now widely implemented for neuroprotection in neonatal HIE, is associated with reduced concentrations of excitatory and inhibitory neurotransmitters. However, glutamate concentrations remain elevated among neonates with s-HIE, indicating ongoing excitotoxicity and glutamate detoxification by conversion to glutamine.

**CLINICAL RELEVANCE/APPLICATION**

Early MRI/S may aid in the management of neonatal HIE and suggests an adjuvant role for glutamate receptor antagonists in neonates with s-HIE.

### VSPD11-09

**Imaging of Neurovascular Conditions in the Pediatric Spine**

Richard Lee Robertson MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the unique imaging characteristics of neurovascular disorders affecting the pediatric spine and spinal cord

**ABSTRACT**

This discussion will focus on neurovascular conditions that are unique to children as well as pediatric manifestations of spinal vascular disorders seen in both children and adults. There are a variety of neurovascular conditions affecting the spine and spinal cord in children. Neurovascular disorders in children may be syndromic or non-syndromic and, depending on the nature of the abnormality, may result in ischemic or hemorrhagic injury to the spinal cord. Recognition of the unique features of these conditions is essential in optimal imaging evaluation of the lesions. Often, non-invasive imaging is sufficient to establish a diagnosis although conventional, catheter-based angiography may be required for a complete diagnostic evaluation or as part of an endovascular approach to treatment.
Neuroradiology Sunday Poster Discussions

Scientific Posters

NR

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 12:30 PM - 1:00 PM  Location: NR Community, Learning Center

Participants

Moderator
Pratik Mukherjee MD, PhD  :  Research Grant, General Electric Company Medical Advisory Board, General Electric Company

Sub-Events

NRE240  Making Sense of Sellar Region Pathology: Image-based Diagnostic Algorithm (Station #9)
Ammar Ahmed Chaudhry MD (Presenter):  Nothing to Disclose

TEACHING POINTS
- Review anatomy of the sella and parasellar regions
- Case-based review of sellar and parasellar pathology highlighting key imaging findings that would narrow the differential diagnosis
- Diagnostic algorithm can assist in navigation and interpretation of sellar pathology

TABLE OF CONTENTS/OUTLINE
TOC/Outline: Lesions in the sellar and pararasellar region are frequently encountered in clinical neuroradiology. Complex anatomy of this region contains numerous key structures which can be affected by various pathology. Although 'SATCHMO', a commonly used mnemonic, may help remember differentials, due to overlap in imaging findings it has limited diagnostic utility. This educational exhibit presents a case-based review utilizing age, gender, anatomic location, imaging characteristics, etc. to formulate an algorithm that will aid in more precise diagnosis of regional pathology. In addition, treatment, prognosis, and follow up guidelines are briefly discussed. Conclusion: A systematic approach is required to narrow the differential diagnosis of sellar and parasellar lesions. At completion of this educational exhibit, the viewer will be able to provide more accurate assessment of regional pathology, guide any potential biopsy and appropriate follow-up.

NRE118  Resting State Functional Magnetic Resonance: A Pictorial Review (Station #10)
Eduardo C. Gonzalez-Toledo MD (Presenter):  Nothing to Disclose

TEACHING POINTS
- The learner will know how to obtain the functional sequence
- The learner will know how to collect and process the data
- The learner will know basic principles on brain connectivity
- The learner will know how to compare his patient's data with a normal pool
- The patient will know how to read the results

TABLE OF CONTENTS/OUTLINE
How to obtain MR data: patient's instructions and acquisition protocol
How to process data obtained using freeware
How to compare patient's results with a normal controls pool
Normal connectivity
Abnormal connectivity in patients with lesions from trauma, infection, neoplasms
Resting state fMRI in neurosurgical planning

NRE297  CT Imaging Appearance of Common Dental Diseases, Post-operative Hardwares, and Complications (Station #8)
Bob B. Chai MD, PhD (Presenter):  Nothing to Disclose

TEACHING POINTS
1. To illustrate CT appearance of varying degrees of dental disease
2. To become familiar with post-operative CT appearance of common dental hardware
3. To evaluate for post-operative complications of common dental procedures

TABLE OF CONTENTS/OUTLINE
2. Dental Disease Treatment Options a. Dental Fillings (Inlay/Onlays) b. Dental Crown c. Root Canal d. Tooth Extraction e. Osseointegrated Implants (w/ or w/o sinus lift) f. Fixed partial denture (Permanent bridge)

NRE238  Law and Order - Neuroimaging: Understanding and Minimizing Risk for the Neuroradiologist (Station #11)
Lee Finkelstone MD (Presenter):  Nothing to Disclose

TEACHING POINTS
- Approximately 1 in 5 neuroradiologists have reported being sued at least once during their career in a recent survey by the American Society of Neuroradiology. While there is growing concern over liability, few physicians understand the fundamentals of malpractice and causes of common errors leading to malpractice suits. By the end of the exhibit, the viewer will have 1) a better understanding of malpractice concepts and 2) learn ways to
reduce errors in neuroimaging in order to reduce risk.

TABLE OF CONTENTS/OUTLINE
1) Brief roadmap to medical malpractice 2) Reasons neuroradiologists are sued 3) Ways to reduce errors in neuroimaging using clinical vignettes with subsequent summary slides (i.e. checklists) 4) Post-test quiz

NRE207
Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)
Komal Bankim Shah MD (Presenter): Nothing to Disclose

TEACHING POINTS
With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

TABLE OF CONTENTS/OUTLINE
Imaging of unusual pituitary adenomas Giant invasive adenoma, extent may be underestimated by post contrast images without fat saturation Ectopic pituitary adenoma Similar histologic appearance of olfactory neuroblastoma and pituitary adenoma as neuroendocrine tumors (importance of radiologist's report) Post treatment imaging (effects of surgery, cabergoline, radiation) Pituitary carcinoma Effect on pituitary of cancers at other sites Pituitary metastasis, association with diabetes insipidus (unlike pituitary adenomas) Ipilimumab induced hypophysitis

NRE146
Multimodality Review of Amyloid-Related Diseases of the Central Nervous System (Station #7)
Adam Landon Sipe MD (Presenter): Nothing to Disclose, Sarah E. Connolly MD: Nothing to Disclose

TEACHING POINTS
Amyloid is a class of aggregated proteins that occur in both common and uncommon diseases of the central nervous system (CNS). This exhibit will aim to: 1. Familiarize the radiologist with the pathophysiology and clinical presentation of amyloid-related diseases in the CNS including Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma. 2. Discuss the imaging appearance of these three CNS amyloid-related diseases in a case-review format with self-assessment questions. The goal is to assist the radiologist with distinguishing among these three amyloid related diseases and other diseases with similar clinical presentations.

TABLE OF CONTENTS/OUTLINE
Clinical cases of Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma are reviewed emphasizing: Clinical presentation Role of amyloid in the pathophysiology of the disease Imaging appearance utilizing the following modalities a. Computed tomography (CT) b. Magnetic resonance imaging (MRI) c. Pittsburgh compound B (11C-PiB) and 18F-Florbetapir positron emission tomography (PET)

NRE207
Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)
Charles H. Kim MD: Nothing to Disclose

TEACHING POINTS
With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

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NRE238
Law and Order - Neuroimaging: Understanding and Minimizing Risk for the Neuroradiologist (Station #11)
Daniel S. Chow MD: Nothing to Disclose

TEACHING POINTS
Approximately 1 in 5 neuroradiologists have reported being sued at least once during their career in a recent survey by the American Society of Neuroradiology. While there is growing concern over liability, few physicians understand the fundamentals of malpractice and causes of common errors leading to malpractice suits. By the end of the exhibit, the viewer will have 1) a better understanding of malpractice concepts and 2) learn ways to reduce errors in neuroimaging in order to reduce risk.

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1) Brief roadmap to medical malpractice 2) Reasons neuroradiologists are sued 3) Ways to reduce errors in neuroimaging using clinical vignettes with subsequent summary slides (i.e. checklists) 4) Post-test quiz
CT Imaging Appearance of Common Dental Diseases, Post-operative Hardwares, and Complications (Station #8)

Lily Zou MD : Nothing to Disclose

TEACHING POINTS

1. To illustrate CT appearance of varying degrees of dental disease. 2. To become familiar with post-operative CT appearance of common dental hardware. 3. To evaluate for post-operative complications of common dental procedures.

TABLE OF CONTENTS/OUTLINE


Resting State Functional Magnetic Resonance: A Pictorial Review (Station #10)

Federico Biafore MPH : Nothing to Disclose

TEACHING POINTS

The learner will know how to obtain the functional sequence The learner will know how to collect and process the data The learner will know basic principles on brain connectivity The learner will know how to compare his patient's data with a normal pool The patient will know how to read the results

TABLE OF CONTENTS/OUTLINE

How to obtain MR data: patient's instructions and acquisition protocol How to process data obtained using freeware How to compare patient's results with a normal controls pool Normal connectivity Abnormal connectivity in patients with lesions from trauma, infection, neoplasms resting state fMRI in neurosurgical planning

Making Sense of Sellar Region Pathology: Image-based Diagnostic Algorithm (Station #9)

Rajesh Gupta MD : Nothing to Disclose, Luboslav Woroch DO : Nothing to Disclose

TEACHING POINTS

? Review anatomy of the sella and parasellar regions ? Case-based review of sellar and parasellar pathology highlighting key imaging findings that would narrow the differential diagnosis ? Diagnostic algorithm can assist in navigation and interpretation of sellar pathology

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TOC/Outline: Lesions in the sellar and pararasellar region are frequently encountered in clinical neuroradiology. Complex anatomy of this region contains numerous key structures which can be affected by various pathology. Although ‘SATCHMO’, a commonly used mnemonic, may help remember differentials, due to overlap in imaging findings it has limited diagnostic utility. This educational exhibit presents a case-based review utilizing age, gender, anatomic location, imaging characteristics, etc. to formulate an algorithm that will aid in more precise diagnosis of regional pathology. In addition, treatment, prognosis and follow up guidelines will be briefly discussed. Conclusion: A systematic approach is required to narrow the differential diagnosis of sellar and parasellar lesions. At completion of this educational exhibit, the viewer will be able to provide more accurate assessment of regional pathology, guide any potential biopsy and appropriate follow-up.

Resting State Functional Magnetic Resonance: A Pictorial Review (Station #10)

Dario Saferstein MD : Nothing to Disclose

TEACHING POINTS

The learner will know how to obtain the functional sequence The learner will know how to collect and process the data The learner will know basic principles on brain connectivity The learner will know how to compare his patient's data with a normal pool The patient will know how to read the results

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Law and Order - Neuroimaging: Understanding and Minimizing Risk for the Neuroradiologist (Station #11)

Akash D. Shah MD : Nothing to Disclose

TEACHING POINTS

Approximately 1 in 5 neuroradiologists have reported being sued at least once during their career in a recent
Approximately 1 in 5 neuroradiologists have reported being sued at least once during their career in a recent survey by the American Society of Neuroradiology. While there is growing concern over liability, few physicians understand the fundamentals of malpractice and causes of common errors leading to malpractice suits. By the end of the exhibit, the viewer will have 1) a better understanding of malpractice concepts and 2) learn ways to reduce errors in neuroimaging in order to reduce risk.

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**NRE207**

**Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)**

Steven Waguespack MD : Nothing to Disclose

**TEACHING POINTS**

With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

**TABLE OF CONTENTS/OUTLINE**

- Imaging of unusual pituitary adenomas
- Giant invasive adenoma, extent may be underestimated by post contrast images without fat saturation
- Ectopic pituitary adenoma
- Similar histologic appearance of olfactory neuroblastoma and pituitary adenoma as neuroendocrine tumors (importance of radiologist's report)
- Post treatment imaging (effects of surgery, cabergoline, radiation)
- Pituitary carcinoma
- Effect on pituitary of cancers at other sites
- Pituitary metastasis, association with diabetes insipidus (unlike pituitary adenomas)
- Ipilimumab induced hypophysitis

**NRE146**

**Multimodality Review of Amyloid-Related Diseases of the Central Nervous System (Station #7)**

Tammie Smith Benzinger MD, PhD : Research Grant, Eli Lilly and Company Researcher, Eli Lilly and Company Researcher, F. Hoffmann-La Roche Ltd , Jonathan Edward McConathy MD, PhD : Speakers Bureau, Eli Lilly and Company Research Consultant, Eli Lilly and Company Research Consultant, General Electric Company Research Consultant, Blue Earth Diagnostics Ltd Research Consultant, Siemens AG

**TEACHING POINTS**

Amyloid is a class of aggregated proteins that occur in both common and uncommon diseases of the central nervous system (CNS). This exhibit will aim to: 1. Familiarize the radiologist with the pathophysiology and clinical presentation of amyloid-related diseases in the CNS including Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma. 2. Discuss the imaging appearance of these three CNS amyloid-related diseases in a case-review format with self-assessment questions. The goal is to assist the radiologist with distinguishing among these three amyloid related diseases and other diseases with similar clinical presentations.

**TABLE OF CONTENTS/OUTLINE**

- Clinical cases of Alzheimer's type dementia, cerebral amyloid angiopathy, and cerebral amyloidoma are reviewed emphasizing:
- Clinical presentation
- Role of amyloid in the pathophysiology of the disease
- Imaging appearance utilizing the following modalities a. Computed tomography (CT) b. Magnetic resonance imaging (MRI) c. Pittsburgh compound B (11C-PiB) and 18F-Florbetapir positron emission tomography (PET)

**NRE207**

**Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)**

T. Linda Chi MD : Nothing to Disclose

**TEACHING POINTS**

With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

**TABLE OF CONTENTS/OUTLINE**

- Imaging of unusual pituitary adenomas
- Giant invasive adenoma, extent may be underestimated by post contrast images without fat saturation
- Ectopic pituitary adenoma
- Similar histologic appearance of olfactory neuroblastoma and pituitary adenoma as neuroendocrine tumors (importance of radiologist's report)
- Post treatment imaging (effects of surgery, cabergoline, radiation)
- Pituitary carcinoma
- Effect on pituitary of cancers at other sites
- Pituitary metastasis, association with diabetes insipidus (unlike pituitary adenomas)
- Ipilimumab induced hypophysitis

**NRE118**

**Resting State Functional Magnetic Resonance: A Pictorial Review (Station #10)**

Jorge Raul Docampo MD : Nothing to Disclose

**TEACHING POINTS**

The learner will know how to obtain the functional sequence The learner will know how to collect and process the data The learner will know basic principles on brain connectivity The learner will know how to compare his patient's data with a normal pool The patient will know how to read the results
How to obtain MR data: patient’s instructions and acquisition protocol
How to process data obtained using freeware
How to compare patient’s results with a normal controls pool
Normal connectivity
Abnormal connectivity in patients with lesions from trauma, infection, neoplasms resting state fMRI in neurosurgical planning

Making Sense of Sellar Region Pathology: Image-based Diagnostic Algorithm (Station #9)
Alexander Filatov MD : Nothing to Disclose, Robert George Peyster MD : Nothing to Disclose

TEACHING POINTS
? Review anatomy of the sella and parasellar regions ? Case-based review of sellar and parasellar pathology highlighting key imaging findings that would narrow the differential diagnosis ? Diagnostic algorithm can assist in navigation and interpretation of sellar pathology

TABLE OF CONTENTS/OUTLINE
TOC/Outline: Lesions in the sellar and parasellar region are frequently encountered in clinical neuroradiology. Complex anatomy of this region contains numerous key structures which can be affected by various pathology. Although 'SATCHMO', a commonly used mnemonic, may help remember differentials, due to overlap in imaging findings it has limited diagnostic utility. This educational exhibit presents a case-based review utilizing age, gender, anatomic location, imaging characteristics, etc. to formulate an algorithm that will aid in more precise diagnosis of regional pathology. In addition, treatment, prognosis and follow up guidelines will be briefly discussed. Conclusion: A systematic approach is required to narrow the differential diagnosis of sellar and parasellar lesions. At completion of this educational exhibit, the viewer will be able to provide more accurate assessment of regional pathology, guide any potential biopsy and appropriate follow-up.

Outlaws in the Saddle: Tumors and Cancer Related Diseases of the Pituitary (Station #12)
Ian McCutcheon MD : Nothing to Disclose

TEACHING POINTS
With reference to pituitary cases seen at a tertiary referral center, the purpose of this exhibit is to review: 1. Unusual pituitary adenomas 2. Imaging appearance of pituitary carcinoma 3. Pituitary disease due to primary cancers at other sites

TABLE OF CONTENTS/OUTLINE
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Multimodality Review of Amyloid-Related Diseases of the Central Nervous System (Station #7)
Michelle M. Miller-Thomas MD : Nothing to Disclose

TEACHING POINTS
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Making Sense of Sellar Region Pathology: Image-based Diagnostic Algorithm (Station #9)
Lev Bangiyev DO : Nothing to Disclose

TEACHING POINTS
? Review anatomy of the sella and parasellar regions ? Case-based review of sellar and parasellar pathology highlighting key imaging findings that would narrow the differential diagnosis ? Diagnostic algorithm can assist in navigation and interpretation of sellar pathology

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**NRS388**

**Head to Head: Evaluating the Utility of Repeat Head CT in the Anticoagulated Trauma Patient (Station #1)**

Armando S. Herradura MD (Presenter): Nothing to Disclose, Esther Bilinsky MD, MS: Nothing to Disclose, Laurie Sophia Sanchez MD: Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic value of routine repeat head CT (RRHCT) in anticoagulated trauma patients with initial head CT negative for intracranial hemorrhage (ICH).

**METHOD AND MATERIALS**

Utilizing PACS and patient electronic medical records, a retrospective analysis of over 30,000 head CTs performed over a three year period (2011-2013) at a Level I trauma center was conducted. Inclusion criteria were: (1) Documented traumatic injury, (2) Initial head CT negative for ICH, (3) Repeat head CT performed six hours after the initial head CT, and (4) Oral anticoagulation or risk factors for delayed ICH (i.e. abnormal coagulation profile) which per institutional protocol necessitated RRHCT. The hospital course of cases positive for delayed ICH were examined in detail to assess clinical outcomes and identify risk factors related to delayed ICH.

**RESULTS**

A total of 376 cases met inclusion criteria, with four cases positive for delayed ICH (1.1%). Statistical analysis yields a mean = 0.0107, SD = 0.1027, and 95% CI = 0.0007 - 0.0214. The most common documented forms of anticoagulation and mechanism of injury were aspirin (161 cases) and fall (193 cases), respectively. Clinical management and patient outcomes for two of the four cases of delayed ICH were unaffected by RRHCT. Seizure prophylaxis with Dilantin was performed for the remainder of the hospital course in the third case. For the fourth case, anticoagulation was withheld for the hospital course and commenced after the initial outpatient follow-up.

**CONCLUSION**

RRHCT is low in diagnostic value for anticoagulated trauma patients with an initial head CT negative for ICH. RRHCT was negative for delayed ICH in the vast majority of cases, nor did it make significant contributions to patient outcome in all cases of delayed ICH. RRHCT resulted in minor, transient changes in the patients' medication regimens in two of the four cases and no change in management for the remaining two cases of delayed ICH. Further investigation is required to elucidate if certain forms of anticoagulation or mechanisms of injury predispose patients to delayed ICH.

**CLINICAL RELEVANCE/APPLICATION**

RRHCT is performed due to theoretical risk of delayed ICH in anticoagulated patients. Current guidelines are scarce due to lack of evidence-based data. We find RRHCT yields minimal benefit at increased cost and radiation exposure.

**NRS388**

**Region of Hypoattenuation vs. Different Leptomeningeal Collateral Grading Scores: Predictive Value for Follow-up Infarct Volume in Conventional and Dynamic CTA (Station #2)**


**PURPOSE**

The aim was (a) to compare the predictive value of the region of hypoattenuation vs. different collateral vessel grading scores and (b) to determine the optimal time-point for reconstruction of the dynamic CTA images in order to best predict follow-up lesion volume.

**METHOD AND MATERIALS**

We included all patients with an M1±ICA occlusion, who had follow-up imaging, from an existing cohort of 1791 consecutive patients who underwent multimodal CT, including whole brain CT perfusion (WB-CTP), for suspected stroke. Collateralization was assessed in conventional and dynamic CTA using three different collateral vessel grading scores and segmentation of the region of hypoattenuation. To determine the optimal time-point for collateral assessment, arterial, arteriovenous, and venous phases were reconstructed for dynamic CTA. Follow-up lesion volume was assessed by MRI or NECT. Different collateral gradings systems were compared using the model fit of multivariate regression analyses (that were corrected for type of treatment) and calculation of the Bayesian information criterion (BIC). Differences in BIC of 2 to 6 were regarded as “positive”, 6 to 10 “strong”, and greater than 10 “very strong”.

**RESULTS**

Our study comprised 119 patients. In the multivariate analysis, models containing region of hypoattenuation showed a significantly better model fit than models containing collateral grading scores for conventional and dynamic CTA (ΔBIC > 10 for both). All collateral grading systems showed the best model fit for the arteriovenous phase. For region of hypoattenuation, model fit was significantly higher for the arteriovenous phase compared to the venous phase (ΔBIC = 6.2), the arterial phase (ΔBIC > 10), and conventional CTA.
(ΔBIC > 10). Also for collateral grading scores, model fit was higher for the arteriovenous phase compared to the venous phase (ΔBIC > 10 for each), the arterial phase (ΔBIC between 4 and 9), and conventional CTA (ΔBIC between 3 and 13).

CONCLUSION

Quantification of the region of hypotauetation has a higher predictive value for follow-up lesion volume than collateral vessel grading scores. Arteriovenous phase is the optimal time-point for assessment of collateralization.

CLINICAL RELEVANCE/APPLICATION

The assessment of collateral blood flow on CT angiographies requires methodological standardization in order to be used to predict tissue outcome.

NRS389

Intracranial Atherosclerotic Plaque Enhancement Using High-resolution MR Imaging in Patients with Ischemic Stroke (Station #3)

Wanqun Yang MD (Presenter): Nothing to Disclose, Biao Huang MD: Nothing to Disclose, Chang Hong Liang MD: Nothing to Disclose

PURPOSE

To assess the enhancement feature of intracranial atherosclerotic plaque in the vessel supplying the territory of infarction by using high-resolution MR imaging. To analyze the correlation between the strength of enhancement, elapsed time and concentration of hypersensitive C-reactive protein (hs-CRP).

METHOD AND MATERIALS

Wall characteristic of 81 patients with ischemic stroke and intracranial vascular stenoses was analyzed. All subjects were imaged with HR-MRI for plaque on a 3.0 T MRI scanner. All subjects were classified as early stage (12 weeks, n=10). The wall characteristic, presence and strength of enhancement of atherosclerotic plaque were assessed and the concentration of hs-CRP was tested. The Kruskal-Wallis H test and the Spearman correlation were used.

RESULTS

Fifty-five (55/81) plaques were located at the M1 segments, and the other 26 (26/81) plaques at the basilar artery. The strength and presence of enhancement from strong to none were 29, 25 and 4 in the early stage; 4, 6 and 3 in the middle stage and 0, 4, 6 in the late stage, respectively. The strength and presence of enhancement was significant different among them (H = 16.934, P = 0.000). The enhancements of the plaques were parallel with levels of hs-CRP (r = 0.526, P = 0.000).

CONCLUSION

Enhanced HR-MRI scanning may clearly demonstrate the enhancement characteristic of intracranial atherosclerotic plaques as an indicator of inflammation. It would play an important role to detect risk factors for intracranial plaque rupture and subsequent acute ischemic stroke.

CLINICAL RELEVANCE/APPLICATION

Enhanced HR-MRI scanning would play an important role to detect risk factors for intracranial plaque rupture and subsequent acute ischemic stroke.

NRS390

Voxel-wise Statistical Testing of FDG-PET/CT: Impact on differential Diagnosis of Dementia (Station #4)


PURPOSE

Early and definite diagnosis of Alzheimer's disease (AD) is critical, as current treatment options under consideration are not free of safety concerns. Currently, a combination of clinical, neurological and neuro-psychological testing and imaging is used in diagnosis. Visual evaluation of FDG PET brain images is challenging. Hence, the Society of Nuclear Medicine (SNM) recommends augmentation by (semi-)automatic quantification approaches. This study evaluated the impact on diagnosis of AD in FDG-PET/CT when applying voxel-based statistical testing to 3D volumes, which have been stereotactically normalized using b-splines.

METHOD AND MATERIALS

N = 94 subjects (50% AD and 50% normal) were selected from the Alzheimer's disease Neuroimaging Initiative (ADNI) database. Two readers with 1 and 6 years of clinical experience classified FDG PET images, first by visual assessment of original images, then by rating stereotactically normalized 3D volumes, on which statistically significant areas of hypo-metabolism (Z-Scores, P
RESULTS

Sensitivity and specificity for the most inexperienced reader increased using voxel-wise statistical testing as overlay: For normal subjects, sensitivity and specificity were 95% and 56% without and 98% and 61% with overlays. In AD subjects, sensitivity and specificity were 54% and 95%, which changed to 59% and 98% when using overlays. Accuracy increased from 75% to 78%. The more experienced reader showed a better specificity by 2% (59% vs. 61%) for normal subjects when using overlays.

CONCLUSION

Voxel-wise statistical testing may help especially inexperienced readers in the differential diagnosis of dementia. As opposed to previously published studies, this not only applies to the assessment of cortical surface projections, but also to the assessment of stereotactically normalized 3D volumes.

CLINICAL RELEVANCE/APPLICATION

Differential diagnosis in dementia and especially Alzheimer’s disease is challenging and may be augmented by software.

NRS391

Comparisons of Contrast-enhancement on Inner Ears among Patients with Unilateral Otologic Symptoms in Magnetic Resonance Images Taken at 10 Minutes and 4 Hours after Gadolinium Injection (Station #5)

Tae-Yoon Kim MD (Presenter): Nothing to Disclose, Dong-Woo Park MD: Nothing to Disclose, Young-Jun Lee MD: Nothing to Disclose, Choong-Ki Park MD: Nothing to Disclose, Ji Young Lee MD: Nothing to Disclose

PURPOSE

To compare the signal intensity of the inner ear in patients with unilateral symptomatic ear disease, between 10 minutes and 4 hours delayed intravenous gadolinium enhanced three-dimensional fluid attenuated inversion recovery magnetic resonance images (3D-FLAIR MRI), between affected and unaffected sides, between patients with sudden sensorineural hearing loss (SNHL) and non-sudden SNHL patients, and between patients with viral disease and non-viral disease, based on clinical manifestation.

METHOD AND MATERIALS

Total 50 patients with lateralizing otologic symptom, such as hearing loss, tinnitus, ear fullness, nystagmus, vertigo, facial nerve palsy, who underwent 3D-FLAIR MRI with 10 minutes and 4 hours delayed intravenous gadolinium enhancement, from May 2012 to October 2013, were retrospectively analyzed by 2 neuroradiologists blinded to the clinical presentation. The signal intensity (SI) ratios of cochlear, vestibule, vestibulocochlear nerve (VCN), Meckel's cavum and cistern segment of trigeminal nerve to medulla oblongata were calculated and compared.

RESULTS

SI ratios of affected cochlea, vestibule, and VCN were higher than unaffected side in both 10 minutes and 4 hours. SI ratios of VCN in non-sudden SNHL patients were higher than sudden SNHL patients in both 10 minutes and 4 hours. Among sudden SNHL patients, SI ratios of affected cochlea with 10 minutes delayed enhancement were significantly higher than unaffected side. SI ratios of VCN in viral disease group were higher than non-viral disease group, in both 10 minutes and 4 hours. No statistically linear correlation, but positive correlation between mean of 4 hours delayed SI ratios of Meckel's cavum of trigeminal nerve and 4 hours delayed SI ratios of unaffected cochlea.

CONCLUSION

SI ratios of inner ear in 10 minutes and 4 hours delayed intravenous gadolinium enhancement shows statistically significant increase in many diseases, especially viral origin disease. Anatomic discrimination of IE and VCN is better in 4 hours than 10 minutes. Positive correlation of SI ratios between trigeminal nerve and cochlea may represent the relationship of cranial nerve permeability and blood-labyrinth barrier disturbance, but requires further study.

CLINICAL RELEVANCE/APPLICATION

SI ratios of inner ear can reveal correlation of contrast enhancement and diverse inner ear pathology. More accurate and objective SI ratio measurement is needed and requires further study.
The Velocity of Collateral Filling as Determined by Dynamic CT-Angiography Predicts Initial and Final Infarct Size in Patients with Acute Ischemic Stroke (Station #1)


PURPOSE

Recent studies in dynamic CTA assessment of collateralization of leptomeningeal vessels in the evaluation of strokes have been promising. Our aim was to evaluate the predictive value of the velocity of collateral filling for initial and follow-up lesion size.

METHOD AND MATERIALS

We included all patients with an M1±ICA occlusion, that had follow-up imaging, from an existing cohort of 1791 consecutive patients who underwent multimodal CT, including whole brain CT perfusion (WB-CTP), for suspected stroke. WB-CTP raw datasets were reconstructed as dynamic angiographies. The velocity of collateral filling was quantified using the mean difference between time to peak contrast enhancement of the M2 segment distal to the occlusion compared to the contralateral M2 segment (figure). CBV and MTT-CBV mismatch were assessed in initial CTP. Follow-up lesion size was assessed by MRI or NECT. Multivariate analyses were performed to adjust for extent and origin of collateralization, additional ICA occlusion and type of treatment.

RESULTS

Our study comprised 116 patients. In the multivariate analysis, a fast collateral filling was an independent predictor of a small CBV lesion (p<0.001) and a large relative mismatch (p<0.001) on initial CTP, of a small follow-up lesion (p<0.001), and of a small difference between initial CBV and follow-up lesion size (p=0.024). Other independent predictors of a small lesion on follow-up were a high morphological collateral grade (p=0.001), lack of an additional ICA occlusion (p=0.009), and IV thrombolysis (p=0.022).

CONCLUSION

Fast filling of collateral vessels predicts initial CTP and follow-up lesion size and is independent of the extent of collateralization. The independent association with the CBV-follow-up difference indicates a role in the process of penumbral loss and may help to select treatment.

CLINICAL RELEVANCE/APPLICATION

Time-resolved dynamic CT angiography allows to assess the velocity of collateral filling which adds important functional information about collateralization.

Perfusion Computed Tomography for Selection of Adult Patients with Acute Ischemic Stroke for Intravenous Thrombolytic Therapy—A Systematic Review and Meta-analysis (Station #2)

Kirsteen Rennie Burton MD, MBA (Presenter): Nothing to Disclose, Del Dhanoa MD: Nothing to Disclose, Richard Aviv MBCh, FRCR: Nothing to Disclose, Alan Rowland Moody MD: Nothing to Disclose, Moira Kapral: Nothing to Disclose, Andreas Laupacis: Nothing to Disclose

PURPOSE

A systematic review of outcomes of patients with suspected acute ischemic stroke (AIS) selected for thrombolytic therapy within three hours and beyond using perfusion computed tomography (CTP) imaging, has not been published. We sought to determine rates of death, disability and symptomatic intracranial hemorrhage (SICH) among patients with AIS selected for thrombolytic therapy using CTP imaging.

METHOD AND MATERIALS

We performed a literature search using MEDLINE, EMBASE, the Cochrane Library, PubMed, and Google Scholar up to August 2012, using terms including "brain ischemia" and "perfusion imaging", and unrestricted by language of publication. Experimental and observational studies were included. Two reviewers extracted study data and independently assessed risk of bias for each selected study. CTP-selected patient outcomes were estimated including case-fatality rate, favourable outcome (modified Rankin Scale score <=2) and rates of SICH.

RESULTS

We identified 14 studies that included a total of 600 patients who received intravenous thrombolysis following CTP imaging. The methodological quality of the small studies was generally good. Overall, 90-day mortality was 12.1% (95% CI, 8.4-16.4%). Among those treated within 3 hours of symptom onset, mortality was 14.4% (95% CI, 8.2-22.1%), a favourable outcome (modified Rankin Scale score <=2) was seen in 44.9% (95% CI, 29.2-61.3%) and the symptomatic intracranial hemorrhage rate was 5.1% (95% CI, 3.0-7.8%). Among those treated after 3 hours of symptom onset, mortality was 8.5% (95% CI, 2.4-18.0%), 61.5% (95% CI, 51.3-71.1%) had a favourable outcome, and 4.1% (95% CI, 0.9-9.3%) had a SICH.

CONCLUSION

The outcomes of patients selected for thrombolysis using CTP imaging appear to be similar to those of patients selected using other imaging modalities except for SICH, wherein MRI selection within 3 hours was safer than CTP and NCCT was less so. Some patients can be safely treated up to 9 hours after stroke onset. Direct comparisons between CTP and other imaging modalities are needed.
Outcomes for acute ischemic stroke patients selected for thrombolysis by CTP are comparable to other imaging modalities, except for SICH rates, which differ in NCCT, CTP and MRI-selected patients.

Prognostic Value of CT Histogram Analysis in Comatose Patients: Evaluation Using Automated Whole-brain Extraction Algorithm (Station #3)

Koji Yamashita MD, PhD (Presenter): Nothing to Disclose, Akio Hiwatashi MD: Nothing to Disclose, Osamu Togao MD, PhD: Nothing to Disclose, Kazufumi Kikuchi MD: Nothing to Disclose, Masatoshi Kondo: Nothing to Disclose, Hiroshi Sugimori: Nothing to Disclose, Takashi Yoshiura MD, PhD: Nothing to Disclose, Hiroshi Honda MD: Nothing to Disclose

PURPOSE
It is important to predict neurological outcome in patients with non-traumatic coma. Our purpose was to evaluate the prognostic utility of CT histogram analysis with an automated whole-brain extraction algorithm in comatose patients.

METHOD AND MATERIALS
We retrospectively studied 138 consecutive comatose patients who were admitted to our intensive care unit and underwent brain CT. The patients were classified into good (n = 43; M:F = 18:25) and poor (n = 95; M:F = 48:47) outcome groups. All CT images were obtained using a 64-detector-row CT scanner with a slice thickness of 4.0 mm. From the whole-brain CT images, a brain region was extracted using our original automated algorithm for the subsequent histogram analysis. The obtained histogram statistics (mean CT value, kurtosis and skewness) as well as clinical parameters were compared between the good and poor outcome groups using the Mann-Whitney U test. In addition, ROC analysis was performed for the discrimination between the 2 groups for each parameter.

RESULTS
The mean CT value was significantly higher in the good outcome group (mean±SD = 34.6±1.47 HU) than in the poor outcome group (mean±SD = 33.9±1.97 HU) (p<0.05). In addition, the kurtosis and age were significantly lower in the good outcome group (mean kurtosis±SD = -0.49±0.12, mean age±SD = 54.1±21.4 years) than in the poor outcome group (mean kurtosis±SD = -0.34±0.21, mean age±SD = 63.7±18.6 years) (p<0.001 and p<0.05, respectively). The AUC values for the kurtosis, mean CT value, and age were 0.717, 0.608, and 0.625, respectively. A combination of the 3 parameters increased the diagnostic performance (AUC = 0.799).

CONCLUSION
Histogram analysis of whole-brain CT images with our automated extraction algorithm is useful for assessing the prognosis of comatose patients.

CLINICAL RELEVANCE/APPLICATION
Histogram analysis method tend to be more reproducible compared with manual region-of-interest placement. Our study revealed that histogram parameters as well as age can help predict the neurological outcome of comatose patients.

Cerebellar White Matter Involvement in Alzheimer’s Disease: Diffusion Tensor Study (Station #4)

Toshiteru Miyasaka MD (Presenter): Nothing to Disclose, Toshiaki Taoka MD: Consultant, Radiology Resources International LLC, Suradech Suthiphosuwan MD: Nothing to Disclose, Saeka Hori: Nothing to Disclose, Masahiko Sakamoto MD: Nothing to Disclose, Kimihiko Kichikawa MD: Nothing to Disclose, Takeshi Wada MD: Nothing to Disclose

PURPOSE
Although cerebellum is not a primary focus of pathological change in Alzheimer’s disease (AD), deposition of amyloid plaques and increased microglia have been reported to be found in the cerebellum of AD. The purpose of the current study is to depict the changes in cerebellar white matter by using diffusion tensor image. We measured diffusivity and fractional anisotropy (FA) of the cerebellar peduncles, in order to evaluate efferent pathway (superior cerebellar peduncle: SCP) and afferent pathway (middle cerebellar peduncle: MCP) of the cerebellum separately.

METHOD AND MATERIALS
We have obtained the approval of institutional review board. The subjects were 19 cases with Alzheimer disease and 5 cases of age matched controls. AD cases included 7 severe (MMSE: less than 11), 5 intermediate (MMSE: 11-19) and 6 mild cases (MMSE: 20-22). Diffusion tensor images were obtained using a single shot echo planar sequence. Tractographies of superior cerebellar peduncle (SCP) and middle cerebellar peduncle (MCP) were constructed. We measured FA and apparent diffusion coefficient (ADC) values of the SCP and MCP. We made statistical analysis (t-test) between control and AD groups.

RESULTS
Mean FA values along SCP of severe AD/ intermediate AD/ mild AD/ control were 0.48/0.54/0.56/0.58 respectively. Statistically significant difference were not shown. While, mean FA of MCP were
0.42/0.50/0.52/0.52 respectively. There was statistically significant differences (p<0.01) between severe AD and control. Mean ADC (x10-3 sec/mm²) along SCP were 0.58/0.55/0.55/0.54 respectively. Statistically significant difference were not shown. While, mean ADC of MCP were 0.49/0.42/0.42/0.41 respectively. There was also statistically significant differences (p<0.01) between severe AD and control.

CONCLUSION

Decreased FA and increased ADC were observed in the MCP of the severe AD group. Thus, white matter changes of cerebellum at the afferent pathway in the cases with severe cognitive impairment by AD were suggested. The result will be one of supportive findings to indicate that cerebellum plays some role in cognitive function.

CLINICAL RELEVANCE/APPLICATION

Evaluation of white matter changes of cerebellum using diffusion tensor image will bring additional information in assessment of Alzheimer’s disease patients especially in the severe cases.

Human Accessory Semicircular Canal: Incidence during Three Dimensional Reconstruction using High Resolution Magnetic Resonance Imaging of the Inner Ear (Station #5)

Ahmed Fathy Emam MBCh (Presenter): Nothing to Disclose, Nagy Naguib Naeem Naguib MD, MSc : Nothing to Disclose, Nour-El Din Abdelrehim Nour-El Din MD, MSc : Nothing to Disclose, Mohammed Ahmed Alsubhi BMBS : Nothing to Disclose, Thomas Josef Vogl MD, PhD : Nothing to Disclose

PURPOSE

Documentation of the incidence of Human accessory Semicircular canal (SCC) of the Inner Ear in Different age groups and both sexes during three Dimensional (3D) reconstruction of high resolution MR-Imaging.

METHOD AND MATERIALS

During a retrospective study that was performed on 536 patients (294 females and 242 males) with a mean age of 48.5 year (standard deviation: 26.5, range: 5 month - 88 year) using High resolution MR-Imaging with an Iso-Space sequence of 0.6 mm slice thickness. 3D reconstructions were performed using Advantage Workstation for diagnostic imaging. The reconstruction was manually performed for each side in all patients and included semicircular canals of the inner ear. The Incidence and origin of the accessory SCC were observed and documented. For cases with detected accessory SCC the source images were revised to exclude the possibility of motion artifacts.

RESULTS

Three dimensional reconstruction was successfully performed on all 1,072 inner ears. Any records and abnormalities observed were recorded and documented. The Accessory SCC was observed in 13 patients, appeared bilateral in 5 Patients and unilateral in 8 patients with a total of 18 inner ears showing accessory SCC (incidence 1.7%). All 13 patients were referred with Vertigo, Dizziness, and Hearing impairment. The accessory SCC had a common origin with other SCCs in 8 inner ears with the common origin been with the Superior SCC (n= 3) and with the Lateral SCC (n= 5) giving a double-stranded shape of the SCC. A separate origin of the accessory SCC was observed in 10 inner ears. None of the accessory SCCs showed a common origin with the posterior SCC.

CONCLUSION

The incidence of Human accessory Semicircular canal (SCC) of human Inner Ear in 1.7% of patients, appeared bilateral in 5 Patients(38.4%) and unilateral in 8 patients(61.6%).

CLINICAL RELEVANCE/APPLICATION

This study shows incidence of an abnormality in the human Inner ear that could be a cause of symptoms as Vertigo, Dizziness and Hearing impairment.

Artery of Superior Orbital Fissure: An Undescribed Branch from the Pterygopalatine Segment of the Internal Maxillary Artery to the Cavernous Sinus through the Superior Orbital Fissure (Station #6)

Hiro Kiyosue MD (Presenter): Nothing to Disclose, Shuichi Tanoue MD : Nothing to Disclose, Ryuichi Shimada MD : Nothing to Disclose, Hiromu Mori MD : Nothing to Disclose

PURPOSE

Artery of foramen rotundum is thought to be a sole arterial branch of the pterigopalatine segment of the internal maxillary artery to the cavernous sinus. However, we found another undescribed branch, provisionally-named artery of superior orbital fissure (SOF), from pterigopalatine segment of the internal maxillary to the cavernous sinus via the SOF in some cases of parasellar hypervascular lesions. In this paper, we investigated the frequency and course of the artery of SOF in cases with parasellar hypervascular lesions.

METHOD AND MATERIALS

We retrospectively reviewed biplane and 3D angiography of external carotid artery undergone from June 2010 to December 2013 in 17 patients with parasellar hypervascular lesions, including 13 cases of cavernous sinus dural arteriovenous fistulas and 4 cases of parasellar meningiomas. 3D angiographic images were reviewed by 2
experienced neuroradiologists with particular interest to the artery of SOF.

RESULTS

The artery of SOF was identified in 7 of 13 cases of cavernous sinus dural arteriovenous fistulas and 2 of 4 cases of parasellar meningoïma. It arose at the pterygopatine segment of the internal maxillary artery, either singly or by a common trunk with the artery of foramen rotundum, and run upward to reach the SOF, and then turned posteriorly to the cavernous sinus with acute angle and fed the AVFs or tumors. In one case, the artery of SOF communicated with lachrymal branch of the ophthalmic artery at the orbital apex.

CONCLUSION

Although it has not been described in anatomic paper, the artery of SOF could be observed approximately half of the cases of parasellar hypervascular lesions

CLINICAL RELEVANCE/APPLICATION

This study demonstrates an arterial branch of the external carotid artery, artery of superior orbital fissure (SOF), which has not been recognized. The artery of SOF can feed the cavernous sinus dural AVFs and hypervascular tumor. Special attention should be paid for embolization of the artery of SOF because it potentially anastomose with ophthalmic artery and anterior branch of the inferolateral trunk of the internal carotid artery.

NRE201

Infant Brain Tumors: Atlas of Radiographic Findings with Histological Correlation (Station #7)

David Robert Pettersson MD : Nothing to Disclose , Teresa Gross Kelly MD : Nothing to Disclose , Asmaa Aamir MD : Nothing to Disclose , Viktor Zherebitskiy MD : Nothing to Disclose , Dianna M. Ehrhart Bardo MD (Presenter): Speakers Bureau, Koninklijke Philips NV Consultant, Koninklijke Philips NV

TEACHING POINTS

Participants will learn: Characteristic CT and MR findings of infant brain tumors Histological appearance and immunohistochemical features of infant brain tumors Correlation of imaging and pathology knowledge to improve diagnostic expertise

TABLE OF CONTENTS/OUTLINE

Epidemiology of infant brain tumors Cell lines / tissue types of infant brain tumors Outline of histological stains and immunohistochemical stains, chromosome analysis Case Presentations: Clinical examination/history of 25 infants with brain tumors Pre-treatment radiographic examination: fetal MR, sonography, CT and MR Neuropathology findings: histology, immunohistochemical stains, chromosome analysis Infant brain tumors of multiple cell lineages from all brain and intracranial tissue types and locations, including: Embryonal Tumors Primitive neuroectodermal tumor Medulloblastoma Malignant embryonal neoplasm Pineoblastoma Atypical teratoid rhabdoid tumor Astrocytic and Neuronal Tumors Glioma (low and high grade) Pilocytic astrocytoma Pilomyxoid astrocytoma Subependymal giant cell astrocytoma Desmoplastic infantile ganglioglioma Other Tumors: Infantile hemangiopericytoma Choroid plexus papilloma and carcinoma Hypothalamic hamartoma Teratoma

NRE292

CT of the Postoperative Orbital Wall Following Trauma: Review of Normal Appearances and Common Complications (Station #8)

Michael Jason Reiter DO (Presenter): Nothing to Disclose , Ryan Becton Schwope MD : Nothing to Disclose , Jonathan Kini : Nothing to Disclose , Jared Theler : Nothing to Disclose

TEACHING POINTS

The major teaching points of this exhibit are: 1. Repair of orbital fractures is unique and differs from the management of other facial or extremity injuries in that surgery is not performed in an attempt to achieve osseous healing. Rather, the goal of surgery is simply to repair the defect and restore structural support of the orbit. 2. Placement of an implant is often necessary to span the osseous defect 3. Generally, at least 3 of the 4 articulations that comprise ZMC injuries must be treated intraoperatively to accurately reduce comminuted fractures. 4. Complications encountered after repair include failed reconstruction due to improper alignment, infection, retrobulbar hemorrhage, and orbital emphysema.

TABLE OF CONTENTS/OUTLINE

1. Highlight the indications for surgical intervention of orbital fractures
   a. Orbital floor
   b. Medial wall
   c. Orbital roof
   d. Zygomaticomaxillary complex (ZMC)
2. Illustrate the various operative approaches for repair
   a. Orbital floor
   b. Medial wall
   c. Orbital roof
   d. ZMC
3. Discuss the goals of surgical repair and the desired CT appearance in the postoperative setting
   a. Overview
   b. Orbital floor
   c. Medial wall
   d. ZMC
4. Common complications
   a. Failed repair
NRE182

Paraneoplastic Syndrome and Mimics: What the Radiology and Clinicians Need to Know (Station #9)

Ammar Ahmed Chaudhry MD (Presenter): Nothing to Disclose, Maryam Gul: Nothing to Disclose, Abbas Ahmed Chaudhry BSc: Nothing to Disclose, Mubashir Sheikh: Nothing to Disclose, Jawed Akhter Mallick MBBS: Nothing to Disclose, Jared Dunkin MD: Nothing to Disclose

TEACHING POINTS

1. Pictorial review of CNS anatomy highlight areas involved in paraneoplastic syndromes. 2. Case based review highlighting common and uncommon causes of paraneoplastic syndrome. 3. Discuss differential diagnoses (physiologic process, congenital, infection, inflammation, trauma, vascular and/or malignancy) that can mimic imaging findings.

TABLE OF CONTENTS/OUTLINE

Content: Multiple presentations of paraneoplastic syndrome will be reviewed involving the brain and spine. We will discuss mimics that may result from neoplasm (lymphoma, leukemia, etc), infection (HSV, Lyme, etc), inflammation (MS, ADEM, Lupus), etc with an emphasis on key findings (on CT, MRI, PET-MRI) differentiating these entities. Summary: Paraneoplastic syndrome is not an uncommon cause of encephalitis. Knowledge of its clinical presentation, pathophysiology and immunology is essential in making the diagnosis. Although the differential diagnosis is broad, it can be narrowed utilizing age, clinical features, imaging characteristics (e.g. Location, enhancement pattern, PET-MRI findings, etc) and pathology correlation. By the conclusion of this presentation, the viewer should have a better understanding of paraneoplastic syndrome and associated imaging findings, and should be able to aid in the workup, guide any potential biopsy/tissue sampling and imaging follow-up.

NRE380

Imaging of Intracranial Vascular Anomalies and Variants (Station #10)

Mohammed Mohsin Khadir MD (Presenter): Nothing to Disclose, Arbab Zafar Iqbal MD: Nothing to Disclose, Burke Morin DO: Nothing to Disclose, Steven Paul Meyers MD, PhD: Nothing to Disclose

TEACHING POINTS

Discussion of CTA and MRA protocols for imaging intracranial vessels. Characterization of various intracranial congenital and developmental vascular anomalies and variants. Imaging findings of intracranial vascular anomalies and variants using CT, MR, CTA, and MRA.

TABLE OF CONTENTS/OUTLINE

1. Discuss CTA and MRA protocols for imaging intracranial vessels. 2. Review anatomy of intracranial vessels 3. Discuss various congenital and development vascular anomalies and variants. 4. Present the imaging findings of these entities as listed below.

- Persistent Fetal Origin of Posterior Cerebral Artery
- Hypoplasia of the A1 Segment of Anterior Cerebral Artery
- Persistent Trigeminal Artery
- Persistent Otic Artery
- Persistent Hypoglossal Artery
- Duplications of Cerebral, Carotid, Vertebral or Basilar Arteries
- Hemiazgyous Artery
- Arterial Fenestration
- Aberrant Position of the Internal Carotid Artery
- Persistent Stapedial Artery
- Unilateral Agenesis, Aplasia, and Hypoplasia of the Internal Carotid Artery
- Vein of Galen Aneurysm
- Sturge Weber
- Moyä Moya
- Menkes
- PHACES Syndrome
- Thoracic Outlet Syndrome
- Venous Angioma (Developmental Venous Anomaly)
- Dehiscence of the Jugular Vein Bulb
- High Position of the Jugular Bulb
- Sinus Pericranii

NRE162

Malformations of Cortical Development: Tutorial & Self Assessment (Station #11)

Taraneh Hashemi-Zonouz MD (Presenter): Nothing to Disclose, Bryan Su-Hyun Jeun MD: Nothing to Disclose, Richard Arden Bronen MD: Research Consultant, Bristol-Myers Squibb Company

TEACHING POINTS

1.) To understand the development of the brain and how aberrations in cell proliferation, migration, and organization result in various morphological phenotypes. 2.) Recognize salient MRI features of these disorders and be able to differentiate between various malformations of cortical development.

TABLE OF CONTENTS/OUTLINE

Embryology Classification of Disorders MRI Features of Cortical Dysgenesis Distinguishing Characteristics and
Differential Diagnosis
1. Hemimegalencephaly
2. Lissencephaly
3. Heterotopia
4. Focal Cortical Dysplasia
5. Polymicrogyria
6. Schizencephaly

Self Assessment Quiz

Vascular Malformations of Head and Neck – What Radiologists Need to Know. A Pictorial Essay and Literature Review (Station #12)

Antonio Padua Mesquita Maia, MD (Presenter): Nothing to Disclose
Eloisa Maria Santiago Gebrim MD: Nothing to Disclose
Flavia I. Cevasco MD: Nothing to Disclose
Regina Lucia Elia Gomes MD: Nothing to Disclose
Bruno Casola Olivetti MD: Nothing to Disclose
Marcio Ricardo Taveira Garcia MD: Nothing to Disclose
Maira Sarpi MD: Nothing to Disclose
Mauro Miguel Daniel MD: Nothing to Disclose

TEACHING POINTS
- To provide an educational exhibit illustrating head and neck vascular malformations.
- To describe the classification of head and neck vascular malformations according to two groups: vascular tumors and vascular structural malformations, subcategorized according to their flow dynamics as low-flow malformations (venous, lymphatic, capillary, capillary-venous, and capillary-lymphatic-venous) and high-flow malformations (arteriovenous malformations and arteriovenous fistulas).
- To identify the imaging features of the different lesions.

TABLE OF CONTENTS/OUTLINE
- Review of literature.
- Classification of vascular tumors and malformations.
- Pathophysiology of vascular malformations.
- Review of imaging findings: CT, MRI
- Correlation with clinical history, signs and pictures.

RC105
Brain Aneurysms

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Sun, Nov 30 2:00 PM - 3:30 PM Location: N230AB

Participants
Moderator
Jacqueline Anne Bello MD: Nothing to Disclose

Sub-Events

Diagnostic Evaluation of Brain Aneurysms

Juan Pablo Villablanca MD (Presenter): Research collaboration, VasSol, Inc Research collaboration, Toshiba Corporation Research collaboration, Olea Medical

LEARNING OBJECTIVES
1) The course will review the relative strengths and limitations of current imaging techniques for the detection and follow-up of patients with symptomatic and asymptomatic cerebral aneurysms. 2) A practical strategy for image review and analysis will be provided that ensures complete lesion characterization and minimizes operator error. 3) A rubric for the analysis of the pre- and post-operative aneurysm patients will also be presented with an emphasis on a practical clinical approach. 4) A brief natural history and modality based literature review will also be provided.

Intervention for Brain Aneurysms

Steven William Hetts MD (Presenter): Consultant, Silk Road Medical Inc Consultant, Medina Medical Inc Research Grant, Stryker Corporation Data Safety Monitoring Board, Stryker Corporation

LEARNING OBJECTIVES
1) Discuss the current endovascular interventional approaches to both ruptured and unruptured brain aneurysm treatment. 2) Critically evaluate recent clinical trial results regarding interventional brain aneurysm treatment. 3) Appreciate the limitations to endovascular brain aneurysm treatment using current technologies. 4) Understand that cerebral vasospasm is the leading cause of mortality and morbidity for hospitalized patients with aneurysmal subarachnoid hemorrhage, and appreciate current approaches to treating vasospasm.

Active Handout

How Improvements in Imaging Can Improve Practice

Charles Milton Strother MD (Presenter): Research Consultant, Siemens AG Research support, Siemens AG License agreement, Siemens AG
LEARNING OBJECTIVES

1) To understand current thinking regarding factors which are predictive of the natural history of intracranial aneurysms. 2) To understand current capabilities of imaging modalities in identifying morphologic and hemodynamic characteristics of intracranial aneurysms. 3) To understand current abilities of assessing therapeutic results after endovascular treatment of intracranial aneurysms.

RC106

Head and Neck Top Five: Important Anatomy, Missed Diagnoses and Imaging Pearls

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Sun, Nov 30 2:00 PM - 3:30 PM   Location: S100AB

Important Head and Neck Anatomy

Hugh D. Curtin MD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be able to identify the key 'fat pads' at the exit points of those cranial nerves most often affected by perineural spread. 2) The participant will be able to describe the fascial organization of the parapharyngeal region. 3) The participant will be able to locate the laryngeal ventricle using axial and coronal imaging.

ABSTRACT

Important Anatomy Head and neck imaging relies heavily on an understanding of the intricate and often difficult anatomy. The session will focus on identification of anatomy that is crucial in defining the margins and patterns of spread of pathology. Other landmarks that are key to description of the location of lesions are also covered. For instance, there is a small amount of fat located just external to each neural foramen through which perineural spread of carcinoma may pass. The most important of these primary 'fat pads' are located in the pterygopalatine fossa (external to foramen rotundum), just inferior to foramen ovale (trigeminal fat pad), and the stylomastoid foramen (facial nerve) fat pad. These fat pads should be examined for potential obliteration as tumor approaches the foramen. The laryngeal ventricle is key to the organization of the larynx and reports should locate lesions related to this important structure. The ventricle may not be directly visible depending on the phase of respiration of an imaging scan. However the lateral wall of the larynx transitions from fat to muscle at the level of the ventricle. The ventricle is located at the upper margin of the thyroarytenoid muscle that makes up the bulk of the true vocal cord. The parapharyngeal spaces are crossed by several substantial fascial layers. The fascia organize the region into compartments that help the radiologist predict the identity of tumors in that location. Specifically, the anatomy makes it possible to separate tumors that are almost certainly of salivary origin from those that are not. Other specific anatomic points useful in interpretation or characterization will also be discussed.

Missed Diagnoses in the Head and Neck

Phillip Randall Chapman MD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Identify some of the most common mistakes radiologists make when evaluating MRI or CT scans of the neck and skull base. 2) Identify different patterns of perineural tumor spread (PNTS) and understand the subtle CT and MRI changes that indicate early PNTS. 3) Recognize atypical patterns of metastatic nodal disease and how it can be missed on routine CT scans. 4) Identify changes in the nasopharynx and skull base that indicate invasive infectious or neoplastic process. 5) Learn to distinguish recurrent tumor in the setting of complex post-treatment changes.

ABSTRACT

This presentation will highlight some of the most common mistakes and misdiagnoses that radiologists make when interpreting head and neck studies, including MRI and CT examinations. Many ‘misses’ are difficult, and rely on identifying subtle changes in small structures in the complex landscape of the neck and skull base. Other misses are difficult because they are relatively rare and may not be on the radar of most radiologists. Some misdiagnoses are the result of satisfaction of search, and are observed in complex cases, especially complex head and neck cancer. Post treatment changes in the neck impose additional limitations on imaging of the head and neck. This lecture will identify some common mistakes that are made in both private and academic practices. Cases will be presented using a case-based approach. They keys to identifying the pertinent findings and making each diagnosis will be highlighted.

Head and Neck Imaging Pearls

Richard Henry Wiggins MD (Presenter):  Nothing to Disclose
LEARNING OBJECTIVES

1) To identify imaging findings in some Imaging pearls in the Head and Neck, including those within the neck, temporal bone, paranasal sinuses, skull base, and orbits. 2) To review the most radiologic and clinical features of some common diagnoses, as well as the most important differential considerations. 3) To suggest scan techniques that will help the radiologist consistently make these diagnoses.

ABSTRACT

This session will review some important pearls in head and neck imaging. These tips and tricks will review some important aspects of imaging in the head and neck to help with protocoling studies, as well as techniques for imaging and interpretation. Important imaging differentials will also be reviewed and discussed.

PS12
Sunday Afternoon Plenary Session

Plenary Sessions

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credits: 1.50
Sun, Nov 30 4:00 PM - 5:45 PM   Location: Arie Crown Theater

Participants

Presiding
N. Reed Dunnick MD Nothing to Disclose President, Radiological Society of North America

Sub-Events

PS12A
Report of the RSNA Research and Education Foundation

James P. Borgstede MD (Presenter): Nothing to Disclose Chairman, Board of Trustees, RSNA Research and Education Foundation

Abstract

The RandE Foundation - A Transformative Force in Radiology The theme of the 2014 RSNA Scientific Assembly and Annual Meeting is "A Century of Transforming Medicine." For 30 years of that century, the RandE Foundation has played a significant role in advancing the RSNA mission to promote excellence in patient care and health care delivery through education, research and technologic innovation. In celebration of 100 years, the Foundation is launching Inspire-Innovate-Invest, The Campaign for Funding Radiology's Future. This bold campaign seeks to raise $17.5 million to fund grants in radiologic research and education, bridging the gaps in funding for promising investigators and educators. The need is great and the time is now, if the Foundation reaches its campaign goal of $17.5 million, it will keep pace with the growing demand and help ensure that critical discoveries by radiologic investigators come to fruition. This year, the Foundation will fund 95 grants totaling $3.7 million. This means the RandE is funding 25% of our ever increasing number of excellent grant applications. While pleased with these achievements, imagine what the R and E Foundation could fund with additional support from all of us as radiology colleagues? And please recall that we are all the beneficiaries of this research. Of these individuals, who will start their academic research career with an RandE grant, and what will grow from this initial funding? What advances will emanate from their research? And, how can radiologists support these investigators and educators as they pursue their chosen career paths in an effort to make the specialty even stronger? During the meeting week, please take time to visit the RandE Foundation Booth, located on Level 3 of Lakeside Center to learn more about how you can be a part of the campaign and support the RandE Foundation and the future of our specialty.

PS12B
Image Interpretation Session


LEARNING OBJECTIVES

1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.
Sub-Events

RC206A The Central Skull Base
Nancy Jane Fischbein MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To review the anatomy of the Central Skull Base. 2) To present common and uncommon pathologies that affect the Central Skull Base. 3) To remind the audience of imaging pitfalls of the Central Skull Base. 4) To discuss the complementary roles of CT and MR in imaging the Central Skull Base.

ABSTRACT
Imaging of the skull base presents many challenges due to its anatomical complexity, numerous normal variants, and lack of familiarity to many radiologists. As the skull base is a region which is not amenable to physical exam, and as lesions of the skull base are generally difficult to biopsy and even more difficult to operate on, the radiologist plays a major role in directing patient management via accurate image interpretation. Knowledge of the skull base should not be limited to neuroradiologists and head and neck radiologists, however, as the central skull base in particular is routinely included in the field of view when cross-sectionally imaging the brain, cervical spine, or head and neck with CT or MRI, and hence its nuances should be familiar to general radiologists as well. We review the basic anatomy of the central skull base, including bony anatomy as well as the anatomy of adjacent soft tissue structures. We will also present imaging findings of common and uncommon pathologies of the central skull base, including primary tumors such as chordoma and chondrosarcoma, metastases and plasmacytoma, and non-neoplastic lesions of the central skull base. We will review some imaging pitfalls and "don't touch" lesions of the central skull base, and will emphasize the complementary roles of CT and MR in solving difficult cases.

RC206B Cranial Nerves I-VI
Wendy R. K. Smoker MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Review the anatomy of the upper six cranial nerves. 2) Learn the functions of these cranial nerves. 3) Be able to identify common pathologies affecting these nerves.

ABSTRACT
Cranial nerve dysfunction is a common presenting symptom in many patients. In order to evaluate for a causative lesion, one must have a thorough knowledge of the anatomy of each nerve. The anatomy of cranial nerves I-VI is presented along with a review of the function(s) of each nerve. For cranial nerves III-VI, the entire course of each nerve from brainstem exit to innervated muscles (for III, IV, V1, and VI) is reviewed. Pathology affecting these nerves is divided into brainstem, cisternal, base of skull (Meckel cave/cavernous sinus), and distal lesions. Common pathologies that affect each nerve along the various segments are presented.

RC206C Cranial Nerves VII-XII
Deborah L. Reede MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Review the anatomy of cranial nerves VII - XII. 2) Learn clinical findings associated with nerve involvement that can help in the localization of a lesions. 3) Demonstrate lesions at various points along the nerve pathway.

RC250 
Interventional Stroke Treatment: Practical Techniques and Protocols (How-to Workshop) (An Interactive Session)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Mon, Dec 1 8:30 AM - 10:00 AM Location: E353B
LEARNING OBJECTIVES

1) Describe the diagnostic evaluation and decision making algorithms leading to urgent endovascular treatment of acute stroke.
2) Review endovascular techniques for the treatment of acute stroke from microcatheter set up to intraarterial thrombolysis to mechanical thrombectomy. 3) Discuss case examples of endovascular treatment including patient selection, technique, and pitfalls.

ABSTRACT

Rapid advances in the evaluation, selection, treatment and management of the acute stroke patient necessitates an ongoing educational event highlighting the newest information, techniques and strategies for obtaining the best outcomes for our patients. In this session, all of these topics will be covered in a practical 'how to' and case based approach which is designed to help the practitioner implement best practices. The course is useful for those performing imaging, treatment or both. Analysis of the latest ongoing trials, devices and techniques will be presented. Endovascular tips and tricks will be discussed, as well as pitfalls in the treatment of these patients.

Active Handout

RC253
Clinical Applications of 3D Printing

Participants
Moderator
Shi-Joon Yoo MD : Owner, 3D HOPE Medical

Sub-Events

RC253A Overview of 3D Imaging Acquisitions
Karin Evelyn Dill MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the concept of three-dimensional image acquisition. 2) Comprehend the importance of high quality three-dimensional image acquisition as it applies to three-dimensional printing.

RC253B From 3D Visualization to 3D Printing
Michael Lally Steigner MD (Presenter): Speaker, Toshiba Corporation

LEARNING OBJECTIVES

1) Review the evolution of 3D image post-processing. 2) Demonstrate the current state-of-the-art of 3D post-processing. 3) Demonstrate the relationship between current 3D image post-processing and 3D printing.

RC253C 3D Printing as a Radiology Educational Tool
Amir Imanzadeh MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the utility of 3D printing in pediatric cardiac imaging and surgery. 2) Demonstrate the surgical anatomy of complex forms of double outlet right ventricle, congenitally corrected transposition and criss-cross or twisted heart shown in 3D print models. 3) Observe the models of the example cases in your hands.

ABSTRACT

Precise understanding of the complex morphology of the heart with congenital heart disease is crucial in surgical decision and undertaking the procedure. Most surgeons rely on the anatomy shown in echocardiograms, CT or MRI. Recent advances in computer graphic technology allows virtual demonstration of 3D anatomy in the computer screen. However, the virtual anatomy still requires surgeon’s mental reconstruction and ability to discriminate between the real and the false. 3D printing ultimately provides the surgeons with the physical replicas of the heart that allows easier and accurate understanding of the anatomy, opportunity to practice the procedure and to prepare the tailor-made implants or patches in advance, and, therefore, improves the accuracy of the surgery, shortens the procedure time, and improved the surgical
outcome. This presentation will show how 3D print models facilitate understanding of complex congenital heart diseases such as atypical forms of double outlet right ventricle, congenitally corrected transposition and criss-cross or twisted heart.

**URL's**

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

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**RC253D**

**Role of 3D Printing in Congenital Heart Disease Surgery**

Shi-Joon Yoo MD (Presenter): Owner, 3D HOPE Medical

**LEARNING OBJECTIVES**

1) Understand 3D printing process for heart models. 2) Know how 3D printing helps pediatric cardiac surgery. 3) Know the future directions of 3D printing for cardiac surgery

**ABSTRACT**

Using rapid prototyping or 3D printing, physical replicas of the hearts can be provided to surgeons before their surgical decision and procedure. The replicas fill the gap between the imagination from the medical images and the reality. By having the replicas in hands, the surgeons can make optimum surgical decision and simulate the intended procedures on the replica prior to the procedure. This allows precise surgical procedures with reduced procedure and anasthesia time. In cases in the grey zone for biventricular versus univentricular repair, the replicas are of tremendous help in a binary decision. The presentation will include a few clinical cases where 3D printing played a crucial role in surgical decision making.

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**RC253E**

**3D Surgical Planning Using Printed Models: The Surgeon's Perspective (Spine and Skull)**

Donald J. Annino MD, DMD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To describe the value of 3D visualization from the surgeon's perspective. 2) To show the role of 3D printing in current and future surgical planning. 3) To review important components of 3D models for face transplantation.

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**RC253F**

**The Impact 3D-Printing in the Imaging Environment**

Frederik Lars Giesel MD, MBA (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) History of 3D-Printing. 2) Imaging modalities and post-processing procedures to provide data surrogates for 3D-printing. 3) Concept of 3D-printing for improved clinical services. 4) Limitations and perspectives of 3D-printing in the imaging environment.

**ABSTRACT**

This presentation outlines the impact of 3D-printing in the imaging environment. Applications in the medical field are reviewed and growing clinical applications are discussed. Starting with an overview of current 3D-printing technologies including fused deposition modelling (FDM), selective laser sintering (SLS), and stereolithography (SLA) common techniques for generating 3D object models based on medical imaging are illustrated. Typically, imaging source data from different modalities are post-processed using dedicated algorithms and software in order to generate triangle mesh surface data. These surface data are usually exported to STL-files that are commonly understood by current 3D printing machines. 3D-printed objects are most often made from plastic, such as ABS, PA, or PLA, but metal or other material is even possible. Finally the presentation will demonstrate how 3D-printed objects are valuable for treatment planning, treatment procedures in several clinical subspecialties, intra-operative surgical navigation, or for prosthesis production. However, medical applications of 3D-printing are still in a very early phase but the growing awareness in the medical and non-medical field nowadays support the promising utilization and development in the very near future.
Sub-Events

VSNR21-01 Back Pain, Healthcare Reform, and Economic Realities

Michael Terrence Modic MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) The participant should gain an appreciation for the objective prognostic value of imaging in spinal disorders.
2) The participant should have an elevated awareness for the current deficiencies in the literature relative to therapeutic trials for spinal intervention.
3) Should be able to characterize peer reviewed publications as they relate to outcomes.

VSNR21-02 Early Imaging in Senior Primary Care Patients with Back Pain: Impact on Resource Utilization and Patient Outcomes


PURPOSE

To compare the effects of early imaging (within six weeks of presentation) to no early imaging with respect to function, pain and subsequent resource utilization in senior patients with new primary care visits for back pain without radiculopathy.

METHOD AND MATERIALS

We analyzed data from 5,239 patients enrolled in the Back pain Outcomes using Longitudinal Data (BOLD) Study, a prospective cohort of patients ≥65 years old with a new primary care visit for back pain. This analysis includes patients completing 1 year of follow-up by 11/2013 (n=3881) but will present data from the entire cohort. Our primary outcome was back-related disability measured by the Roland-Morris Disability Questionnaire (RMDQ) at 12 months. Secondary outcomes included 0-10 numerical rating scale of average back pain in the past week, EQSD and cumulative 12-month back-related relative value units (RVUs). We performed propensity score matching to construct comparable early imaging and no-early imaging groups creating two propensity-matched comparisons: 1) early x-ray vs. no-early imaging (n=652/group); 2) early CT or MR vs. no-early imaging (n=312/group).We used separate generalized estimating equation models on the matched samples to compare outcome measures between the early vs. no early imaging groups. We adjusted each model for site and important precision variables.

RESULTS

There were statistically significant but clinically unimportant differences between patients who received early x-ray compared to patients who did not (adjusted 12mo RMDQ: early x-ray: 8.4±6.5 vs. 9.1±6.9 no-early imaging; p=0.04; adjusted 12mo EQSD-Index (high=lower) early x-ray: 0.79±0.16 vs. no-early imaging: 0.77±0.18; p=0.02). There was no difference in adjusted 12-month RMDQ or EQSD in the early CT/MR group vs. no-early imaging. Total RVUs were ~2.2 times greater in the early CT/MR group (170±400) as in the no-early imaging group (77±230, p=0.001). The difference for spine-related RVUs was ~10 times higher in the early CT/MR group compared with the no-early imaging group (120±350 vs. 12±72, p=0.0001).

CONCLUSION

Senior patients undergoing early imaging had similar 12-month RMDQ, pain and EQSD scores to patients not undergoing early imaging but had substantially higher back-related and total RVUs.

CLINICAL RELEVANCE/APPLICATION

Guidelines for imaging seniors with back pain should have similar limitations to those in younger patients and not exempt seniors simply because of their age.

VSNR21-03 Systematic Literature Review of Imaging Features of Spinal Degeneration in Asymptomatic Populations

Imaging evidence of spine degeneration influences medical decision making in back pain patients. Prior studies demonstrate that degenerative changes are highly prevalent in asymptomatic individuals. We performed a systematic review to study the prevalence of imaging evidence of spine degeneration in asymptomatic individuals. Findings from this systematic review are being used to help physicians with clinical decision making for low back pain patients in A Pragmatic Trial of Lumbar Image Reporting with Epidemiology (LIRE); a multicenter randomized controlled trial aimed at reducing testing and unnecessary treatments for low back pain.

**METHOD AND MATERIALS**

We performed a comprehensive literature review for articles describing the prevalence of the following relevant imaging findings in asymptomatic individuals: disc degeneration, disc signal loss, disc height loss, disc bulge, disc protrusion, annular fissures, facet degeneration, and spondylolisthesis. We selected age groupings of 18-39, 40-59 and 60+ years old for age-specific prevalence estimates. For each imaging finding, we fit a generalized non-linear mixed effects model for the age-specific prevalence estimate clustering on study and adjusting for the midpoint of the reported age interval.

**RESULTS**

Twenty-seven articles were included in our study. Among asymptomatic individuals, disc degeneration was present in 53% of individuals under 40, 75% of individuals 40-59, and 91% of individuals ≥60 years old. Disc signal loss was present in 39% of individuals 18-39, 60% of individuals 40-59, and 89% of individuals ≥60 years old. Disc bulge was present in 44% of individuals under 40, 60% of individuals 40-59, and 75% of individuals ≥60 years old. Disc protrusion was present in 32% of individuals 18-39, 35% of individuals 40-59, and 36% of individuals ≥60 years old. Facet degeneration was present in 20% of individuals 18-39, 20% of individuals 40-59, and 55% of individuals ≥60 years old. Annular fissures were present in 12% of individuals 18-39, 20% of individuals 40-59, and 35% of individuals ≥60 years old.

**CONCLUSION**

Imaging evidence of spine degeneration is present in up to 90% of asymptomatic individuals. Many imaging-based degenerative features may be a part of normal aging and unassociated with pain.

**CLINICAL RELEVANCE/APPLICATION**

The results from this systematic review strongly suggest that normal age-related changes must be considered when interpreting lumbar spine imaging studies.

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**VSNR21-04**

**Differentiating Benign from Malignant Vertebral Fractures with Dynamic Contrast-enhanced MRI**

**PURPOSE**

Differentiating pathologic from benign vertebral fractures can be challenging especially among cancer patients who are prone to developing both types. We hypothesize that DCE-MRI can aid in non-invasive distinction between pathologic and benign fractures, improving patient care and management.

**METHOD AND MATERIALS**

Consecutive patients with vertebral fractures who underwent DCE MRI, biopsy and kyphoplasty were reviewed. A total of 47 fractures were analyzed for this study. Fractures were divided into 2 groups according to biopsy results: 19 pathologic fractures from 12 patients and 28 benign fractures from 9 patients (subgroups 13 chronic and 15 acute). ROIs were placed over fractured and normal appearing vertebral bodies on sagittal imaging. Perfusion parameters: blood plasma volume (Vp), time-dependent leakage (Ktrans), wash-in slope, peak enhancement and area under the curve(AUC) were calculated. Indices were compared between the 3 different groups of fractures: pathologic and benign, chronic and acute, and pathologic and acute. A Mann-Whitney U test at a significance level of corrected p<0.01 was conducted to assess the difference between the groups.

**RESULTS**

Pathologic fractures had significantly higher perfusion parameters (Vp, Ktrans, wash-in slope, peak enhancement and AUC) (p<0.01) when compared with benign fractures. Among benign vertebral fractures we also found significant differences (p<0.001) in all parameters comparing chronic and acute fractures. Vp and Ktrans were also able to discriminate between pathologic and acute fractures (p<0.01). Wash in was only marginally significant (p<0.02). No significant differences were found with peak enhancement (p<0.21) and AUC (p<0.4) in this last group.

**CONCLUSION**

Our data demonstrates that DCE-MRI helps to distinguish between pathologic and benign, acute and chronic and even benign acute and pathologic vertebral fractures. Adding DCE perfusion maps to standard MRI can aid to improve diagnostic accuracy.
**CLINICAL RELEVANCE/APPLICATION**

DCE MRI is a useful non invasive method that could help to distinguish between pathologic and benign vertebral fractures, avoiding unnecessary biopsy or preventing diagnostic and treatment delay.

**VSNR21-05**

**Diffusion Weighted Imaging, Diffusion Tensor Imaging, and Enhanced MRI in Patients with Spinal Cord Infarct: Differentiation with Other Acute Myelopathy**

*Dong-Ho Ha (Presenter): Nothing to Disclose, Sunseob Choi MD, PhD: Nothing to Disclose*

**PURPOSE**

To evaluate the diagnostic value of diffusion weighted imaging (DWI), diffusion-tensor imaging (DTI), and enhanced MRI in patients with spinal cord infarct, focused on the differentiation from acute inflammatory and demyelinating lesions.

**METHOD AND MATERIALS**

Institutional review board approval was obtained, but informed consent was waived. We retrospectively reviewed the MRI data and medical record of patients who admitted with acute myelopathy between August 2011 and December 2013. Twenty two patients (seven with spinal cord infarct, 15 with other acute myelopathy) were included in the study. The group of other acute myelopathy consists of 6 patients with neuromyelitis optica or spectrum disorder, 5 patients with transverse myelitis, 4 patients with multiple sclerosis. Exclusion criteria were traumatic or compressive acute myelopathy. The following imaging findings were analyzed: (a) length of lesion on T2 weighted image, (b) presence of high SI on DWI, (c) DTI indices (FA value and mADC), (d) degree of enhancement.

**RESULTS**

The patients with spinal cord infarct had a significantly greater frequency of the presence of high SI on DWI (6 of 7, p<0.05) and showed more decreased FA values (0.31± 0.15, P<0.05). The length of lesion on T2 weighted image showed similar appearance between two groups. On enhanced MRI image, all of cases of spinal cord infarct revealed non-enhancement or minimal enhancement, other acute myelopathy showed more frequent prominent enhancement (4 of 15), however statistically no significant (p=0.34).

**CONCLUSION**

DWI, DTI and enhanced MRI were useful to differentiate spinal cord infarct from the other acute myelopathy.

**CLINICAL RELEVANCE/APPLICATION**

DWI MRI is the essential imaging tool to diagnosis the spinal cord infarct, even it has various technical challenging.

**VSNR21-06**

**Providing Value in Spine Imaging**

*Michael D. Phillips MD (Presenter): Nothing to Disclose*

**LEARNING OBJECTIVES**

1) Discuss the concepts of price, cost and value of imaging in spinal disorders. 2) Gain an appreciation for the available literature regarding the economics of spinal imaging. 3) Gain an appreciation for changing role of spinal imaging in the transition from fee for service to ACO models.

**VSNR21-07**

**Imaging of the Craniovertebral Junction**

*Jeffrey S. Ross MD (Presenter): Nothing to Disclose*

**LEARNING OBJECTIVES**

1) Recognize the difference between basilar impression and basilar invagination. 2) Identify the pathologies associated with basilar invagination. 3) Identify the pathologies associated with basilar impression. 4) Understand the common measurements useful in disease of the craniovertebral junction.

**ABSTRACT**

The craniovertebral junction is a complex anatomic area, with a confusing array of pathologies and nomenclature. This presentation will define the commonly used terms and their associated pathologies. Commonly used eponymous measurements will be discussed. Basilar impression, basilar invagination, cranial settling and basilar kyphosis will be defined via imaging and measurements, and correlating pathologies demonstrated.

**VSNR21-08**

**Quantitative Magnetic Resonance Imaging for Spinal Cord Degeneration in Whiplash Associated Disorders**

*Mark A Hoggarth MS (Presenter): Nothing to Disclose, James Matthew Elliott PhD: Owner, Pain Id, LLC*

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*VSNR21-09, VSNR21-10, VSNR21-11*
PURPOSE

Whiplash Associated Disorder (WAD) has been commonly treated as a homogenous condition but there remains little evidence that doing so will improve functional recovery in the long-term. No structural mechanism of WAD has been found leading to the assertion that chronic WAD is primarily and uniquely found in the psychologically weak-willed. However, recent evidence has identified degenerative changes in neck muscles specific to those with chronic WAD, suggesting a biological contribution. Precise mechanisms, however, remain elusive. Magnetization Transfer (MT) imaging is a method of investigating white matter integrity in multiple pathologies, including demyelination in the spinal cord. MT ratio (MTR) analysis in the spinal cord could refine diagnosis in WAD. The goal of this work is threefold: 1) introduce quantitative MTR methods by which patients with WAD can be characterized; 2) promote quantitative metrics in the study of WAD; 3) present degeneration in regional spinal cord pathways which may be present in a subpopulation of persons with chronic WAD.

METHOD AND MATERIALS

15 subjects, 5 chronic WAD, 5 recovered and 5 controls were recruited into this study. Images were gathered perpendicular to the cervical spinal cord at the superior aspect of the fifth vertebra using MEDIC MRI. The MT pulse was 1.5kHz off-resonance with Flip angle/duration of 5400/10ms. Scan time was 8 minutes for MT and non-MT imaging. Ventral, dorsal, and lateral (left and right) aspects of the cord were segmented, and MTRs were calculated. The range in MTR values (dMTR) was then recorded.

RESULTS

dMTR differences were significant between WAD versus control and recovered groups (P < 0.01). Average dMTR values were dMTR: 18.87, recovered: 7.45 and control: 6.59. Control and recovered were not distinguishable (P = 0.37).

CONCLUSION

A quantitative imaging technique was introduced and preliminary findings suggest that the group of concern demonstrates reductions of magnetization transfer ratios in spinal cord white matter pathways. Recovered and healthy controls do not have such findings. These findings provide foundation for larger-scaled work.

CLINICAL RELEVANCE/APPLICATION

50% of people with a whiplash injury from a motor vehicle collision will never fully recover and 25% have complex clinical presentations. This work contributes to the understanding of potential neurological pathologies in the spinal cord underlying chronic WAD.

Diagnostic Accuracy of MRI Following Whiplash Injury Is Improved by Routine Imaging of the Cranio-cervical Junction

Francis William Smith MD (Presenter): Nothing to Disclose

PURPOSE

To improve diagnosis in patients following whiplash injury

METHOD AND MATERIALS

20 patients (14 female, 6 male) age range 15 - 69 yrs (Mean 47yrs), previously investigated following a hyperextension injury of the neck with reportedly normal MRI examination of the cervical spine were entered to the study. Previous MRI examinations had comprised sagittal T1 and T2 weighted images together with axial T2 weighted images at all levels from C2/3 to C7/T1. For the study, patients were studied in the seated upright position, where in addition to the sequences above, had a series of Coronal T2 weighted images and coronal and axial proton density images made from the skull base down to the C2/3 level. Spinal alignment, integrity of the intervertebral discs, alignment of the atlanto axial joints and atlanto-occipital joints, the integrity of the alar and cruciate ligaments, as well as the integrity of the neck muscles were assessed in all cases. If dislocation of either the atlanto-axial or atlanto-occipital joints were observed, further axial imaging at these levels was made with the head turned to the right and the left to assess for instability.

RESULTS

In 50% of the patients, the comprehensive imaging protocol found no cause that could be attributed to hyperextension injury of the neck. In the other 10 patients, eight had dislocation at the atlanto-axial joint two of which showed instability when the rotation images were assessed. Two showed stable dislocation at the antlanto-occipital joint, one of which also had low lying cerebellar tonsils.

CONCLUSION

We believe that the accepted practice of imaging the cervical spine, limiting the axial images to below the axis is inadequate and under estimates the incidence of significant post traumatic dislocation above this level. For thorough MRI examination of the neck in patients following hyper-extension injury, the use of good resolution imaging of the cranio-cervical junction in both the coronal and axial planes is mandatory, both to find evidence of dislocation and also to exclude it when it is not present.

CLINICAL RELEVANCE/APPLICATION

The cost implications of under diagnosis of mechanical damage at the cranio-cervical junction, both in terms of patient suffering and cost in insurance claims, is very large. We believe it is of paramount importance to not
only to show dislocation and ligamentous damage when present, but also to categorically exclude such damage when it is not present.

**VSNR21-10**


Jan Robert Kroger MD (Presenter): Nothing to Disclose, SURAJ THYAGARAJ: Nothing to Disclose, Daniel Giese: Nothing to Disclose, Dennis Hedderich MD: Nothing to Disclose, Richard Lukas Clemens Uwe Morsdorf-Schulte: Nothing to Disclose, David Christian Maintz MD: Nothing to Disclose, Theresia Yiallourou: Nothing to Disclose, Soroush Heidari Pahlavian: Nothing to Disclose, Alexander Christian Bunc: Nothing to Disclose, Bryn A Martin PhD: Nothing to Disclose

**PURPOSE**

The mechanisms of cerebrospinal fluid (CSF) hydrodynamics in the pathophysiology of Chiari malformation Type 1 (CMI) are still poorly understood. The aim of this study was to reverse-engineer 3D printed models of the subarachnoid space (SAS) at the craniovertebral junction, based on subject-specific MR measurements, to help understand the accuracy of 4D-phase-contrast-(PC)-MRI and the hydrodynamics in CMI.

**METHOD AND MATERIALS**

4D-PC-MRI and high-resolution T2-weighted MR-images were obtained for a CMI patient and healthy control. Four subject-specific 3D-printed models of the subarachnoid space near the craniovertebral junction were constructed based on the in-vivo images, two with idealized nerve roots. A pulsatile computer-controlled pump was constructed to produce subject-specific flow waveforms. The four in-vitro models were scanned by 4D-PC-MRI and peak velocities were compared along the cervical spine for the in-vivo and in-vitro measurements.

**RESULTS**

For the healthy volunteer, in-vitro and in-vivo flow characteristics were similar. Peak CSF flow velocities correlated with the area of the SAS in all models ($r=0.6$; $p<0.001$) and in the healthy volunteer ($r=0.7$; $p<0.05$) but not in the CMI patient ($p>0.05$). For the CMI patient, in-vivo and in-vitro velocities had poor agreement, particular near the foramen magnum. At this region, in-vivo flow patterns in the CMI patient showed unilateral dominated flow jets and elevated flow velocities that were not present in the corresponding in-vitro models. The in-vitro models with nerve roots showed elevated flow velocities compared to the models without nerve roots. Flow distribution along the cervical spine was similar for the models with and without nerve roots with localized flow disturbances surrounding the nerve roots.

**CONCLUSION**

Quantification of the CSF flow field by 4D-PC-MRI showed good agreement with in-vivo flow characteristics in the healthy case and poor agreement for the CMI patient. These differences demonstrate that a replication of static morphology is insufficient to explain the alterations in CSF dynamics seen in CMI patients and that neural tissue motion and/or a systematic error in the 3D model geometry reconstruction could be an important factor.

**CLINICAL RELEVANCE/APPLICATION**

The simulation of CSF hydrodynamics in our controlled set-up promotes a better understanding of the crucial variables causing the characteristic alterations in CSF dynamics seen in patients with CMI.

**VSNR21-11**

**Psoas Sign in Lumbar Vertebral Infections: “Look at Me Lesion!”**


**PURPOSE**

Spine infections, including vertebral body osteomyelitis and discitis, are relatively common causes of morbidity and mortality. The most common clinical symptom is nonspecific back pain, making a clinical diagnosis difficult. Magnetic resonance imaging (MRI) is the optimal modality for evaluation of suspected vertebral infections. Characteristic MRI findings in infections include low T1 signal and high T2 signal within the vertebral bodies, high T2 signal within the intervertebral disc, and variable post contrast osseous and disc enhancement. These findings often overlap with noninfectious etiologies, such as degenerative disc disease, inflammatory spondyloarthropathy, neuropathic arthropathy, and hemodialysis associated spondyloarthropathy. Our purpose in this study is to demonstrate that abnormalities within the psoas muscle, the psoas sign, is strongly associated with lumbar discitis-osteomyelitis and not commonly observed in noninfectious etiologies of lumbar pathology such as degenerative disc disease, inflammatory spondyloarthropathy, neuropathic arthropathy, and hemodialysis associated spondyloarthropathy.

**METHOD AND MATERIALS**

A retrospective imaging and chart review was preformed of all patients who received a MRI of the lumbar spine in the calendar year of 2013 with the clinical indication or findings that included the key words “infection,” “discitis,” or “osteomyelitis.” Patients were divided into an infectious (23 patients) and noninfectious group (25 patients) based on either biopsy and/or clinical treatment for infection after imaging. Studies were reviewed for presence or absence of abnormal T2 signal and, if available, enhancement within the psoas musculature. Statistical analysis was performed with a two-tailed Fisher’s exact test.

**RESULTS**

The infection group showed a positive psoas sign in 21 of 23 patients. The noninfection group had a positive psoas sign in 2 of 25 patients. The association of psoas sign with discitis-osteomyelitis was found to be
CONCLUSION

The psoas sign is strongly associated with lumbar discitis-osteomyelitis.

CLINICAL RELEVANCE/APPLICATION

Discitis-osteomyelitis can be a difficult clinical and imaging diagnosis secondary to nonspecific symptoms and imaging findings. A positive psoas sign on MRI can be used as a reliable finding to suggest lumbar discitis-osteomyelitis as opposed to noninfectious etiologies.

VSNR21-12  Pearls and Pitfalls in Spinal Imaging
Rolland Robert Lee MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Correlate the patient's symptoms with imaging findings, to optimize interpretation. 2) Categorize the various etiologies of spondylolisthesis, and recognize/describe the clinical significance of each. 3) Diagnose various common but under-recognized spinal pathologies. 4) Recognize and avoid common pitfalls in reporting spinal MRIs.

MSCM22

Case-based Review of Magnetic Resonance (An Interactive Session)

LEARNING OBJECTIVES

1) Review the use of MRI in gynecological disorders in a case-based format. 2) Highlight common pearls and pitfalls in MRI of the female pelvis. 3) Enhance findings that should not be overlooked in MRI of gynecological disorders.

Sub-Events

MSCM22A Female Pelvis
Antonio Luna MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Correlate the patient's symptoms with imaging findings, to optimize interpretation. 2) Categorize the various etiologies of spondylolisthesis, and recognize/describe the clinical significance of each. 3) Diagnose various common but under-recognized spinal pathologies. 4) Recognize and avoid common pitfalls in reporting spinal MRIs.

MSCM22B Head and Neck
Christine M. Glastonbury MBBS (Presenter): Investor, Amirsys, Inc

LEARNING OBJECTIVES

1) To learn the key points that create a succinct imaging differential diagnosis while appreciating the 'big picture' in HandN imaging. 2) To recognize the imaging findings of critical disease and what to do or recommend next with your patient.

Active Handout

MSCM22C Brain
Jonathan H. Burdette MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the latest brain imaging techniques and how they can be used in routine clinical practice. 2) Recognize commonly missed or misinterpreted findings/abnormalities. 3) Recognize imaging features of various brain pathologic entities, such as neoplastic, infectious, inflammatory, and vascular diseases.

ABSTRACT

Magnetic Resonance Imaging continues to be the workhorse technique in brain imaging. The brain imaging capabilities of MRI continue to make MRI a more sensitive and specific diagnostic tool compared with CT for most clinical entities. The past 15 years has ushered in the era of Physiologic MRI techniques, such as
diffusion-weighted imaging, diffusion tensor imaging, gadolinium-based and arterial spin labeled perfusion imaging, spectroscopy, functional MRI (fMRI), and, most recently, connectivity/network-based imaging. This presentation will cover the MR imaging features of several brain pathologic entities, and some of the latest brain MR imaging techniques will be introduced.

### SSC09

**Neuroradiology (Traumatic Brain Injury)**

**Scientific Papers**

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**AMA PRA Category 1 Credits™**: 1.50  
**ARRT Category A+ Credits**: 1.50  
**Mon, Dec 1 10:30 AM - 12:00 PM**  
**Location: N229**

#### Participants

**Moderator**  
Pratik Mukherjee MD, PhD: Research Grant, General Electric Company Medical Advisory Board, General Electric Company

#### Sub-Events

**SSC09-01**  
**Increased Cerebrovascular Reactivity Correlated with Subjective Headache Scores in the Days Following Sports Related Concussion**

Adam Richard Militana MD (Presenter): Nothing to Disclose, Manuel Donahue PhD: Nothing to Disclose, Megan Kay Strother MD: Nothing to Disclose, Allen K. Sills MD: Nothing to Disclose, Gary S. Solomon MD: Nothing to Disclose, Victoria L. Morgan PhD: Nothing to Disclose

**PURPOSE**

The measurement of cerebrovascular reactivity (CVR) in response to increased levels of carbon dioxide may be important to investigate in an athlete following concussion because this most closely simulates the physiologic challenge that she will encounter upon return to physical activity. To date, no study has been published using functional MRI (fMRI) to assess CVR following sports-related concussion. The purpose of this study is to measure CVR using fMRI in college athletes following a sports-related concussion and to correlate this measure with days after injury and headache symptomatology.

**METHOD AND MATERIALS**

We enrolled 6 college athletes (3M/3F, 18-22 yrs) 3-6 days following a diagnosed sports related concussion and 11 healthy controls (5M/6F, 18-23 yrs, 7 athletes) with no history of concussion. CVR was measured using fMRI via a 5% carbon dioxide block paradigm. A total of 18 regions of interest (ROIs) were evaluated across the brain. A subjective headache score (HAS) was reported at the time of scanning from 0-4.

**RESULTS**

CVR was increased approximately 37% across all ROIs in athletes following concussion compared to controls (p=0.025). We found that HAS was negatively correlated with days after injury (p=0.01). Across all ROIs, CVR was negatively correlated with days after injury (p=0.07). Individual regions which demonstrated this negative correlation and also had increased CVR in the concussion subjects were: right inferior parietal lobule, dorsomedial prefrontal cortex, right dorsolateral prefrontal cortex and right thalamus. Of these, the right inferior parietal lobe showed increased CVR correlated with increased HAS (p=0.02).

**CONCLUSION**

We observed markedly increased CVR in college athletes in the days following a sports-related concussion. Furthermore, this increase is associated with more recent injury, and in one region it is also associated with increased headache symptoms. These preliminary results suggest that a hypereactive vasodilatory response to hypercarbia may be an indicator of acute injury and contribute to recurrent headache symptoms. Future work will investigate the role of CVR changes in symptoms upon an athlete’s return to physical activity. [NIH UL1 TR000445]

**CLINICAL RELEVANCE/APPLICATION**

Our findings suggest that CVR is increased in the days following sports related concussion and this may be related to headache symptomatology.

**SSC09-02**  
**Head Impacts and White Matter Changes in High School Football: A TBSS Analysis**

Naeim Bahrami (Presenter): Nothing to Disclose, Elizabeth Davenport: Nothing to Disclose, Christopher Thomas Whitlow MD, PhD: Nothing to Disclose, Jillian Urban: Nothing to Disclose, Fatemeh Mokhtari MS: Nothing to Disclose, Mark A. Espeland PhD: Nothing to Disclose, Youngkyoo Jung PhD: Nothing to Disclose, Daryl A. Rosenbaum MD: Nothing to Disclose, Gerard A. Gioia PhD: Nothing to Disclose, Alexander K. Powers MD: Nothing to Disclose, Joel Stitzel: Nothing to Disclose, Joseph Antoine Maldjian MD: Nothing to Disclose

**PURPOSE**
The purpose of this study is to determine if head impacts acquired over a season of high school football produce diffusion tensor imaging (DTI) white matter changes in the absence of clinically diagnosed concussion. We hypothesize that players with greater levels of head impact exposure (heavy hitters) compared to those with lower levels of impact exposure (light hitters), will have decreases in fractional anisotropy (FA) that have been associated with white matter injury.

METHOD AND MATERIALS

24 high school football players (mean age=16.7; age range=16-18) were instrumented with the Head Impact Telemetry System (HITs) during all practices and games. DTI images were acquired pre and post-season at 2 mm isotropic resolution in accordance with the NINDS Common Data Elements advanced protocol recommendations on a 3T Siemens MRI. Risk weighted cumulative exposure (RWE) was computed from the HITs data, representing the collected risk of concussion over the course of the season. Total impacts and RWE were used to separate the players into 9 heavy hitters (HH) and 15 light hitters (LH). None of the players experienced concussion during the season. A whole brain tract based statistics (TBSS) analysis was conducted on the FA data. A 2x2 (group x time) repeated measures ANOVA was used to determine within group and between group differences (HH vs LH) for pre and post-season. Results were corrected for multiple comparisons using threshold free cluster enhancement at P < 0.05.

RESULTS

Both groups demonstrated a main effect of time, with global increases in FA (post vs pre season) likely reflecting effects of brain development. Between group analyses revealed widely distributed statistically significant areas of decreased delta FA (post-pre season) for HH compared to LH (Figure 1). These areas included the splenium of the corpus callosum and deep white matter tracts.

CONCLUSION

High school football players experiencing greater levels of head impact exposure, in the absence of clinical concussion, have more loss in FA compared to a lower impact exposure group, raising concern for white matter injury or delayed development. Similar brain MRI changes have been previously associated with mild traumatic brain injury.

CLINICAL RELEVANCE/APPLICATION

This study adds to the growing body of literature providing evidence that a season of play in a contact sport can show brain MRI changes in the absence of concussion or clinical findings.
POURPOSE
To determine if a central axonal injury underlies cervicalgia and paresthesias after mild traumatic brain injury (mTBI) utilizing tract-based spatial statistics (TBSS) analysis of diffusion tensor imaging (DTI).

METHOD AND MATERIALS
The institutional review board approved this study, with waiver of informed consent. Retrospective review of diffusion tensor imaging in 19 mTBI patients with cervicalgia and 9 with peripheral paresthesias was performed. Control subjects consisted of 56 mTBI patients without cervicalgia and 66 mTBI patients without paresthesias, respectively. Fractional anisotropy (FA) maps were generated as a measure of white matter integrity and analyzed using TBSS regression analysis utilizing a general linear model and unpaired t-tests.

RESULTS
As compared to controls, mTBI patients with cervicalgia had decreased FA values in the right superior longitudinal fasciculus (p

CONCLUSION
Decreased FA values in the SLF in mTBI patients with cervicalgia support the hypothesis that post-traumatic neck pain has a central axonal injury component. Injury to the SLF is associated with hemispatial neglect, which is often treated with neck muscle vibration. This suggests that post-traumatic neck pain may result not from direct injury to the cervical region, but from attempts at compensation for spatial orientation insufficiencies after mTBI.

CLINICAL RELEVANCE/APPLICATION
Detecting a central diffuse axonal injury (DAI) underlying post traumatic cervicalgia indicates that DAI is responsible for more post-concussive symptoms than simply the cognitive and executive deficits investigated previously. Diagnosis and treatment of patients with post-traumatic neck pain should not merely be focused on the cervical region, but also extend to possible intracranial injuries.

SSC09-05
Relationship of Post-concussive White Matter Injuries to Demographic Factors, Injury Mechanism, and Major Symptoms Utilizing Global Fractional Anisotropy Histogram Analysis
Joseph Delic MD (Presenter): Nothing to Disclose
Lea M. Alhilali MD: Nothing to Disclose
Michael W. Collins PhD: Nothing to Disclose
Saeed Fakhran MD: Nothing to Disclose

POURPOSE
To determine if different white matter injury severity relates to demographics, injury mechanism or results in differing post-concussive symptoms by analyzing whole brain fractional anisotropy histograms.

METHOD AND MATERIALS
Fractional anisotropy (FA) maps and serial neurocognitive testing with Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) were obtained in 75 mild traumatic brain injury (mTBI) patients. FA histograms were obtained with the Image Histogram Function in the Tract-Based Spatial Statistics software package. Kurtosis and skewness, previously shown as markers of overall injury severity, were extracted and correlated with demographic factors (age, sex), concussion mechanism, neurocognitive test scores, prior concussions, and time to recovery. Comparison of kurtosis and skewness was then performed between patients with and without major post-concussive symptoms (vestibulopathy, ocular motor insufficiency, sleep disturbances, anxiety, depression, anger, cervicalgia, paresthesias, and migraines). Analysis was performed with Pearson's correlation coefficient for continuous variables. Comparison between groups was performed with a two-tailed unpaired t-test.

RESULTS
Right skewness and leptokurtosis increased with decreasing age (r=-0.302 and r=-0.280, p=0.01 and p=0.008, respectively) and was greater in patients with sports-related injuries (p=0.007 and p=0.01, respectively), indicating greater injury severity with a more uniform distribution of injuries in these patients. Greater severity and variability in injuries was detected in patients with depression after mTBI (p=0.04 and p=0.02, respectively). No significant difference was seen in injury severity or variability among the remaining major post concussive symptoms. Injury severity and variability, as indicated by skewness and kurtosis, did correlate with initial symptom severity (r=0.288 and 0.280, p=0.02), but not neurocognitive testing, time to recovery, or prior injury.

CONCLUSION
More severe injuries are seen in younger patients, sports-related injuries, and depression after mTBI. No significant difference in the overall injury severity was seen among the remaining post-concussive symptoms.

CLINICAL RELEVANCE/APPLICATION
The more severe overall white matter injury seen in younger patients, sports-related concussion, and patients with depression after mTBI may indicate groups at risk on which to focus future clinical trials and interventions.

SSC09-06
Association of Baseline Neuroimaging with Short-term and Long-term Clinical Outcomes in Combat-related Traumatic Brain Injury
Jeffrey Ware MD (Presenter): Nothing to Disclose
Rosette Biester PhD: Nothing to Disclose
Elizabeth Whipple MS: Nothing to Disclose
Keith Robinson MD: Nothing to Disclose
Richard Ross MD, PhD: Nothing to Disclose
Paolo Nucifora MD, PhD: Nothing to Disclose

POURPOSE
Mild traumatic brain injury (m-TBI) is an increasingly-recognized clinical problem, particularly in military
populations which have seen a dramatic rise in the incidence of m-TBI over the past two decades. TBI has therefore become known as the 'signature injury' of recent military operations, and it is associated with poor neuropsychiatric outcomes. Clinical evaluation of veterans with m-TBI remains challenging due to difficulties in establishing the diagnosis and selecting appropriate therapy. Reliable biomarkers are sought to improve not only the sensitivity and specificity of m-TBI diagnosis, but also accuracy in predicting clinical outcome and ultimately evaluating therapeutic efficacy.

METHOD AND MATERIALS

We performed a retrospective cohort study of veterans of Operation Enduring Freedom and Operation Iraqi Freedom who were evaluated within a single VA hospital system from 2008-2013, screened positive for m-TBI, and were referred for brain MRI including diffusion tensor imaging and a high resolution T1-weighted sequence. Conventional MRI sequences were regarded as normal at clinical interpretation. Additional sequences were used for derivation of diffusion metrics, brain morphometry, and structural connectivity. Veterans underwent baseline clinical and neuropsychological evaluation. Clinical data were collected over a follow-up period of up to 6 years. Imaging metrics were analyzed in group-wise fashion, in addition to regression with baseline and follow-up clinical data.

RESULTS

Significant correlations between baseline imaging metrics and both short-term and long-term clinical outcomes were identified. At the time of imaging, fractional anisotropy in left frontal lobe white matter was positively correlated with percentile performance on the Trail-Making Test, a measure of executive function (p < 0.05). Furthermore, fractional anisotropy was significantly reduced in multiple brain regions in m-TBI veterans who were unemployed at the end of the follow up period compared to those able to obtain employment (p < 0.05).

CONCLUSION

Metrics derived from baseline neuroimaging are correlated with neurocognitive function and associated with long term employment status.

CLINICAL RELEVANCE/APPLICATION

Our study suggests that neuroimaging metrics can predict short-term as well as long-term clinical outcomes, building upon existing evidence for imaging biomarkers of m-TBI.

SSC09-07

Prognostication of Coma Caused by Traumatic Brain Injury Using Quantification of Damage to Individual White-matter Bundles in Diffusion Magnetic Resonance Imaging

Emad Ahmadi MD (Presenter): Nothing to Disclose, Anastasia Yendiki: Nothing to Disclose, Louis Puybasset MD, PhD: Nothing to Disclose, Damien Pierre Galanaud MD, PhD: Research Consultant, Olea Medical, Omid Khalilzadeh MD, MPH: Nothing to Disclose, Vincent Perlbarg PhD: Nothing to Disclose, Rajiv Gupta PhD, MD: Nothing to Disclose

PURPOSE

Quantification of injuries to white-matter (WM) bundles in diffusion magnetic resonance images (dMRI) has a great potential for prognostication of coma caused by traumatic brain injury (TBI). We studied a new method for reconstructing 18 WM bundles automatically in dMRI with the purpose of quantifying and localizing damage along each bundle. We tested this method for predicting neurologic and cognitive outcomes caused by bundle injuries in TBI-associated coma.

METHOD AND MATERIALS

We studied dMRI and T1 images of 53 patients who remained comatose at least 7 days after TBI, and 17 controls. We used Freesurfer for automatic segmentation and labeling of brain substructures in T1 images. Fully automated probabilistic tractography was performed with TRACULA (Tracts Constrained by Underlying Anatomy). Up to two diffusion orientations, corresponding to crossing fiber bundles, were fit to the dMRI data at each voxel in WM. This information was combined with the structural segmentation extracted from T1 images to reconstruct 18 WM bundles for each subject. Diffusion anisotropy and diffusivity were calculated at every point along the trajectory of each bundle in each subject. These values were compared between subjects at each point along each bundle. Comparisons were made between patients and controls, and between patients with good and poor outcome. Clusterwise correction was used to correct for multiple comparisons. The injured areas of WM bundles in each patient were then extracted by comparing each patient's anisotropy values along WM bundles with the distribution of the same values in controls.

RESULTS

Thirteen WM bundles showed significant difference at least in one region of neighboring points between comatose patients and controls, and 11 WM bundles showed significant difference at least in one region between patients with good and poor outcome. The figure shows the injured areas of WM bundles in a patient with poor outcome.

CONCLUSION

Our method for dMRI analysis using TRACULA allows us to extract clinically relevant information about the integrity of each WM bundle that can differentiate between patients with good and poor outcome, and might facilitate decision making for patients in coma caused by TBI.

CLINICAL RELEVANCE/APPLICATION
Assessment of Brain Volume Changes, White Matter Hyperintensities and Microbleeds in Concussed Hockey Players Purpose

The aim of this study is to compare the MR imaging characteristics of CFE and hemorrhagic DAI, as well as compare findings on SWI and GRE in both disease processes.

RESULTS

At the end of the hockey season, BV was reduced compared to baseline by 0.32% (p < 0.001) in the whole cohort and by 0.26% (p < 0.01) in the concussed athletes. Two months after concussion, BV was reduced by 0.23% (p = 0.016). No significant volume changes were found at 72 hours and two weeks after concussion, nor in the control group. Hockey players had on average 3.5 WMHI compared to 2.1 per control. WMHI were significantly closer to the cortical gray matter in hockey players (2.6 ± 2.6 mm) than in controls (5.2 ± 1.7 mm). Only 1 player had a microbleed at baseline that persisted throughout the study.

CONCLUSION

The lack of increase in volume during the first two weeks after injury suggests that there is no edema related increase in brain volume. The significant brain volume reduction in both the concussed and non-concussed athletes at the end of the season suggests an association with playing hockey. WMHI were significantly closer to the nearest gray matter in hockey players compared to controls but greater number was not significantly associated with concussion. Microbleeds were uncommon.

CLINICAL RELEVANCE/APPLICATION

A deeper understanding of the changes in brain volume and lesion load after concussion, as assessed by MRI, will help inform clinical interventions and return to play decisions.

Blood on the Brain: Differentiation of Traumatic Cerebral Fat Embolism from Hemorrhagic Shear Injury on MR Imaging

PURPOSE

The aim of this study is to compare the MR imaging characteristics of CFE and hemorrhagic DAI, as well as compare findings on SWI and GRE in both disease processes.

METHOD AND MATERIALS

Adult patients were selected based on clinical characteristics of CFE, GCS of 14-15 at initial presentation with a latent decline to <6T, no LOC at time of injury and normal initial head CT. Hemorrhagic DAI patients were selected who presented with GCS<6T, no latent decline in GCS and no long bone fractures, to exclude the possibility of superimposed CFE. A single double blinded rater evaluated the T2-FLAIR and DWI pattern and extent of disease, and evaluated SWI and GRE for size, configuration and number of hemorrhagic lesions at the following stations: frontal, parietal, occipital and temporal subcortical, periventricular and deep white matter, medulla, pons, midbrain, cerebellum and striatocapsular regions. Hemorrhages were counted and categorized accordingly: 0, 1-5, 6-10, 11-20, >20 lesions at each station, and total lesions were also categorized: 0, 1-10, 11-20, 21-100, 101-200, >200. Hemorrhage size was assessed on the following criteria: punctate<3, small 4-10, medium 10-20 and large>20 mm. Mann-Whitney statistical analysis test was performed at each station and whole brain for each sequence and for hemorrhagic lesion size and shape.

RESULTS

12 patients with CFE and 16 patients with DAI were selected. 6 CFE had SWI only, 3 GRE and 3 had both.
DAI had SWI, and 5 had GRE only. CFE usually presented with confluent, patchy or punctate white matter abnormalities on FLAIR, while DAI had better defined lesions intermediate in size. On DWI, CFE had significantly more lesions (p=.027), typically with confluent or punctate abnormality. There was no significant difference in the total number of hemorrhagic lesions (p=.72), but CFE had significantly more lesions in the pv (p=.0011) and deep (p=.0061) white matter, brainstem and cerebellum. CFE hemorrhages were typically smaller (p=.0061) and punctate or small, while DAI showed small and linear hemorrhages. There was a difference in the number of hemorrhages seen on SWI and GRE for both diseases, but this was more pronounced for CFE.

**CONCLUSION**

CFE can be differentiated from DAI on MRI, and should be evaluated using SWI in place of GRE.

**CLINICAL RELEVANCE/APPLICATION**

Differentiation of CFE from hemorrhagic DAI is important for prognostic purposes, and in CFE can prevent future events with prompt treatment of the cause.

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**SSC10**

**Neuroradiology (New Techniques in Brain Tumor Imaging)**

**Scientific Papers**

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**Participants**

**Moderator**

**Eu-Meng Law** MBBS : Speakers Bureau, Toshiba Corporation Medical Advisory Board, Bayer AG Medical Advisory Board, Bracco Group Medical Advisory Board, FUJIFILM Holdings Corporation

**Rivka Rachel Colen** MD : Nothing to Disclose

**Sub-Events**

**SSC10-01**

**Differentiation of Low Grade and High Grade Gliomas Using A Non-Gaussian Diffusion Imaging Model**

**Yi Sui** MS (Presenter): Nothing to Disclose, **Ying Xiong** : Nothing to Disclose, **Karen Xie** DO : Nothing to Disclose, **Frederick Damen** PhD : Nothing to Disclose, **Xiaohong Joe Zhou** PhD : Nothing to Disclose, **Wenzhen Zhu** MD, PhD : Nothing to Disclose

**PURPOSE**

To investigate the feasibility of using a set of novel parameters from a non-Gaussian diffusion imaging model to differentiate low-grade from high-grade gliomas.

**METHOD AND MATERIALS**

The study was performed on 27 patients with diagnosed gliomas, including 13 WHO low grade (I or II) and 14 WHO high grade (III or IV) tumors. MRI scans were conducted at 3Tesla using an 8-channel head coil. In addition to T1, T2, FLAIR and T1+C images, diffusion images with 17 b-values (0-4000 sec/mm2) were acquired in order to apply a new non-Gaussian diffusion model, known as fractional order calculus (FROC) model in which tissue microstructural information can be directly obtained. A set of FROC parametric maps (ADC, intra-voxel tissue heterogeneity index β, and mean free diffusion length µ) was calculated. The tumor ROIs were drawn on the diffusion images by an experienced neuro-radiologist, guided by anatomic images. Areas of necrosis, cyst, hemorrhage and edema were avoided. The parameter values averaged from the entire ROI of each tumor were used to differentiate low grade from high grade gliomas. ADC, β and µ were also combined using a binary logistic regression method for tumor differentiation. The difference in those parameters between the two tumor groups was analyzed using a Mann-Whitney U-test. The performance of tumor differentiation was further evaluated by an ROC analysis on each individual parameter and the combination of all parameters.

**RESULTS**

Significant differences between the low and high grade glioma groups were found in ADC (1.7 ± 0.5 µm²/ms vs 1.1 ± 0.4 µm²/ms, p = 0.005) and β (0.84 ± 0.06 vs 0.77 ± 0.04, p = 0.001), but not in µ (8.7 ± 0.6 µm vs 8.1 ± 0.7 µm, p = 0.06). The AUC values for ADC, β and µ were 0.817, 0.876 and 0.722, respectively, suggesting that individually β was the best indicator. The AUC value was further increased to 0.953 when combining all three parameters of the FROC diffusion model.

**CONCLUSION**

The use of high b-value diffusion MRI together with a non-Gaussian diffusion model - the FROC model - can effectively differentiate high-grade from low-grade gliomas.

**CLINICAL RELEVANCE/APPLICATION**
Development and Validation of a Quantitative Image Signature that Predicts Clinical Survival in Glioblastoma

Haruka Itakura MD (Presenter): Nothing to Disclose, Achal Achrol: Nothing to Disclose, Tiffany Ting Liu BS: Nothing to Disclose, Sebastian Echegaray MS: Nothing to Disclose, Joshua Joseph Loya BA, MS: Nothing to Disclose, Abhishek H. Feroze BS: Nothing to Disclose, Lex Allen Mitchell MD: Nothing to Disclose, Scott Rodriguez: Nothing to Disclose, Erick Michael Westbroek: Nothing to Disclose, Samuel H. Cheshier MD: Nothing to Disclose, Gary K. Steinberg MD, PhD: Nothing to Disclose, Daniel L. Rubin MD, MS: Nothing to Disclose, Kristen W. Yeom MD: Nothing to Disclose, Sandy Napel PhD: Medical Advisory Board, Fovia, Inc Consultant, Carestream Health, Inc Scientific Advisor, EchoPixel, Inc, Griffith Harsh : Nothing to Disclose, Olivier Gevaert PhD : Nothing to Disclose

PURPOSE

To develop and validate a univariate and multivariate model-based quantitative image signature to prognosticate survival in glioblastoma multiforme (GBM)

METHOD AND MATERIALS

Preoperative MR imaging and survival data from 553 patients from two distinct cohorts with de novo GBM were analyzed. First, we analyzed single-institution data on 360 subjects with GBM at our medical center. A board-certified neuroradiologist delineated Regions-Of-Interest (ROIs) around areas of enhancement in each T1 post-contrast MR slice to define a 3D tumor volume. We computed quantitative image features (morphological characteristics and pixel density statistics) from these 3D ROIs and compared them to 2D features derived from the largest slice of the tumor volume. We applied Cox proportional hazards modeling to individual image features with correction for multiple hypothesis testing to identify markers significantly correlated with survival. We then performed multivariate Cox proportional hazards regression with L1-norm regularization to build a parsimonious model that best approximated the survival outcome. Finally, we validated this multivariate model on an independent, validation cohort, consisting of 193 subjects whose MR imaging and survival data were obtained from The Cancer Imaging Archive and The Cancer Genome Atlas, respectively, and processed in the same manner as above.

RESULTS

From the training and validation sets, we extracted 138 quantitative image features in 2D and 125 in 3D for each patient. In the univariate Cox proportional hazards model, 38 2D and 42 3D image features were significantly associated with survival after correcting for multiple hypothesis testing (P-value <0.05, FDR <0.05). In the multivariate Cox model, combinations of six 2D features (p=0.009), and two 3D features (p=0.0132), respectively, were significantly associated with survival. These particular features capture the variability of the boundary shape, with smooth shapes correlated to good prognosis and irregular shapes correlated with bad prognosis.

CONCLUSION

Univariate and multivariate combinations of quantitative image features from both 2D and 3D MR robustly predicted survival in GBM. The predictive strength of these features was further confirmed using an independent validation cohort.

CLINICAL RELEVANCE/APPLICATION

A robust quantitative image signature may constitute the basis of a clinical tool for noninvasively prognosticating survival in patients with GBM.

Utility of Amide Proton Transfer Imaging for Prediction of Recurrent Glioblastoma: Initial Experience

Kye Jin Park MD (Presenter): Nothing to Disclose, Ho Sung Kim: Nothing to Disclose, Choong Gon Choi MD: Nothing to Disclose, Sang Joon Kim MD: Nothing to Disclose

PURPOSE

To test the predictive value of the amide proton transfer (APT) imaging for differentiating recurrent tumor from treatment-related effect in patients with newly diagnosed glioblastomas.

METHOD AND MATERIALS

Twenty-seven consecutive patients who showed new or enlarged, contrast-enhancing lesions within the radiation field after concurrent chemoradiotherapy were assessed by use of conventional MR imaging and APT imaging. APT imaging was performed using a gradient-echo multishot echo-planar imaging with thirty frequency offsets from +5.0 to -5.0 ppm in 0.357 ppm step. The imaging parameters for APT were as follows: echo time = 6.2 msec; a flip angle = 25 degree; RF irradiation power = 1.0µT; and saturation duration = 70 msec/shot. The calculated APT asymmetry map at the offset of 3.5 ppm is called the APT image. The APT signal was measured on solid (APTsolid) and necrotic (APTnecrosis) of the enlarged contrast-enhancing lesion using ‘hot-spot’ method. Reference standard was pathology or clinico-radiologic diagnosis. The diagnostic performance

High b-value diffusion imaging and non-Gaussian diffusion analysis have great potential for differential diagnosis of gliomas, and thereby providing valuable information for glioma patient management.
of APT parameter was determined by receiver operating characteristic curve (ROC) and leave-one-out cross validation. Interreader agreement was assessed using intraclass correlation coefficient (ICC).

RESULTS

Twenty-seven patients were subsequently classified as having recurrent tumor (n=19) or treatment-related effect (n=8). There was statistically significant differences of APTsolid between the two groups (median, 0.055 vs 0.024; P = .007). But APTnecrosis was not significantly different between the two groups (median, 0.004 vs 0.009; P = .339). ROC curve and leave-one-out cross validation showed the APTsolid to be the predictor of recurrent tumor, with a sensitivity of 94.7% and a specificity of 71.4%. The ICCs for APTsolid and APTnecrosis were 0.81 and 0.89.

CONCLUSION

APT signal on solid portion of enlarged contrast-enhancing lesion can be used for differentiating recurrent tumor from treatment-related effect in patients with newly diagnosed glioblastomas.

CLINICAL RELEVANCE/APPLICATION

APT imaging can be a potential, noninvasive imaging biomarker for monitoring treatment response in patients with newly diagnosed glioblastomas.

SSC10-04

Detection of 2-Hydroxyglutarate in Gliomas Using Spatial and Spectral 2D MR Spectroscopy: Translation to the Clinic

Alexander Peter Lin PhD (Presenter): Nothing to Disclose, Raymond Y. Huang MD, PhD : Nothing to Disclose, Sai Merugumala MS : Nothing to Disclose, Hujun Vicky Liao BS : Nothing to Disclose, Xi Long MD : Nothing to Disclose, Srinivasan Mukundan MD, PhD : Institutional research support, Siemens AG, Institutional research support, Toshiba Corporation Consultant, Toshiba Corporation, David A. Reardon MD : Research support, F. Hoffmann-La Roche Ltd Advisory Board, F. Hoffmann-La Roche Ltd, Patrick Y. Wen MD : Research Consultant, F. Hoffmann-La Roche Ltd, Nils David Arvold MD : Nothing to Disclose

PURPOSE

Gliomas are the most common primary malignant brain tumor, yet MRI provides limited functional information regarding tumor viability/activity and represents a major research and clinical challenge. Recent studies have shown that magnetic resonance spectroscopy can be used to non-invasively measure 2-hydroxyglutarate (2HG) in gliomas that harbor the isocitrate dehydrogenase 1 (IDH1) mutation, thus providing a highly specific measure for diagnosis.

METHOD AND MATERIALS

In this study we utilize two methods of measuring 2HG: 1) 2D chemical shift imaging (2D-CSI) with an optimal echo time of 97 ms to measure the 2HG resonance at 2.25 ppm from which spatial metabolic maps can be produced (7 min scan). 2) 2D spectral MRS using single-voxel localized correlated spectroscopy (2D-COSY) of 64 increments of 0.8 ms with a starting TE=30 ms and 8 averages (12 min scan). 15 subjects with pathologically confirmed gliomas were recruited and examined on a 3T Siemens Skyra using a 32 channel head coil. 2D-CSI was post-processed using clinically available software on the MRI platform (Syngo, Siemens) as well as LCmodel (Provencher). 2D-COSY was processed using commercially available software (FelixNMR) and crosspeaks at 2.25-4.0 and 1.9-4.0 ppm were measured. IDH status was compared with both MRS analyses.

RESULTS

Results using both of the methods were compared with histology: 10 IDH1-mutant, 5 IDH1-wildtype. 2D-CSI provided useful metabolite maps of the 2HG signal that were highly specific. However, there were several cases in IDH1-mutant gliomas in which baseline and phasing issues resulted in difficulty detecting 2HG. Fortunately in those cases where 2D-CSI failed, 2D-COSY was able to detect 2HG signal due to the use of multiple crosspeaks that can be used for analysis that are disambiguated from surrounding spectral signal. However, 2D-COSY suffers from partial volume effects due to the large voxel size required for adequate SNR, but this is complimented by 2D-CSI which provides excellent spatial coverage.

CONCLUSION

The combination of 2D-CSI to provide spatial resolution and 2D-COSY to provide spectral resolution, provided the greatest sensitivity and specificity for the characterization of 2HG in IDH1-mutant gliomas.

CLINICAL RELEVANCE/APPLICATION

Developing MRS methods to detect 2HG for the diagnosis of IDH1-mutant gliomas presents a tremendous opportunity, and might serve as a molecular imaging biomarker of glioma treatment response.

SSC10-05

Generic SVM Model for Preoperative Glioma Survival Associations: A Multi-center Validation Study

Kyrre Eeg Emblem MSc, PhD (Presenter): Intellectual property; NordicNeuroLab AS, Marco Cunha Pinho MD : Nothing to Disclose, Frank G. Zoellner : Nothing to Disclose, Paulina Due-Tonnessen MD : Nothing to Disclose, John K. Hald MD : Nothing to Disclose, Lothar R. Schad PhD : Nothing to Disclose, Torstein Meling : Nothing to Disclose, Otto Rapalino MD : Nothing to Disclose, Atle Bjornerud MSC : Intellectual property; NordicNeuroLab AS Board Member; NordicNeuroLab AS

PURPOSE

SSC10-05
PURPOSE
To develop a generic support vector machine (SVM) model using MRI-based blood volume distribution data for preoperative glioma survival associations and to prospectively evaluate the diagnostic efficacy of this model in autonomous patient data.

METHOD AND MATERIALS
Our study was approved by institutional and regional medical ethics committees. We retrospectively included 235 preoperative adult patients from two institutions with a subsequent histologically confirmed diagnosis of glioma after surgery. A SVM learning technique was applied to whole-tumor relative cerebral blood volume (rCBV) histograms from dynamic contrast enhanced MRI (1,2). SVM models with the highest diagnostic accuracy for 6-months, 1-, 2-, and 3-year survival associations were trained on 101 patients from the first institution. Using linear and cox regression analysis for diagnostic accuracy and survival associations, respectively, the diagnostic efficacy of the SVM models were tested on independent data from 134 patients from the second institution.

RESULTS
Compared to histopathology and presence of contrast enhancement, the whole-tumor rCBV-based SVM model was the strongest parameter associated with 6-months, 1-, 2-, and 3-year survival in the independent patient data (Chi-square = 25.49-48.43, P < 0.001; ROCAUC = 0.794-0.851). Results were corrected for known survival predictors, including patient age, tumor size, neurologic performance and postsurgical treatment.

CONCLUSION

CLINICAL RELEVANCE/APPLICATION
Machine learning techniques have the potential to improve standardization of current advanced MRI methods for preoperative glioma characterization and from this aid treatment planning.

To Assess the Added Value and Diagnostic Performance of Intratumoral Susceptibility Signals (ITSS) on High Resolution Susceptibility Weighted MR Imaging (HR-SWI) in the Differential Diagnosis of Solitary Enhancing Brain Lesions (SEL)

Ritu Manoj Kakkar MBBS (Presenter): Nothing to Disclose, Sameer Surendra Soneji DMRD: Nothing to Disclose, Vinayak Vishwanath Kabate MBBS, DMRD: Nothing to Disclose, Shrinivas Balaji Desai MD: Nothing to Disclose

PURPOSE
Determine the benefit of using adjunctive HR-SWI for differentiating SEL of brain by assessing ITSSs compared with conventional imaging alone. Grade the gliomas depending upon the presence of ITSS Compare results with histopathology as the gold standard

METHOD AND MATERIALS
32 Patients (age 15-65) with SEL who met with the inclusion criteria for this study were retrospectively reviewed from our database. Conventional MR and HR-SWI sequences were analysed. ITSS was defined as low-signal-intensity fine linear or dot like structures, which are not obvious on conventional MR images, with or without conglomeration within a tumor as depicted on HR-SWIs. ITSS were graded as Grade 1, no ITSS Grade 2, 1-10 dotlike or fine linear and Grade 3, as ≥ 11 dotlike or fine linear ITSSs. Sensitivity, Specificity, PPV, NPV and diagnostic accuracy were calculated for both conventional imaging alone and with adjunctive HR-SWI imaging, comparing with histopathology as gold standard.

RESULTS
2 radiologists diagnosed accurate tumor pathology within 6 categories (GBM, anaplastic astrocytoma, metastatic tumor, lymphoma, tumefactive MS, and inflammatory granuloma) in 20 (62.5%) of 32 SELs after reviewing both conventional MR images and HR-SWIs. The McNemar test showed statistically significant (P = 0.031) difference in overall diagnostic accuracy of conventional MR imaging versus using adjunctive HR-SWI. ITSSs were seen in all 9 GBMs (100%), in 1 of 2 (50%) anaplastic astrocytomas, and in 8 (72.7%) of 11 metastatic tumors and were not identified in lymphomas and nontumorous lesions. Higher grade of ITSSs (grade 3) are seen in 8 out 9 GBMs.

CONCLUSION
The use of ITSSs provides a benefit for the differential diagnosis of SELs compared with conventional imaging. Presence of ITSS reflects increased intratumoral neovascularity and is indicative of higher grade of malignancy. Lack of ITSS can be a specific sign in the imaging diagnosis of lymphomas or nontumorous lesions.

CLINICAL RELEVANCE/APPLICATION
HR-SWI should be included in MR evaluation of SELs, to further validate its role in differential diagnosis. HR-SWI
Comparative Study of Predictive Classification Models for MGMT Promoter Methylation Using Imaging Features in Glioblastoma

Ginu A. Thomas MBBS (Presenter): Nothing to Disclose, Jixin Wang PhD: Nothing to Disclose, Pascal O. Zinn MD: Nothing to Disclose, Rivka Rachel Colen MD: Nothing to Disclose

PURPOSE

To compare multiple predictive classification models used to predict MGMT methylation status in Glioblastoma.

METHOD AND MATERIALS

We identified 86 treatment-naïve patients from The Cancer Genome Atlas (TCGA) who had both gene and microRNA expression profiles (MGMT methylation status) and pretreatment MRI from The Cancer Imaging Archive (TCIA). Qualitative VASARI imaging features for these 86 patients were assessed by 3 independent neuroradiologists and consensus was reached. Quantitative volumetric analysis was done in the 3D Slicer software 3.6(http://www.slicer.org) using segmentation module. Fluid Attenuated Inversion Recovery (FLAIR) was used for segmentation of the edema and post-contrast T1 weighted imaging (T1W1) for segmentation of enhancement (defined as tumor) and necrosis. Each qualitative and quantitative feature was correlated to MGMT methylation status both independently and as groups and subgroups. Multiple classification models were created via regression modeling and partition analysis using various combinations of variables. JMP Pro 11 was used for modeling and statistical analysis.

RESULTS

Multiple classification models to predict MGMT promoter methylation status were created and compared. The logistic regression model with quantitative volumetric variables, clinical variables and the qualitative variable ‘diffusion’ could predict MGMT methylation with an AUC of 0.847 with a sensitivity of 82% and a specificity of 83.8%.

CONCLUSION

MGMT methylation status plays an important role in patient predictive and prognostic stratification of patients with GBM. The identification of a non-invasive biomarker signature as a surrogate for MGMT methylation can help stratify patients in specific therapy and predict response versus non response to therapy. An imaging genomic signature can be expected to promote a more robust personalized approach to patient care and accelerate drug development and clinical trials.

CLINICAL RELEVANCE/APPLICATION

Imaging prediction of MGMT methylation status will help to specifically identify and treat those patients who respond to therapy with Temozolomide.

Imaging Glioblastoma Multiforme at 7T versus 3T: The More Tesla, the Better?

Lale Umutlu MD (Presenter): Consultant, Bayer AG, Anja Fischer MD : Nothing to Disclose, Cornelius Deuschl : Nothing to Disclose, Jorg Hense : Nothing to Disclose, Thomas C. Lauenstein MD : Nothing to Disclose, Michael Forsting MD : Nothing to Disclose, Mark E. Ladd PhD : Nothing to Disclose, Oliver Kraff MSc : Nothing to Disclose, Marc U. Schlamann : Nothing to Disclose

PURPOSE

Glioblastoma multiforme is known to be the most common and most aggressive malignant primary brain tumor in humans. Pretreatment assessment of exact localization, tumor extent and tumor-associated vasculature is inevitable. With successful introduction of ultra-high-field brain MRI within the last few years and potential benefits associated to the increase of the field strength, the aim of this trial was to compare the diagnostic ability of tumor assessment utilizing 3T and 7T magnetic field strength.

METHOD AND MATERIALS

10 subjects were examined on a 3T MR scanner (Magnetom Skyra) and a 7T whole-body MR system (Magnetom 7T; both Siemens Healthcare) utilizing 32-channel head coils (Siemens Healthcare). Inter-field strength comparisons were performed for the following sequences: (1) SWI imaging (3T voxel size = 0.7x0.8x2.6 mm3; 7 Tesla voxel size = 0.25x0.25x1.0 mm3), (2) T2w FLAIR sequence (3T voxel size = 0.4x0.4x5.0 mm3 ; 7T voxel size = 0.6x0.6x5.0 mm3) and (3) a post-contrast 11-w 3D MPRAGE (3T voxel size = 0.5x1.0x1.0 mm3; 7 Tesla voxel size 0.7x 0.7x 0.7mm3). Two radiologists assessed the delineation of the (1) tumor in T1w MRI, (2) microvasculature in SWI imaging, (3) potential necrosis and edema in FLAIR imaging, (4) overall image quality for all squences and (5) impairment due to artifacts utilizing a 5-point scale (5= excellent to 1= non-diagnostic).

RESULTS

Visual analysis revealed an equivalently high delineation of tumor extent and morphology as well as tumor-associated edema at both field strengths (MPRAGE 3T 4.7 vs MPRAGE 7T 4.9; FLAIR3T 4.6 vs Flair7T 4.6). 7T SWI MRI demonstrated its superiority, yielding a significant improvement in the assessment of tumor-associated microvasculature (SWI 3T 3.8 vs SWI 7T 4.8). Evaluation of artifacts showed slightly stronger image impairment for 7T imaging (mean3T 4.7 vs mean7T 4.3).
CONCLUSION

Both field strengths provide high-quality assessment of tumor extent, morphology and tumor-associated edema / necrosis, with 7T SWI imaging demonstrating its superiority in the assessment of tumor-associated microvasculature, in terms of tumor-associated neoangiogenesis.

CLINICAL RELEVANCE/APPLICATION

7 Tesla enables superior assessment of tumor-associated neoangiogenesis, potentially allowing for superior therapy monitoring of patients undergoing anti-angiogenic therapy.

Magnetic Resonance Fingerprinting of Brain Tumors: Initial Clinical Results

Chaitra Ashok Badve MD, MBBS (Presenter): Nothing to Disclose, Alice Yu BS, MS: Nothing to Disclose, Dan Ma MS: Nothing to Disclose, Anagha Deshmane: Nothing to Disclose, Yun Jiang: Nothing to Disclose, Andrew Sloan: Nothing to Disclose, Jeffrey Lloyd Sunshine MD, PhD: Research support, Siemens AG Travel support, Koninklijke Philips NV Travel support, Sectra AB Travel support, Allscripts Healthcare Solutions, Inc, Vikas Gulani MD, PhD: Research support, Siemens AG, Mark A. Griswold PhD: Research support, Siemens AG Royalties, Siemens AG Royalties, General Electric Company Royalties, Bruker Corporation Contract, Siemens AG

PURPOSE

Magnetic Resonance Fingerprinting (MRF) is a novel framework for simultaneous accurate quantitation of multiple MR tissue properties. Here we apply MRF for evaluation of different types of intra-axial brain tumors.

METHOD AND MATERIALS

14 patients including 7 glioblastoma multiforme (GBM), 4 oligodendrogliomas (OG) and 3 metastases (MET) were scanned using a MRF protocol. Imaging was acquired through representative areas of brain and quantitative T1 and T2 maps were generated. T1 and T2 quantification of solid tumor component, immediate perilesional white matter (PWM) within 1 cm from enhancing margin, and contralateral white matter (CWM) was performed using ROI analysis. Student’s t-test was used for statistical analysis.

RESULTS

Mean T1, T2 of solid parenchyma in GBMs (n = 7) were 1786 ± 243 ms; 131 ± 30 ms, respectively. T1, T2 of abnormal signal within 1cm of enhancing margin in GBMs (n =7) were 1704 ± 471 ms; 130 ± 47 ms. T1, T2 for solid parenchyma in METS were 1243 ± 132 ms; 104 ± 31 ms. Measurements were in agreement with published literature. Tumor T1, T2 were different than T1, T2 of CWM (n=14, p < 3.8 x 10-7, p < 2.4 x 10-7). There was difference between T1 of solid regions of GBMs and METS (T1: p < 0.01). Also, there was difference between the PWM OF GBMs and METS (T1: p < 0.03; T2: p < 0.07). T2 relaxometry revealed difference between GBMs and OGs (p < 0.04).

CONCLUSION

MRF is able to simultaneously measure T1 and T2 values of brain tumors and surrounding tissues. It can distinguish with high statistical significance between tumor types and PWM changes from CWM. Preliminary data supports using MRF to identify regions of infiltrative edema in GBM, and differentiation of tumor types and grades.

CLINICAL RELEVANCE/APPLICATION

The preliminary data on MRF of brain tumors suggest application of this technique to identify, diagnose, and offer prognosis of intracranial masses, delineate of tumor margins, and characterization of therapeutic response.
Establishing the Structural Connectome as a Quantitative Imaging Biomarker: Application to Alzheimer’s Disease (Station #1)

Jeffrey William Prescott MD, PhD (Presenter): Nothing to Disclose, P. Murali Doraiswamy MD: Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neurontin, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neurontin, Inc Research Grant, Medivation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder, Clarimedx, Inc Speaker, Forest Medical, LLC, Jeffrey Robert Petrella MD: Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited

PURPOSE

The current study analyzes structural connectome topological metrics and their reproducibility in the setting of Alzheimer’s disease pathology.

METHOD AND MATERIALS

We studied 102 subjects enrolled in the multi-center biomarker study, the Alzheimer’s Disease Neuroimaging Initiative (ADNI) 2 who had both DTI and florbetapir PET data. Subjects’ T1 scans were automatically parcellated into cortical regions of interest. Standardized uptake value ratios (SUVr) were calculated from florbetapir PET scans for 5 cortical lobes (frontal, cingulate, parietal, temporal, and occipital). Structural connectome graphs were created from DTI scans, and connectome topology was analyzed in each lobe using graph theoretic metrics: strength, local efficiency, clustering coefficient, and betweenness centrality. Linear mixed effects models were fit to analyze the effect of florbetapir SUVr on the structural connectome metrics. In addition, reproducibility of the topological metrics was analyzed in the cohort of normal controls between baseline and 3 month scans.

RESULTS

There were strong, significant associations between florbetapir SUVr and structural connectome metrics in each of the 5 lobes. Increased cortical florbetapir SUVr was associated with decreases in strength (p = 0.00001), local efficiency (p = 0.00001), and clustering coefficient (p = 0.0006), but not betweenness centrality (p = 0.69). The best reproducibility between consecutive measurements for normal controls was 6% for strength, 16% for local efficiency, 13% for clustering coefficient, and 48% for betweenness centrality.

CONCLUSION

Increased amyloid burden is strongly associated with changes in the topology of the large-scale structural network architecture of the brain (the ‘structural connectome’), even in the preclinical stages of AD. The most reproducible topological measurement studied was strength, while local efficiency and clustering coefficient had acceptable but not great reproducibility. These results suggest that it may be possible to use structural network topology as an imaging biomarker of Alzheimer’s disease, and therefore as a target for therapy early in the course of AD.

CLINICAL RELEVANCE/APPLICATION

These results suggest that it may be possible to use structural network topology as an imaging biomarker of Alzheimer’s disease, and therefore as a target for therapy early in the course of AD.

Relationships between Quantitative Amyloid Burden and Cognition in Alzheimer’s Dementia (Station #2)

Alex Bibbey MD (Presenter): Nothing to Disclose, P. Murali Doraiswamy MD: Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neurontin, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neurontin, Inc Research Grant, Medivation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder, Clarimedx, Inc Speaker, Forest Medical, LLC, Jeffrey Robert Petrella MD: Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited, Jeffrey William Prescott MD, PhD: Nothing to Disclose

PURPOSE

The hypothesis of the current study is that relationships between cortical amyloid burden as evaluated by florbetapir PET imaging and cognitive testing batteries may provide complementary information about pathologic changes in Alzheimer’s Disease (AD).

METHOD AND MATERIALS

Subjects were those newly enrolled in the ADNI2 study. Baseline data was used. T1 anatomical images were parcellated using FreeSurfer software. Parcels were registered to florbetapir PET scans. Florbetapir SUVr for each parcellated cortical region of interest was calculated, using the whole cerebellum as the reference region. Clinical cognitive assessments included ADAS-Cog, MMSE, Rey AVLT, Boston Naming Test, Trail Making Test A and B, and the Clock Drawing Test. Statistical analyses were performed between amyloid status in selected cortical regions (superior, middle, and inferior temporal, entorhinal, precuneus, posterior cingulate, and superior frontal) as assessed by PET and clinical cognitive measures.

RESULTS

There were 102 ADNI2 subjects (64 males, 38 females, mean age 73.8 years) available at the time of the analysis. There were 37 normal control, 19 early mild cognitive impairment (MCI), 25 late MCI, and 21 AD subjects, representing a spectrum of clinical cognitive status. Regression modeling of florbetapir SUVr as a predictor of cognitive battery performance revealed the region with the most significant associations between cognitive performance and amyloid SUVr was the right precuneus, with ADAS-cog, MMSE, and Trail A test (p < 0.05). The cognitive test with the most association with regional florbetapir SUVr was ADAS-cog, with left entorhinal, left posterior cingulate, and right precuneus.
CONCLUSION
Significant associations between regional florbetapir PET SUVr and cognitive battery performance indices were noted mostly in the right precuneus, with the ADAS-cog cognitive test the most associated with SUVr across regions. It is thought that the rate of cognitive decline is greatest when the rate of amyloid accumulation has plateaued, and further increase is minimal. Ongoing longitudinal investigations will further evaluate how cognitive decline may be affected in the setting of increasing amyloid burden in asymptomatic subjects or those with mild cognitive impairment.

CLINICAL RELEVANCE/APPLICATION
Quantitative amyloid PET may provide information about local and structural changes in AD, aiding in diagnosis and disease tracking.

NRS401
White Matter Lesions (WML), Cognitive Domains and Vascular Factors in a Population-based Cohort Study (Station #3)
Thais Minett PhD (Presenter): Nothing to Disclose, Blossom Stephan: Nothing to Disclose, Shabina Hayat: Nothing to Disclose, Stephanie Moore: Nothing to Disclose, Elliott Grigg: Nothing to Disclose, Robert Luben: Nothing to Disclose, Fiona Matthews: Nothing to Disclose, Carol Brayne: Nothing to Disclose, Kay-Tee Khaw: Nothing to Disclose

PURPOSE
To assess the impact of White Matter Lesions (WML) on global and domain specific cognitive functions and whether vascular co-morbidities modify these associations in a population-based sample.

METHOD AND MATERIALS
Participants were recruited from a population-based study. At baseline (1993-1997) 30,446 participants aged 40-79 years were selected from general practices. Participants were re-seen in later life, 13 years follow-up (wave III). The core data resources include lifestyle/physical activity, diet, medical status, and blood samples. The present study added a pilot neuroimaging component to this project. From participants seen at wave III, 67 were randomly selected weighted towards the more cognitively frail. Participants were scanned and WML were rated using the Fazekas' scale on FLAIR acquisitions. Cognition was assessed using the Addenbrookes Cognitive Examination (ACE-R) battery and cognitive domains divided into memory, attention, fluency, language and visuospatial. The vascular factors considered were: stroke; heart disease; diabetes; cholesterol; blood pressure; current smoker; body mass index (BMI); alcohol intake.

RESULTS
There was a significant association between WML intensity and attention (B = -0.75; 95%CI(B)= -1.42, -0.08). This relationship was independent of age, sex and presence of multiple vascular risk factors. No significant relationship was demonstrated between WML ratings and global cognition or memory, fluency, language and visuospatial performance.

CONCLUSION
WML were found to be associated with impairment of attention. Moreover, this association was independent of age, sex and the presence of multiple vascular risk factors. Our findings suggest that there might be other factors, potentially non-vascular, contributing to the relationship between WML and impairment in executive function.

CLINICAL RELEVANCE/APPLICATION
The fact that there might be other contributing factors to the relationship between WML and impairment in executive function has implications for intervention targets aimed at promoting cognitive function in older aged individuals.

NRS402
Association of Baseline Neuroimaging with Short-term and Long-term Clinical Outcomes in Combat-related Traumatic Brain Injury (Station #4)
Jeffrey Ware MD (Presenter): Nothing to Disclose, Rosette Biester PhD: Nothing to Disclose, Elizabeth Whipple MS: Nothing to Disclose, Keith Robinson MD: Nothing to Disclose, Richard Ross MD, PhD: Nothing to Disclose, Paolo Nuñifora MD, PhD: Nothing to Disclose

PURPOSE
Mild traumatic brain injury (m-TBI) is an increasingly-recognized clinical problem, particularly in military populations which have seen a dramatic rise in the incidence of m-TBI over the past two decades. TBI has therefore become known as the 'signature injury' of recent military operations, and it is associated with poor neuropsychiatric outcomes. Clinical evaluation of veterans with m-TBI remains challenging due to difficulties in establishing the diagnosis and selecting appropriate therapy. Reliable biomarkers are sought to improve not only the sensitivity and specificity of m-TBI diagnosis, but also accuracy in predicting clinical outcome and ultimately evaluating therapeutic efficacy.

METHOD AND MATERIALS
We performed a retrospective cohort study of veterans of Operation Enduring Freedom and Operation Iraqi Freedom who were evaluated within a single VA hospital system from 2008-2013, screened positive for m-TBI, and were referred for brain MRI including diffusion tensor imaging and a high resolution T1-weighted sequence. Conventional MRI sequences were regarded as normal at clinical interpretation. Additional sequences were used for derivation of diffusion metrics, brain morphometry, and structural connectivity. Veterans underwent baseline clinical and neuropsychological evaluation. Clinical data were collected over a follow-up period of up to 6 years. Imaging metrics were analyzed in group-wise fashion, in addition to regression with baseline and follow-up
RESULTS

Significant correlations between baseline imaging metrics and both short-term and long-term clinical outcomes were identified. At the time of imaging, fractional anisotropy in left frontal lobe white matter was positively correlated with percentile performance on the Trail-Making Test, a measure of executive function (p < 0.05). Furthermore, fractional anisotropy was significantly reduced in multiple brain regions in m-TBI veterans who were unemployed at the end of the follow up period compared to those able to obtain employment (p < 0.05).

CONCLUSION

Metrics derived from baseline neuroimaging are correlated with neurocognitive function and associated with long term employment status.

CLINICAL RELEVANCE/APPLICATION

Our study suggests that neuroimaging metrics can predict short-term as well as long-term clinical outcomes, building upon existing evidence for imaging biomarkers of m-TBI.

NRS403

Diffusion and Conventional MR Imaging Genomic Biomarker Signature Predicts Specificity Protein 1 Expression Identification in Glioblastoma Patients (Station #5)

Mohamed G. Elbanan MBBCh (Presenter): Nothing to Disclose, Eslam Wassal Youssef MD: Nothing to Disclose, Pascal O. Zinn MD: Nothing to Disclose, Rivka Rachel Colen MD: Nothing to Disclose

PURPOSE

Sp1 plays a critical role in the regulation of multiple genes implicated in tumorigenesis, also it represents potential prognostic markers for glioma progression. Currently used methods to determine the Sp1 expression status of GBM include immunohistochemical analysis and genotyping of the DNA extracted from the brain tumor specimens. Thus, we seek to identify a diffusion and conventional MR imaging signature associated with Sp1 expression tumors that can be considered as a non-invasive predictor of the Sp1 expression status in Glioblastoma patients.

METHOD AND MATERIALS

We identified 80 GBM patients from The Cancer Genome Atlas (TCGA) who had genetic expression profiles of Sp1 and neuroimaging available at The Cancer Imaging Archive (TCIA). All morphological image analyses and segmentation were done using slicer 3.6 (slicer.org) and reviewed in consensus by 3 neuroradiologists. Fluid-Attenuated Inversion Recovery (FLAIR) was used for segmentation of the edema and post-contrast T1 weighted imaging (T1WI) for segmentation of enhancement (defined as tumor) and necrosis. The non-enhancing perilesional FLAIR hyperintensity reflected a mixture of edema/tumor infiltration. Diffusion was analyzed in Olea Sphere 2.3 and Conventional FLAIR/post-contrast T1WI was registered to DWI/ADC maps. ADC, FLAIR and T1 Gadolinium enhancement values will be measured using the ROI based method, in the perilesional edema/non enhancing tumor and the enhancing tumor zones, with dividing the perilesional edema/non enhancing tumor into 3 zones each of 1 cm width, 3 ROI measurements will be taken from each zone. Multiple quantitative imaging features were identified and combined to create the imaging biomarker signature predictive of Sp1 expression status.

RESULTS

We created a complex imaging biomarker signature using quantitative diffusion and conventional MR imaging features to predict those GBM patients with Sp1 expression status and furthermore that was predictive of patient survival.

CONCLUSION

GBM tumors with Sp1 expression status hold a specific imaging biomarker signature that can be used as a predictive and prognostic biomarker and non-invasive surrogate for Sp1 expression status.

CLINICAL RELEVANCE/APPLICATION

GBM tumors with Sp1 expression hold a specific diffusion and conventional MR imaging biomarker signature that can be used as a predictive and prognostic biomarker.

NRS404

Spectral Imaging Associated with Lower Contrast Injection Rate for Carotid Artery: Initial Clinical Experience (Station #6)

Yunjing Xue MD (Presenter): Nothing to Disclose, Qing Duan MD: Nothing to Disclose, Jin Wei: Nothing to Disclose, Lin LIN: Nothing to Disclose, yuanfen liu: Nothing to Disclose

PURPOSE

To investigate the clinical value of using a Gemstone spectral imaging (GSI) protocol with 50% adaptive statistical iterative reconstruction (ASiR) and lower contrast injection rate (3ml/s) in carotid CTA by comparison with a conventional 120-kVp protocol with normal contrast injection rate (5ml/s).
METHOD AND MATERIALS

With local ethical committee approval, 41 patients were prospectively enrolled in the study: 21 were scanned with parameters of 120 kVp, 240 mAs, contrast medium (CM) of 320 mg I/mL with 5ml/s injection rate in group A, and the other 20 were scanned with GSI mode, 315 mAs, 50% ASiR using the same CM with 3 ml/s injection rate in group B. Monochromatic images of 60keV were evaluated in GSI group. Image quality (IQ) of the two groups was compared in terms of arterial enhancement, noise, signal-noise-ratio (SNR) and contrast-to-noise ratio (CNR). The effective dose (ED) of radiation and contrast dose were calculated and compared. Data were analyzed by using independent samples t test.

RESULTS

Both carotid (9.78±2.88HU) and three main branches of thoracic aorta (19.05±6.40HU) showed lower image noise in GSI (50% ASiR, 3ml/s) than that of 120-kVp group (26.69±4.68HU) (P<0.05, respectively). The artery enhancement, CNR and SNR of carotid artery and three main branches of thoracic aorta has no significant differences statistically between two groups (all of them P>0.05), respectively. The ED and contrast dose of GSI group (2.86±0.07mSv, 49.42±8.91ml) was 10.9% and 26.79% lower than that of 120-kVp group (3.21±0.30mSv, 67.5±13.72ml), respectively. There was significant difference statistically in ED and contrast dose, respectively, between two groups (all of them P<0.05).

CONCLUSION

The use of spectral imaging with 50% ASiR and injection rate of 3ml/s could provide lower image noise of both carotid and three main branches of thoracic aorta arteries than that of 120-kVp scan and provide higher image quality than that of 120-kVp protocol with a smaller amount of iodine and a lower radiation dose.

CLINICAL RELEVANCE/APPLICATION

GSI low keV monochromatic imaging can improve the effect of enhancement and thus reducing the amount of contrast agent, in addition, combined with ASiR, it can decrease the noise of images, improve image quality and reduce the scanning of GSI dose.

NRS406

Assessment of Brain-blood Barrier (BBB) Permeability after Local Brain Cooling with Dynamic Contrast Enhanced MRI in Transient Middle Cerebral Artery Occlusion (MCAO) Rat Model (Station #8)

Eun Soo Kim (Presenter): Nothing to Disclose, Seung-Koo Lee MD, PhD : Nothing to Disclose, Hye Jeong Kim MD : Nothing to Disclose, Kwangsop Lee : Nothing to Disclose

PURPOSE

To evaluate effect of local brain cooling by quantification of the permeability parameters (Ktrans, Kep, Ve, and Vp) presenting the microvascular BBB permeability using dynamic contrast enhanced MRI at a transient middle cerebral artery occlusion(MCAO) rat model

METHOD AND MATERIALS

31 Adult Sprague-Dawley rats (280-300 gram) were used in transient middle cerebral artery occlusion (MCAO) and underwent DCE-MRI on a 3T MRI scanner with 8-channel SENSE wrist coil. MCAO was induced by an intra-luminal filament. For one hour, middle cerebral artery was occluded at rat model. In the stroke control group without treatment, a 1-h MCA occlusion was induced and followd by 3 hour of reperfusion. Immediate MRI was performed and 24 hour of reperfusion was followed. The next day, the second MRI was done. In the local saline infusion group, after a 1-h MCA occlusion, 6ml of cold and warm saline (20°C or 37°C) through the hollow filament for about 10 minutes was infused before the onset of 3 hour of reperfusion. Immediate MRI was also performed and 24 hour of reperfusion was followed. The next day, following MRI was done. In all animals, the rotarod test was performed before MCAO and after MCAO for 1 to 9 days. The following day, all animals were euthanized and their brains were sectioned. To detect BBB breakdown after MCAO, we performed immunohistochemistry for myeloperoxidase (MPO) to identify infiltrating neutrophils associated with the inflammatory response. Data post-processing of permeability parameter was performed using Pride tools provided by Philips Medical system.

RESULTS

There was a statistically significant decrease of Ktrans and Kep at infarction area in cold saline (20°C) group compared with no treatment control group and a borderline decrease of Kep in cold saline (20°C) group, compared with warm saline (37°C) group. The behavior test was no statistically significance between three groups. Compared to total mixed inflammatory cells, the number of MPO-positive cells was significantly higher in control group than in cold and warm saline (20°C or 37°C) groups. In addition, the MPO-positive cells in cold saline (20°C) group are statistically lower than warm saline (37°C) group.

CONCLUSION

Local brain hypothermia induced by local saline infusion at stroke make a stable environment as decrease of BBB breakdown.

CLINICAL RELEVANCE/APPLICATION

DCE MRI can demonstrate the microvascular BBB permeability in stroke research.

NRS407

Volumetric Evaluation of the Dorsal Root Ganglia and Nerves in the Cervical and Brachial Plexus
Using Nerve Specific MRI (Station #9)

Tessa Buckle PhD (Presenter): Nothing to Disclose, Berit Michaela Verbist MD: Nothing to Disclose, Thij Engelen BSC: Nothing to Disclose, Martijn J.A. Malessy MD, PhD: Nothing to Disclose, Fijis Willon Bernard van Leeuwen PhD: Nothing to Disclose

**PURPOSE**

Nerve damage to the cervical or brachial plexus results in reduced sensory and/or motor function. Neuron cell death is related to a decrease in volume of the dorsal root ganglion (DRG). The purpose of this study is to evaluate the use of D-prep MR neurography (MRN) for specific visualization of (damaged) nerves. Morphological features and variations in the DRGs and nerves of the cervical and brachial plexus were assessed in healthy volunteers and patients with tumor or trauma of the plexus.

**METHOD AND MATERIALS**

Five healthy volunteers and six patients (nerve tumor (n=3) or brachial plexus lesion (3T; Philips Ingenia) using a D-prep MRN sequence. A standard T2 STIR was acquired for anatomical reference. The DRGs from C1 through C8 and nerves of the cervical and brachial plexus were assessed for their detectability and dimensions.

**RESULTS**

(Volumetric) measurements were feasible in all patients and volunteers. DRGs of (especially at the cervical plexus) were more clearly visualized with D-prep MRN compared to T2 STIR. In the volunteers DRG volume increased from 30 mm3 in C2-C4 to 180 mm3 in C7-C8. Spinal nerves of the cervical plexus (C1-C4; diameter 19.1 +/- 3.6 mm) and/or brachial plexus (C5-C8; diameter 39.7 +/- 4.8 mm) could be accurately visualized, and traced downward from their ganglion (Figure 1). Nerve trauma did not affect nerve diameter but resulted in a decrease in DRG volume (26 +/- 7%) at C8, compared to the contralateral side and C7. Tumor invasion and localized edema prohibited DRG and nerve measurements when located in close proximity to tumor, while the dimensions of unaffected nerves and DRGs were comparable to the measurements in healthy volunteers.

**CONCLUSION**

Measurement of the diameter of cervical nerves and the volume of their DRGs was feasible with D-prep MRN in both healthy volunteers and patients with either a nerve tumor or neuropathy after trauma. Volumetric measurements showed a decrease in DRG volume after trauma, while the diameter of the nerve was not affected.

**CLINICAL RELEVANCE/APPLICATION**

Morphologic evaluation of nerves based on nerve specific MRI can potentially provide a non-invasive in vivo measure of the degree of functional recuperation after damage to the cervical of brachial plexus.

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Imaging of Neurologic Complications of Pregnancy (Station #10)

Sangam Gurudas Shet Kanekar MD (Presenter): Nothing to Disclose, Shante Bennett MD: Nothing to Disclose, Ritesh Patel: Nothing to Disclose

**TEACHING POINTS**

1. To discuss with illustration neurological complications in pregnant and post-partum women.

**TABLE OF CONTENTS/OUTLINE**

Acute neurological symptoms in pregnant and postpartum women could be caused by exacerbation of a pre-existing neurological condition, by initial presentation of a non-pregnancy-related problem or a new acute-onset neurological problem that is either unique to or occurs with increased frequency during or just after pregnancy. We retrospectively studied CT/MRI brain of 76 pregnant patients who presented with neurological symptoms and complications. We present this exhibit into two main categories: **Common complications**: Eclampsia, Venous thrombosis, Stroke (infarct or haemorrhage), SAH, vasoconstriction syndrome, PRES, Subdural haematoma and; **Rare complications**: Amniotic fluid and air embolism, Pituitary apoplexy, Thrombotic thrombocytopenic, purpura, Wernicke's encephalopathy, aneurysm or AVM rupture, neoplasms, Choriocarcinoma, and Bell's palsy. Early diagnosis of neurological complications in pregnancy is very important to avoid complications to the mother and fetus. Imaging especially MR plays a vital role. This exhibit will be core learning module for understanding the imaging signs in various neurological complications in pregnancy with 'diagnostic pearls' .

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Down but Not out! Reversible Causes of Cranial Neuropathies (Station #11)

Ammar Ahmed Chaudhry MD (Presenter): Nothing to Disclose, Maryam Gul: Nothing to Disclose, Luboslav Woroch DO: Nothing to Disclose, Robert George Peyster MD: Nothing to Disclose, Lev Bangiyev DO: Nothing to Disclose

**TEACHING POINTS**

1. Review cranial nerve anatomy, highlight common regions of nerves involved in pathology  
2. Case-based review of reversible and irreversible cranial nerve pathology highlighting key imaging findings that would narrow the
differential diagnosis? Diagnostic algorithm can assist in navigation and interpretation of cranial nerve pathology.

**TABLE OF CONTENTS/OUTLINE**

TOC/Outline: Cranial nerve pathology is frequently encountered in clinical neuroradiology. Complex cranial nerve anatomy and numerous adjacent key structures can be affected by various pathology. Due to overlap in imaging findings, a systematic approach is required to formulate a relevant differential diagnosis and aid clinicians in arriving at the correct diagnosis. This educational exhibit presents a case-based review utilizing age, gender, anatomic location, imaging characteristics, etc. to formulate an algorithm that will aid in more precise diagnosis of cranial pathology. In addition, treatment, prognosis, and follow-up guidelines will be briefly discussed. Conclusion: A systematic approach is required to narrow the differential diagnosis of cranial lesions. At completion of this educational exhibit, the viewer will be able to provide more accurate assessment of regional pathology, guide clinical management, and recommend appropriate imaging follow-up.

**NRE259**

**Imaging Impact for Facial Aging "Basic Consideration": CT and MR Imaging Description Based on Anatomic Knowledge (Station #12)**

Itsuko Okuda MD (Presenter): Nothing to Disclose, Keiichi Akita MD, PhD: Nothing to Disclose, Katsuhiro Abe: Nothing to Disclose, Masahiro Irimoto MD: Nothing to Disclose, Yukio Shirakabe MD: Nothing to Disclose, Yasuo Nakajima MD: Nothing to Disclose

**TEACHING POINTS**

1. To review the anatomic features of facial aging, and the factors that it occurs in. 2. To realize the human anatomy and CT/MRI imaging anatomy of the face. 3. To explain the comparison of imaging features with anatomic features of the facial structures affecting facial aging.

**TABLE OF CONTENTS/OUTLINE**

1. Aging process in morphology: facial aging appearance, and its principles 2. Human anatomy: facial structures Facial muscles Superficial musculoaponeurotic system (SMAS) Retinacula cutis (RC) Fat layers 3. CT/MR imaging anatomy of the face: description based on human anatomy 4. Image-based: facial structures affecting aging changes 5. Summary: 1) It is necessary to know the physiological changes of the facial aging. 2) It is important to understand the superficial facial imaging features based on anatomy for the analyses mechanism of facial aging. 3) CT and MR images could contribute to evaluate for the facial aging.

**NRE329**

**Where Are You Going?: Geographic Approach for the Evaluation of Perineural Tumor Spread in the Head and Neck (Station #13)**

Vamsi Kunam MD (Presenter): Nothing to Disclose, Deborah L. Reede MD: Nothing to Disclose, Roy Andrew Holliday MD: Nothing to Disclose, Wendy R. K. Smoker MD: Nothing to Disclose

**TEACHING POINTS**

After viewing this module the user will know the:
1. Normal gross and imaging anatomy of nerves commonly involved in perineural tumor spread (PNTS) with emphasis on their relation to various spaces/locations in the head and neck (HandN) 2. Imaging findings of PNTS and common pathways of spread encounter with lesions in specific locations 3. Clinical findings and significance of PNTS

**TABLE OF CONTENTS/OUTLINE**

Cross sectional images and illustrations are used to demonstrate the anatomy of pertinent nerves most commonly involved by PNTS (CN V, CVII and Greater Auricular), and their relationship to various spaces of the HandN. Common connections between these nerves are reviewed, followed by a discussion of pathophysiology, clinical findings, therapeutic and prognostic implications. Direct and indirect imaging findings of PNTS are presented. Cases are used to demonstrate common pathways of PNTS associated with tumors in specific locations. Lesions locations and common patterns of nerve involvement (including retrograde spread) include: Nasopharyngeal tumors (V2 and V3), masticator space (V3), parotid space (VII, auriculotemporal branch and greater auricular nerve), supraorbital lesions (V1), maxillary sinus and buccal space lesions (V2) and hard palate (palatine nerve to the pterygopalatine ganglion, vidian nerve and V2).

**NRS-MOB**

**Neuroradiology Monday Poster Discussions**

**Scientific Posters**

**NRE259**

**Imaging Impact for Facial Aging "Basic Consideration": CT and MR Imaging Description Based on Anatomic Knowledge (Station #12)**

It’suko Okuda MD (Presenter): Nothing to Disclose, Keiichi Akita MD, PhD: Nothing to Disclose, Katsuhiro Abe: Nothing to Disclose, Masahiro Irimoto MD: Nothing to Disclose, Yukio Shirakabe MD: Nothing to Disclose, Yasuo Nakajima MD: Nothing to Disclose

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Vamsi Kunam MD (Presenter): Nothing to Disclose, Deborah L. Reede MD: Nothing to Disclose, Roy Andrew Holliday MD: Nothing to Disclose, Wendy R. K. Smoker MD: Nothing to Disclose

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**NRS-MOB**

**Neuroradiology Monday Poster Discussions**

**Scientific Posters**

**NRE259**

**Imaging Impact for Facial Aging "Basic Consideration": CT and MR Imaging Description Based on Anatomic Knowledge (Station #12)**

Itsuko Okuda MD (Presenter): Nothing to Disclose, Keiichi Akita MD, PhD: Nothing to Disclose, Katsuhiro Abe: Nothing to Disclose, Masahiro Irimoto MD: Nothing to Disclose, Yukio Shirakabe MD: Nothing to Disclose, Yasuo Nakajima MD: Nothing to Disclose

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Vamsi Kunam MD (Presenter): Nothing to Disclose, Deborah L. Reede MD: Nothing to Disclose, Roy Andrew Holliday MD: Nothing to Disclose, Wendy R. K. Smoker MD: Nothing to Disclose

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In intraoperative brain mapping the action naming task is shown to be more promising for localization of Broca’s area than the object naming task (Rofes, 2012). The present study compares effectiveness of the object naming and picture verb generation task for localization of Broca’s area in fMRI.

**METHOD AND MATERIALS**

18 healthy volunteers (age 20-50, 10 women) and 8 patients with a space-occupying lesion in the left frontal lobe (age 17-40, 5 women) took part in the study. All participants were right-handed and native speakers of Russian. During the experimental blocks participants viewed pictures of objects and were asked to either silently name them (object naming) or to silently name actions that could be performed with these objects (picture verb generation task). Patients performed only the second task. In the control blocks participants passively viewed pictures of distorted objects. Patients performed only the second task. Functional MR images were acquired using EPI sequence on Siemens Avanto 1.5T scanner (whole brain imaging, TR 2.52 sec., voxel size 3.6x3.6x3.8mm). Data were analyzed with SPM8 software. Lateralization index (LI) was calculated for the inferior frontal gyrus voxels only.

**RESULTS**

In healthy participants brain activation in experimental vs. control condition was found in triangular and/or opercular part of the inferior frontal gyrus (Broca’s area) in 72,2% of participants for the object naming task and in 95% for the picture verb generation task (p<0.001, exact Fisher’s test). Mean LI was 0.55 (SD=0.4) for the object naming task and 0.86 (SD=0.26) for the picture verb generation task (Mann-Whitney U= 91.5; p=0,024). The patient group has shown no significant difference from the controls in either LI (U=47; p=0.18) or presence of activation (p>0.05).

**CONCLUSION**

Picture verb generation task results in more frequent localization and greater lateralization of Broca’s area than object naming task in healthy native speakers of Russian. Parameters of activation evoked by verb generation in patients with space-occupying lesions do not differ from those in healthy controls, so this task is recommended for pre-neurosurgical brain mapping.

**CLINICAL RELEVANCE/APPLICATION**

The present study suggests that the picture verb generation task rather than object naming task should be used in pre-neurosurgical fMRI mapping of language processing.

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**NRS410 Correlating the Structural Impairment of Hippocampus with Cognitive Disorders in Parkinson’s Disease: a 3T MRI Voxel-based Morphometry and Diffusion Tensor Imaging Study on 80 Patients (Station #3)**

**Bruno Law-Ye JD (Presenter): Nothing to Disclose, Daniel Garcia-Lorenzo : Nothing to Disclose , Romain Valabregue : Nothing to Disclose, Lyidia Yahia-Cherif : Nothing to Disclose, Marie Vidailhet : Nothing to Disclose, Stephane Lehericy MD, PhD : Nothing to Disclose**

**PURPOSE**

Cognitive disorders are among the most frequent non-motor symptoms of Parkinson’s disease, including attentional and executive disorders but also memory disorders. Our goals were to assess the structural impairment of hippocampus in Parkinson’s disease (PD), by means of voxel-based morphometry and diffusion tensor imaging (DTI) in 3 Tesla MRI and determine its relation to mild cognitive impairment (MCI) in PD.

**METHOD AND MATERIALS**

Our population consisted of 55 parkinsonian patients (PD) and 25 healthy volunteers (HV), included prospectively between 2010 and 2012. Diagnosis of idiopathic Parkinson disease had been assessed by neurologists. All patients were tested by a neuropsychologist. PD patients were divided into patients with mild cognitive impairment (MCI, n = 23) and patients without MCI (non MCI, n = 32). All patients underwent brain MRI (3 Tesla, Trio TIM 32 channels, Siemens) including 3D T1 MP-RAGE, 3D T2* and diffusion tensor imaging. Hippocampus were segmented automatically by Freesurfer® software, needing manual corrections in 6 patients (7,5%). Pre-treatments of the T1 and DTI images were performed using FSL® non-linear image registration tool. Then voxel-based-morphometry and DTI analysis provided us the data for hippocampal volumes, fractional anisotropy (FA) and mean diffusivity (MD).

**RESULTS**

Hippocampal MD was significantly increased in PD patients vs HV (0.8496 vs 0.8217 mm²/s; p = 0.01). MD was significantly increased in MCI PD patients when compared with non-MCI PD patients (0.8564 vs 0.8450 mm²/s ; p=0.03). We did not find a significant difference of hippocampal volume in PD vs HV. There was however a trend toward volume decrease in MCI vs non-MCI patients (4057,2 vs 4214,1 cubic millimeters; p= 0.11). There was no significant modification of FA in PD vs HV or MCI vs non-MCI.

**CONCLUSION**

Hippocampal MD was significantly increased in PD patients compared with healthy volunteers, underlining the specific impairment of this structure in Parkinson’s disease. MD was significantly increased in the MCI vs the non-MCI PD. Based on our results, hippocampal MD might be a specific and reliable biomarker in Parkinson’s disease cognitive troubles.

**CLINICAL RELEVANCE/APPLICATION**

Diffusion tensor imaging can demonstrate the structural impairment of hippocampus in Parkinson’s disease (PD) and its correlation to the specific cognitive disorders of PD.
Evaluation of White Matter Injuries Underlying Migraine Headaches after Mild Traumatic Brain Injury
(Station #4)

Joseph Delic MD (Presenter): Nothing to Disclose, Lea M. Alhilali MD: Nothing to Disclose, Michael W. Collins PhD: Nothing to Disclose, Saeed Fakhran MD: Nothing to Disclose

PURPOSE
To determine if a central axonal injury underlies migraine headaches and their variants after mild traumatic brain injury (mTBI) utilizing tract-based spatial statistics (TBSS) analysis of diffusion tensor imaging (DTI).

METHOD AND MATERIALS
DTI was performed in 58 mTBI patients with post-traumatic migraine headaches, including 35 patients with post-traumatic headaches (PTH) with photophobia, 33 with PTH with nausea, 33 with PTH with phonophobia, and 5 patients with post-traumatic migraines with aura. Controls consisted of 17 mTBI patients without migraine headaches. Fractional anisotropy (FA) maps were generated as a measure of white matter integrity and analyzed using TBSS regression analysis utilizing a general linear model and unpaired t-tests.

RESULTS
Compared to controls, mTBI patients with post-traumatic migraines had significantly decreased FA values in the body of the corpus callosum (p

CONCLUSION
White matter injuries underlying post-traumatic migraines are similar to known white matter abnormalities in non-traumatic migraine patients, suggesting a common pathophysiology. Injuries to the corpus callosum were common among patients with PTH, regardless of the type of migrainous symptom, although additional regions of white matter injury were seen in the brainstem in mTBI patients presenting with PTH with phonophobia or nausea.

CLINICAL RELEVANCE/APPLICATION
The similarity of white matter injuries underlying post-traumatic migraines to non-traumatic migraine abnormalities suggests a similar pathophysiology, which may aide our understanding of the origins of these headaches as well as assist in their treatment. The presence of white matter injuries in the brainstem in post-traumatic migraine patients with nausea or phonophobia, however, indicates additional complexity in this subset of patients.

Ferumoxytol MRI Improves Vascular Visualization of Brain Tumors—Aiming for FDA Market Approval
(Station #5)

Csanad Gyorgy Varallyay MD, PhD (Presenter): Nothing to Disclose, Rochelle Fu: Nothing to Disclose, Joao Prola Netto MD: Nothing to Disclose, Bronwyn Elizabeth Hamilton MD: Nothing to Disclose, Edward Neuwelt MD: Nothing to Disclose

PURPOSE
Contrast enhancement in central nervous system (CNS) MR imaging using gadolinium contrast agents visualizes the intravascular compartment and the disrupted blood brain barrier at the same time. Ferumoxytol is beneficial to assess vasculature early after injection, and the parenchymal enhancement peaks around 24h later. As shown previously, high resolution steady state cerebral blood volume (CBV) maps are feasible with ferumoxytol, and the late enhancement may improve the differential diagnosis. This study aimed to further explore the benefits of ferumoxytol MRI of brain tumors.

METHOD AND MATERIALS
52 MRI studies of 21 patients with primary malignant brain tumors were analyzed to compare vascular visualization and parenchymal enhancement between ferumoxytol and gadoteridol. Each MR study included three days of MR imaging using gadoteridol on day1, 510mg or 2mg/kg iv. ferumoxytol on day2, and on day3 24h post ferumoxytol. Anatomical T1, T2 and high resolution T2*-weighted images pre- and post contrast were scored by 3 radiologists using a 3 point scale for visualization criteria: #1 contrast enhancement, #2 border delineation, #3 thickness of enhancement and #4 abnormal vascularity.

RESULTS
With one point non inferiority margin (suggested by the FDA), ferumoxytol was non inferior to gadoteridol in criteria #1-3 at 510mg and non inferior in criteria #2 and 3 at 2mg/kg. The mean differences in visualization scores between ferumoxytol at 510mg and gadoteridol were -0.47 (95%CI -0.85, -0.08), -0.31 (95%CI, -0.76, 0.13) and -0.17 (95%CI -0.58, 0.25) in criteria #1, 2 and 3 respectively. Further, ferumoxytol is superior to gadoteridol in visualizing abnormal vasculature, with a mean score of 1.35 point higher (95% CI 0.87,1.84; P<0.0001) at 510mg and 0.57 point higher (95% CI 0.20,0.93; P=0.0003) at 2 mg/kg.

CONCLUSION
Ferumoxytol can be used as an MR contrast agent in the CNS. The improved visualization of abnormal vasculature provides additional information to gadoteridol. A multicenter phase 3 clinical trial is being designed to support FDA market approval of ferumoxytol as an MR imaging agent in CNS neoplasms.

CLINICAL RELEVANCE/APPLICATION
Ferumoxytol (Feraheme, approved for iv. iron replacement) is now clinically available for off label use as an MR imaging agent, with increasing CNS and non CNS applications.

**NRS413**

**ECG–Gated CT Angiography of Intracranial Aneurysms (Broken and Not) Using 320 Row Detector CT Scanner: Identification of Higher Risk Aneurysms and Rupture Site before Surgery. (Station #6)**

**Federico D'Orazio (Presenter): Nothing to Disclose , Alessandra Splendiani MD : Nothing to Disclose, Aldo Victor Giordano : Nothing to Disclose, Sergio Carducci : Nothing to Disclose, Massimo Gallucci MD : Nothing to Disclose, Carlo Masciocchi MD : Nothing to Disclose**

**PURPOSE**

To evaluate the diagnostic potentials of ECG--gated CT angiography (CTA) in identifying a sub-population of unbroken aneurysms with higher rupture risk, and the rupture site when studying ruptured intracranial aneurysms.

**METHOD AND MATERIALS**

In the period between January 2012 and December 2013, 70 ECG--gated CTA were performed using a 320 row-detector CT scanner, in as many patients with cerebral aneurysms both broken and not. Scan protocol was designed as follows: first scan without contrast media: 

FV=160mm/120KV/300mA/Rot.Time=0,35s/Collimation=0,5mm; second scan, with contrast enhancement and superimposable on the first to obtain further bone subtraction, had duration of one heart beat between an R-R interval and was acquired co-registering the patient's ECG. The subtracted volume was reconstructed with a step interval of 5%, obtaining 20 volumes per each contrast scan. An MPR and 3D rendering of the aneurysms could then be observed in motion during the whole R−R interval. The sites where abnormal/not synchronized movement of the aneurysmal wall were found, were subsequently compared with its intra-operative observation during neurosurgical treatment, which was filmed.

**RESULTS**

Among the aneurysms studied, 55 belonged to the anterior circulation and 15 to the posterior one. We found abnormal or not synchronized movement in part of the aneurysmal wall in 15% of the unbroken intracranial aneurysms; similar findings were found in about 45% of the broken aneurysms studied in emergency before surgical treatment, and in that case it always matched with the cleavage site highlighted during surgery.

**CONCLUSION**

ECG--gated CTA is a promising add to the study of intracranial aneurysms. It can help in identifying a subpopulation of intracranial aneurysms with higher risk of rupture or directly demonstrate the site of rupture before surgical treatment. This information can be useful when planning both their endovascular and surgical treatment.

**CLINICAL RELEVANCE/APPLICATION**

When in an ECG-gated intracranial CTA a not-synchronous movement of part of the aneurysmal wall is observed, this may correspond (in the case of a ruptured aneurysm) to the rupture site, or may actually correspond (in an aneurysm with higher risk of rupture) to the region of higher weakening of its wall.

**NRS414**

**Gait-related Brain Resting State Functional Connectivity in Patients with Idiopathic Parkinson Disease after Peripheral Pressure Neuro Stimulation (Station #7)**

**Carlo Cosimo Quattrocchi MD, PhD (Presenter): Nothing to Disclose , Claudia Piervincenzi : Nothing to Disclose, Carlo Augusto Mallio MD : Nothing to Disclose, Yuri Errante : Nothing to Disclose, Filippo Carducci : Nothing to Disclose, Bruno Beomonte Zobel MD : Nothing to Disclose**

**PURPOSE**

To evaluate the changes of the brain resting state functional connectivity (RSFC) induced by Peripheral Pressure Neuro Stimulation (PPNS) in patients with Idiopathic Parkinson Disease (IPD).

**METHOD AND MATERIALS**

Ten consecutive patients with IPD underwent brain fMRI pre- and post-sham and pre- and post-effective PPNS by means of the electomedical device GONDOLA (Ecker Technologies Sagl, Lugano, CH). Imaging data were acquired using a Siemens 1.5-T MAGNETOM Avanto (Siemens, Erlangen, Germany). A total of 80 volumes during a 4.50 min scan was acquired before and after sham and effective PPNS in resting state condition. RSFC analysis was carried out using the seed-ROI based analysis. Seed ROIs were positioned on basal ganglia (nuclei accumbens, nuclei striatum, globi pallidi, thalami, as obtained with FIRST segmentation tool), on primary sensory-motor cortices (as on the Harvard-Oxford Cortical Atlas) and on the cerebellum (as on the MNI Structural Atlas). Individual differences for pre- and post-effective PPNS (treatment) and pre- and post-sham conditions were obtained and then entered into a paired-group t-test analysis.

**RESULTS**

Clusters of significantly (corrected p < 0.05) higher RSFC were found in the group analysis for the treatment condition effect with respect to the sham condition effect in the following areas: right cerebellar cortex and right lateral inferior Occipital Cortex for the sensory-motor seed ROI (max Z score 3.25); left lateral superior occipital cortex and left cerebellum for the cerebellar seed ROI (max Z score 3.64).

**CONCLUSION**
Our results show a consistent effect of the PPNS on increasing resting state functional connectivity (RSFC) of brain regions involved in visuo-spatial integration and processing, in sensory-motor integration and anticipation of body position during movements after effective PPNS.

**CLINICAL RELEVANCE/APPLICATION**

The study could give more insight into the intrinsic properties of functional brain organization associated with novel rehabilitation strategies in IPD.

**NRS415**

**Medial Occipital Lobe Hyperperfusion— A Poor Prognostic Sign for Patients with Hypoxic-anoxic Injury (Station #8)**

Adam de Havenon MD (Presenter): Nothing to Disclose, David Tirschwell MD, MSc: Nothing to Disclose, Yoshimi Anzai MD: Nothing to Disclose, Ali Sultan-Qurraie: Nothing to Disclose, Wendy A. Cohen MD: Nothing to Disclose, Mahmoud Mossa-Basha MD: Nothing to Disclose, Jalal Badi Andre MD: Consultant, Hobbitview, Inc Research Grant, Koninklijke Philips NV

**PURPOSE**

To determine the prognostic value of arterial spin labeling (ASL) MRI after hypoxic-anoxic brain injury (HAI).

**METHOD AND MATERIALS**

A retrospective database and patient chart review was performed in adult patients (>17 years of age) with HAI, admitted to the ICU from 2012-2014 with GCS 100 mL/100g/min. Correlation with electroencephalogram (EEG) was made for 14/15 patients, with cerebrospinal fluid creatine kinase BB isoenzyme (CSF CK-BB) for 8/15 patients, and with somatosensory evoked potentials (SSEPs) for 8/15 patients.

**RESULTS**

15 of the 17 patients who met inclusion criteria had hyperperfusion on ASL and abnormal diffusion weighted imaging (DWI), typically involving cerebral cortex and/or the basal ganglia. 14/15 patients with abnormal CBF died. The ASL abnormalities comprised smaller volumes than the diffusion restriction. 8/15 had prominent or isolated hyperperfusion of the bilateral medial occipital lobes on ASL; in this group 7/8 EEGs showed a burst suppression pattern and 4/5 SSEPs were bilaterally absent, both indicators of poor prognosis. In the 7 patients without medial occipital hyperperfusion, only 1/7 EEGs showed burst suppression, with the remainder mostly showing non-specific slowing, and 2/4 SSEPs were bilaterally absent. CSF CK-BB, a sensitive and specific marker of severe brain injury, was higher in 5/8 patients with medial occipital hyperperfusion, in whom the mean was 829 ng/mL versus 263 ng/mL for 3/7 patients without medial occipital hyperperfusion. In 7/7 hyperperfusion patients with susceptibility weighted imaging, there was absence of venous deoxyhemoglobin signal in matched areas of infarct and hyperperfusion. Two patients in this study had normal CBF, both of whom had negative DWI and an excellent clinical outcome.

**CONCLUSION**

ASL hyperperfusion may have a complimentary role in the evaluation of patients with severe HAI and warrants further study. The positive predictive value of death is 93% and rises to 100% when restricted to patients with medial occipital lobe hyperperfusion, which may be a particularly malignant pattern given the discordantly elevated rates of burst suppression on EEG, bilaterally absent SSEPs, and high CSF CK-BB in that subgroup.

**CLINICAL RELEVANCE/APPLICATION**

Hypoxic-anoxic brain injury is a potentially devastating neurologic illness with uncertain prognosis. Multimodal and accurate diagnostic testing, perhaps including ASL, is crucial for decision-making in the acute setting.

**NRS416**

**Evaluation of rFOV DWI in Patients with known or Suspected Congenital Spine Malformations (Station #9)**

Suraj Serai PhD (Presenter): Nothing to Disclose, Suchandrima Banerjee: Employee, General Electric Company, Marguerite Care MD: Nothing to Disclose, Aaron Betts MD: Nothing to Disclose, Rupa Radhakrishnan MBBS: Nothing to Disclose, Blaise Vincent Jones MD: Nothing to Disclose

**PURPOSE**

Diffusion-weighted imaging has the potential to substantially enhance assessment of the child with congenital spine abnormalities, by increasing sensitivity and confidence in the identification of restricting lesions such as dermoid/epidermoid inclusion cysts and abscesses. Current commercially available EPI techniques for DWI are plagued by severe susceptibility artifact and image distortion, limiting their clinical value and acceptance. Reduced FOV (rFOV) DWI is a new technique where the excited FOV is reduced in the phase-encoding direction by using a 2D spatially selective echo-planar RF excitation pulse. This technique has the potential to improve image quality and increase acceptance of spinal DWI as a useful clinical tool in pediatric MR imaging. This study compares this new technique with standard EPI based DWI in children referred for suspected or known congenital spine abnormalities.

**METHOD AND MATERIALS**

This study was performed under an IRB approved protocol. 55 pediatric patients referred for MR imaging of the lumbar spine for known or suspected congenital spine malformations had imaging that included both the rFOV DWI (0.25 phase FOV) and routine EPI DWI sequences. Studies were performed on a 1.5T GE HDx MRI scanner with 40 mT/m maximum gradient strength and 150 mT/m ms maximum slew rate using an 8-channel Spine coil. The individual diffusion-weighted series were evaluated independently by 3 reviewers for lesion detection,
image quality, and confidence in diagnosis.

RESULTS

The rFOV DWI scans scored higher on measures of image quality (ref. figure) and reviewer confidence. Objective measures of image quality were more consistent for the rFOV sequences for all reviewers.

CONCLUSION

When imaging the pediatric spine for congenital malformations, the rFOV technique substantially improves image quality and radiologist confidence in comparison to standard EPI based DWI techniques.

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted imaging has the potential to increase sensitivity and confidence in the diagnosis of lesions that complicate the management of children with congenital spine abnormalities, but it has been sparingly used because of problems with susceptibility artifact that degrades image quality. By reducing this artifact, rFOV should result in more routine use of DWI in the spine in children, with an associated increase in the ability to detect restricting lesions such as dermoid and epidermoid inclusion cysts.

NRE202

Lesions of the Petrous Bone: Clues to Narrowing the Differential Diagnosis (Station #10)

Gabriela De La Vega Muns MD (Presenter): Nothing to Disclose, Nicholas Mark Gutierrez MD: Nothing to Disclose, Jeffrey A. Chuy BA, MD: Nothing to Disclose, Charif Sidani MD: Nothing to Disclose

TEACHING POINTS

1. Review the relevant anatomy of the petrous bone
2. Review pseudolesions, common, and uncommon lesions of the petrous bone along with their CT and MRI findings
3. Help create an algorithm to help the radiologist narrow the differential diagnosis of common petrous bone lesions taking into account the relevant clinical history and imaging characteristics

TABLE OF CONTENTS/OUTLINE

- Petrous bone anatomy
- Different classifications of petrous apex lesions: etiology vs. imaging characteristics
- Algorithm for narrowing the differential diagnosis of common petrous bone lesions
- Sample cases and review of CT and MRI imaging findings:
  o Nonexpansile lesions
  o Expansile nonaggressive lesions of the petrous apex
  o Expansile aggressive lesions of the petrous apex

NRE277

Comprehensive Imaging Assessment of the Post-operative Orbit, Pearls and Pitfalls (Station #11)

Farbod Nasseri MD (Presenter): Nothing to Disclose, Seyed Ali Nabavizadeh: Nothing to Disclose, Laurie A. Loevner MD: Nothing to Disclose, Yin Jie Chen MD: Nothing to Disclose, Arastoo Vossough MD, PhD: Nothing to Disclose, Suyash Mohan MD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To present a comprehensive and systematic review of the imaging spectrum of the post-operative orbit. 2. To familiarize the radiologist with a broad range of oculoplastic and orbital surgeries and different types of orbital implants and prostheses. 3. To review imaging features of potential surgical complications and discuss conceivable pitfalls.

TABLE OF CONTENTS/OUTLINE

We will present a comprehensive pictorial review of postoperative orbit including:

1) Orbital surgeries:
   a) Orbital wall reconstruction, augmentation and decompression
   b) Orbital enucleation, evisceration and exenteration with globe prostheses
2) Lacrimal apparatus surgery such as dacryocystorhinostomy and nasolacrimal duct stents
3) Strabismus surgery
4) Glaucoma surgery
5) Retinopexy and scleral buckles
6) Lens surgery and implants
7) Eyelid surgery and eyelid weights

NRE298

Getting an Ear Full: Imaging Features of Tympanosclerosis (Station #12)

Michael Cathey MD (Presenter): Nothing to Disclose, Tabassum A. Kennedy MD: Nothing to Disclose, Samuel P. Gubbels MD: Nothing to Disclose, Lindell R. Gentry MD: Nothing to Disclose

TEACHING POINTS

Tympanosclerosis (TS) is a fairly common but radiographically underrecognized cause of postinflammatory ossicular fixation and noncholesteatomatous conductive hearing loss. Pathologically it represents submucosal deposition of fibrous or calcium within the tympanic membrane, middle ear and rarely the mastoid. Some investigators report an association with chronic secretory otitis media to be as high as 25%. A history of ventilation tubes and tympanic membrane perforation likewise put patients at risk. Radiologists should be aware of these associations and TS should strongly be suspected, particularly if there is a history of significant conductive hearing loss with imaging features of chronic otitis. Clinically significant lesions can be subtle at imaging, but areas of hyperdensity associated with the tympanic membrane, ossicular chain, ligaments and middle ear should raise suspicion. The focus of this exhibit is to review the radiologic features of TS, emphasizing relevant anatomy, pathologic correlation and treatment options.

TABLE OF CONTENTS/OUTLINE
Fat, Flaps and Failures: The Complicated Evaluation for Recurrence in the Post-Treatment Neck (Station #13)

Marin Alisa McDonald MD, PhD (Presenter): Nothing to Disclose, Julie Bykowski MD: Nothing to Disclose

TEACHING POINTS

Understanding the expected appearance of surgical resection, reconstruction and post-radiation changes is critical for appropriate diagnosis of treatment complications and recurrence. Awareness of limitations of CT, MR and PET in the determination of recurrence.

TABLE OF CONTENTS/OUTLINE

1. Review of NCCN guidelines for surgical and/or adjuvant treatment of head and neck squamous cell carcinoma, based on stage and adverse features on pathology. 2. Case series illustrating expected CT, MR and PET post-operative and post-radiation treatment changes and corresponding symptoms with those of proven complications or recurrence. Specific case series include: lymph node dissection changes, persistent nodes after radiation therapy (Fig 1), lymphatic recurrence myocutaneous flap reconstruction (Fig 2), flap failure, recurrence at flap margin (Fig 3) soft tissue edema (Fig 4), soft tissue infection (Fig 5), local recurrence chondronecrosis, cartilage invasion osteonecrosis, osteomyelitis, direct osseous invasion, osseous metastases delayed sarcoma after prior radiation recurrence in patients who are immunocompromised or have 2nd malignancy. 3. Brief self-assessment test to consolidate the basic principles and approach for successful diagnosis of these complicated cases.

Musculoskeletal Imaging (Central, Plexus, Nerve and Disc Imaging)

Scientific Papers

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Mon, Dec 1 3:00 PM - 4:00 PM Location: E450B

Participants

Moderator Michael Gregory Fox MD: Stockholder, Pfizer Inc
Moderator Bruno C. Vande Berg MD, PhD: Nothing to Disclose

Sub-Events

SSE14-01 DTI-derived Measurements and Three-dimensional Tractography in Neoplastic Conditions of Brachial Plexus

Yifang Bao (Presenter): Nothing to Disclose, Weijun Tang MD: Nothing to Disclose, Dao-Ying Geng MD, PhD: Nothing to Disclose

PURPOSE

To explore diffusion tensor imaging (DTI) and tractography in directly demonstrating nerve fiber changes of brachial plexus neoplastic lesions.

METHOD AND MATERIALS

Ten patients with neoplastic lesions and 1 patient with tumor-like lesion underwent DTI on a 3.0-T system in addition to conventional MR protocol, including 8 cases of schwannoma, 1 case of invasive fibrous tumor and 1 case of synovial sarcoma, which were proved pathologically. Fractional anisotropy (FA) and tractography of brachial plexus were obtained.

RESULTS

The lesions were clearly delineated with tractography, and the nerve fibers were displaced and deformed obviously. Mean FA values of lesions, nearby nerve fibers and the opposite normal nerve fibers were obtained as follows: 0.235±0.031, 0.352±0.074 and 0.403±0.108 in 8 cases of schwannoma, 0.229±0.062, 0.272±0.075, 0.352±0.046 in the invasive fibrous tumor, 0.289±0.153, 0.383±0.001 and 0.412±0.104 in the synovial sarcoma, respectively. Mean FA value of the tumor-like lesion was 0.308±0.095, and its opposite normal nerve fiber was 0.409±0.003.

CONCLUSION

DTI could clearly show the relationship between neoplastic lesions and brachial plexus nerve fibers, and FA value could provide more accurate information for diagnosis of tumor lesions.
**CLINICAL RELEVANCE/APPLICATION**

DTI-derived measurements and three-dimensional tractography could clearly show the relationship in neoplastic conditions of brachial plexus, and FA value could provide more accurate information for diagnosis of tumor lesions.

**Diagnostic Value of Diffusion Tensor Imaging (DTI) and Tractography (DTT) of Lumbar Nerve Roots on Lumbar Disc Herniation Assessment**

Qingwei Song BS, BEng (Presenter); Nothing to Disclose, Meiyu Sun: Nothing to Disclose, Qiang Wei: Nothing to Disclose, Shao Wu Wang MD: Nothing to Disclose, Ziheng Zhang: Nothing to Disclose, Minting Zheng: Nothing to Disclose, He Qing Wang MSc: Nothing to Disclose

**PURPOSE**

To evaluate the DTI and DTT of lumbar nerve roots in the diagnosis of lumbar disc herniation through all the related qualitative info from tractography and quantitative measures of the fraction anisotropy (FA) and apparent diffusion coefficient (ADC) values.

**METHOD AND MATERIALS**

This prospective study was approved by our Institutional Review Board and written informed consent was obtained. Twenty patients (age=27-67 years; 10 males, 10 females) with clinically confirmed lumbar disc herniation and without a previous history of spinal trauma, surgery, or neurological diseases (left: 11; right: 9) and 20 normal controls (age=26-63 years; 10 males, 10 females) were performed DTI, DTT and axial T2W MRI scanning on a GE Signa HDxt 3.0T MR scanner. All fiber tracking images were taken in lumbar nerve roots with fused T2WI image as an anatomic background and the FA and ADC values of left- and right-side nerve roots were also measured for both groups. The difference between groups was compared with t-test. A P value ≤0.05 was considered statistically significant. All the original and morphologic iamges from tractography were blindly reviewed and analyzed by two experienced observers.

**RESULTS**

A high success rate (>90%) of achieving the DTI with tractography of lumbar nerve roots was obtained. At the pressurized areas of the lumbar nerve roots, a high signal intensity was observed in the T2WI of DTI from the patients comparing with the contralateral and from the controls. In addition, apparent morphological changes were observed at the corresponding regions in a pattern of shift, bending, sparsity in number and so on. No significant difference in the mean FA and ADC values between the left- and right-side nerve roots at same level (L5 and S1) and in between. However, the mean FA values of compressed nerve roots were statistically lower (p

**CONCLUSION**

DTI with tractography provides an abundant diagnostic information with specificity on qualitative- and quantitative-wise, which is great helpful to assess the disorders with lumbar nerve root compression.

**CLINICAL RELEVANCE/APPLICATION**

A strong suggestion of putting DTI scan into the clinical MRI setting for lumbar nerve roots related examinations.

**Qualitative and Quantitative Properties of the Human Annulus Fibrosus Using DTI Followed by Fiber Tracking**

Dan Stein (Presenter): Nothing to Disclose, Yaniv Assaf: Nothing to Disclose, Gali Dar: Nothing to Disclose, Haim Cohen MSc.: Nothing to Disclose, Viviane Slon MSc.: Nothing to Disclose, Bahaa Medlej MD: Nothing to Disclose, Israel Hershkovitz PhD : Nothing to Disclose

**PURPOSE**

To explore the 3D architecture of the intervertebral discs’ (IVD) annulus fibrosus (AF) via Diffusion Tensor Imaging (DTI) followed by fiber tracking in order to provide qualitative as well as quantitative information regarding its structure.

**METHOD AND MATERIALS**

Eight segments of the AF taken from human lumbar cadavers were scanned on a 7T\30 MRI scanner followed by fiber tracking. The data was than quantitatively analyzed and the structure is presented three dimensionally.

**RESULTS**

The mean fractional anisotropy (FA) and mean diffusivity (MD) for the fibers were respectively in the range of 0.35-0.58/ 1.3±0.7 . Mean fiber density for all samples was 84 Mean length found was 2.6mm ±1.9mm and the mean interlamellar angle was in the range of 28°-61°.

**CONCLUSION**

To our knowledge this is the first time the annulus fibrosus, or any other fibrocartilage tissue has undergone DTI followed by fiber tracking. This has enabled to see for the first time the 3D structure as well as generate quantitative information to characterize the structure, its frequent failure and explore biological variations as well as a source for better computer based models of the IVD.

**CLINICAL RELEVANCE/APPLICATION**
The exploration of the 3D structure and the quantitative characteristics of the AF using DTI and fiber tracking could be used for objective assessment of the IVD's condition.

**SSE14-04**

Assessment of Glycosaminoglycan Content in Lumbar Intervertebral Discs with Chemical Exchange Saturation Transfer Imaging: Comparison with T1-rho Measurement

Osamu Togao, MD, PhD (Presenter); Nothing to Disclose, Akio Hiwatashi, MD; Nothing to Disclose, Koji Yamashita, MD, PhD; Nothing to Disclose, Kazufumi Kikuchi, MD; Nothing to Disclose, Tatsuhiro Wada; Nothing to Disclose, Jochen Keupp, PhD; Employee, Koninklijke Philips NV, Hiroshi Honda, MD; Nothing to Disclose

**PURPOSE**

Glycosaminoglycan CEST (gagCEST) imaging is an emerging molecular MR imaging technique to measure in-vivo glycosaminoglycan content in cartilaginous tissue. The purpose of this study was to evaluate the utility of this method in assessments of lumbar intervertebral disc degeneration (IDD) by comparing with T1-rho, an established quantitative biomarker of IDD, and conventional morphological assessments.

**METHOD AND MATERIALS**

Thirty-six intervertebral discs in nine volunteers (age 32.7 ± 5.9 years; 8 males, 1 female) were examined with both gagCEST imaging and T1-rho measurements. GagCEST imaging was conducted on a 3T MR scanner using a 32-channel torso coil for signal reception and 2-channel parallel transmission via the body coil. A sagittal image covering L2/3, 3/4, 4/5, and L5/S1 levels was acquired using 2D turbo spin-echo sequences with driven equilibrium refocusing. Saturation pulses were irradiated with duration of 1.0 s, and B1 power of 0.8 μT. Other parameters were as follows: TR/TE=5s/6ms, FOV=2302mm2, resolution=1.8×1.8×5mm3, 25 frequency offsets δ = -3.3 ppm (step 0.25ppm) and Ω = -160 ppm. B0 maps were acquired separately for B0 inhomogeneity correction. CEST effect was defined as: MTR asym = (S[-Appm] - S[+Appm])/S0. GagCEST value was defined as the average CEST effects from 0.5 to 1.5 ppm. For T1-rho measurements, 3D gradient-echo sequence was performed with five spin-lock times (1, 25, 50, 75, 90 ms). A region-of-interest was placed in nucleus pulposus of each intervertebral disc. In addition, T2-weighted images were obtained to assess Pfirrmann grading for morphological assessment of IDD.

**RESULTS**

The number of intervertebral discs with Pfirrmann grading 1, 2, 3, 4, 5 was 13, 13, 1, 7, 2, respectively. GagCEST values significantly correlated with T1-rho (r = 0.63, P< 0.0001, linear regression) in lumbar intervertebral discs. Both gagCEST values (r = -0.76, P< 0.0001, Spearman rank correlation) and T1-rho (r = -0.65, P< 0.0001, Spearman rank correlation) correlated with Pfirrmann grades.

**CONCLUSION**

GagCEST correlated with T1-rho and Pfirrmann grades in lumbar IDD. GagCEST can provide a quantitative measure to assess IDD.

**CLINICAL RELEVANCE/APPLICATION**

GagCEST imaging correlated with both quantitative T1-rho measurements and qualitative morphological assessments of IDD in the lumbar spine, and thus GagCEST can be a noninvasive and quantitative biomarker of IDD.

**SSE14-05**

Diffusion Tensor Imaging Focusing on Lower Cervical Spinal Cord Using 2D Reduced FOV Interleaved Multislice Single-Shot Diffusion-weighted Echo-Planar Imaging: Comparison with Conventional Single-Shot Diffusion-weighted Echo-Planar Imaging

Eun Hae Park; Nothing to Disclose, Seok Hahn, MD (Presenter); Nothing to Disclose, Young Han Lee, MD; Nothing to Disclose, Sungjun Kim, MD; Nothing to Disclose, Ho-Taek Song, MD; Nothing to Disclose, Jin-Suck Suh, MD; Nothing to Disclose

**PURPOSE**

To evaluate the performance of diffusion tensor imaging (DTI) in the cervical spinal cord by comparing 2D ss-IMIV-DWEPI (interleaved multisection inner volume) and custom made 2D ss-DWEPI in a clinical population with focusing at lower cervical spinal cord .

**METHOD AND MATERIALS**

From July to November 2013, total 21 patients who underwent cervical spinal MR with DTI were retrospectively enrolled (M:F= 7:14, mean age 45.5 years, range 24-76). All MRI examinations were performed using a 3.0 T with a phased-array spine coil including two different 2D reduced FOV DTI sequences: 2D ss-IMIV-DWEPI(DTI) and 2D ss-DWEPI without interleaved(cDTI). For quantitative analysis, two musculoskeletal radiologists blinded to sequence measured fractional anisotropy (FA), and apparent diffusion coefficient (ADC) value throughout the whole cervical spinal cord (C1-T1). For qualitative analysis, the readers rated each image based on spinal cord distortion, dural margin delineation, depiction of intervertebral disc. Both quantitative and qualitative evaluations were analyzed as upper and lower segment. For quantitative analysis t-test was used and for qualitative analysis, Two-way analysis of variance(ANOVA) and t-test were performed.

**RESULTS**

FA were significantly higher and ADC value were significantly lower at iDTI than those of cDTI (0.679 versus 0.563, respectively for FA, 631 versus 1026, respectively for ADC value, P<0.0001), and this was consistent at lower segment of spinal cord. The reviewers rated iDTI superior in terms of all assessed characteristics. And the mean score of iDTI of lower segment was significantly higher compared with cDTI as well as higher segment(<0.0001).
CONCLUSION

2D rFOV ss-IMIV-DWEPI can be used to acquire higher performance in terms of improving image quality even in lower segment of cervical spinal cord and is preferred to conventional 2D rFOV ss-DWEPI.

CLINICAL RELEVANCE/APPLICATION

2D rFOV ss-IMIV-DWEPI can be used to acquire higher performance in terms of improving image quality even in lower segment of cervical spinal cord and is preferred to conventional 2D rFOV ss-DWEPI.

Whole Body MR Neurography - Initial Results


PURPOSE

1. Evaluate the quality and feasibility of 3D whole body MR neurography (MRN) imaging. 2. Assess disease burden (nerve thickening and hyperintensity) in the diffuse known neuropathy cases and compare with controls. 3. Evaluate differences among the different types of diffuse neuropathies.

METHOD AND MATERIALS

Patients and healthy controls were all imaged on 3 Tesla MR scanner. 2-3 sets of 3D anatomic MRN (1.5mm isotropic from the base of skull to proximal thighs), contiguous axial T2W SPAIR of the symptomatic extremity, and DTI of brachial and LS plexuses was obtained with a total imaging time of upto 1hr-1S minutes. Two readers assessed the quality in consensus and independently performed all the measurements. Nerve diameter and signal intensity ratios was measured for C5-7 nerves, L4-S1 nerves, sciatic and femoral nerves bilaterally. FA and ADC values were also measured. Tractography was obtained in all cases. Descriptive analysis and analytic methods (paired t test, weighted kappa calculation for differences) were used.

RESULTS

18 subjects [7 controls (6 men, 1 women, age 28+/−3 yrs) and 11 patients with neuropathy (4 men, 7 women; mean age 45+/−4 yrs)] were studied. The diagnosis included- Charcot Marie Tooth disease (CMT) type IA (7/11), CMT type II (1/11) CMT type III: HNPP (2/11) and MMN (1/11). Most exams (95%) recieved good-excellent imaging quality. The nerve thickening was significant in LS plexus, sciatic and femoral nerves (p<0.05); while hyperintensity was significant in brachial and LS plexuses (p<0.05). The most thickening was seen in CMT type IA. MMN showed patchy bilateral nerve thickening. Pseudomasses were seen in CMT 1A. Nerve entrapments in extremity were seen in (4/11) cases. Mean left to right differences in DTI values were not significantly different. ADC of brachial plexus, LS plexus and FA values of LS plexus were significant (p<0.05). Tractography differences were observed among normal and abnormal subjects. Interobserver performance was good to excellent.

CONCLUSION

Whole body MRN is feasible method with good to excellent interobserver performance that can be objectively used to evaluate disease burden and detect differences among diffuse neuropathies.

CLINICAL RELEVANCE/APPLICATION

Whole body MR neurography is a non invasive method that can be applied to diffuse neuropathy cases to evaluate the disease burden, differentiate among various causes of diffuse neuropathy and to detect superimposed entrapments.
3D CE-MRA for Imaging of Unruptured Cerebral Aneurysms: A Hospital-based Prevalence Study

Jing Li (Presenter): Nothing to Disclose, Bi-Xia Shen: Nothing to Disclose, Chao Ma: Nothing to Disclose, Jianping Lu MD: Nothing to Disclose

CONCLUSION
This hospital-based study suggested a higher prevalence (8.8%) of unruptured cerebral aneurysms observed by three-dimensional contrast enhanced MRA than the results of previous reports. We also found the most common site of aneurysm is the carotid siphon, and most lesions (85.3%) had a maximum diameter of 3-7 mm in the patient cohort.

Background
Contrast enhanced MRA can help overcome the limitations of other imaging techniques to clearly display the details of cerebral aneurysms. We investigated the prevalence of unruptured cerebral aneurysms by using three-dimensional contrast enhanced MRA in a tertiary comprehensive hospital in China.

Evaluation
The cases were prospectively recorded at our hospital between February 2009 and October 2010. Two observers independently analyzed all MRAs on a workstation to obtain the age-specific prevalence, sex-specific prevalence and characteristics of unruptured cerebral aneurysms.

Discussion
Of the 3,993 patients (men:women = 2159:1834), 408 unruptured cerebral aneurysms were found in 350 patients (men:women = 151:199). The prevalence was 8.8% overall (95% CI, 8.0-10.0%), with 7.0% for men (CI, 6.0-8.0%) and 10.9% for women (CI, 9.0-12.0%). The overall prevalence of unruptured cerebral aneurysms was higher in women than in men (P<0.001) and increased with age in men and women. Prevalence peaked at age group 75-80 years. Forty two patients (11.7%) had multiple aneurysms, including 10 (2.9%) male patients and 32 (9.1%) female patients. The most common site of aneurysm was the carotid siphon, and most lesions (85.3%) had a maximum diameter of 3-7 mm.

Color-coded Cerebral CT Angiography: Technical Feasibility and Benefits in Patients with Acute Ischemic Stroke

Kolja Thierfelder MD, MSc (Presenter): Nothing to Disclose, Lukas Havla: Nothing to Disclose, Sebastian Ekkehard Beyer: Nothing to Disclose, Felix G. Meinel MD: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Wieland H. Sommer MD: Nothing to Disclose

PURPOSE
Recently introduced dynamic CT angiography (dCTA) provides additional information on cerebral hemodynamics, but small differences in the time delay of maximum enhancement are hard to detect. Our aim was to evaluate a new method of displaying dCTA datasets in which the time of maximum enhancement is displayed in a range of colors (color-coded CT angiography, cCTA) in different types of acute ischemic stroke.

METHOD AND MATERIALS
Our sample comprised 16 patients who underwent multiparametric CT due to suspected stroke. MRI-confirmed diagnoses were M1- (6), ACI- (4), both M1- and ACI- (1), and carotid t occlusion (3). Two patients had no cerebral pathology. cCTA was reconstructed from whole-brain CT perfusion raw data that were acquired on a 128-slice CT with one scan acquired every 1.5s. The delay of vessel enhancement was quantified using the time-to-maximum (Tmax) of the residue functions. Tmax parameters were color-coded and then filtered. Non-enhancing areas were masked. cCTA is a composite image of angiographic data superimposed by colored Tmax maps. Two experienced readers evaluated whether cCTA provided additional information when compared to conventional CTA alone with respect the Circle of Willis, M1-segment, M2-segement, and leptomeningeal collaterals. The visualization of the collateralization and the diagnostic confidence in determining occlusion site were rated using maximum intensity projections of 20, 40, and 60mm slab thicknesses on 5-point Likert scales.

RESULTS
The combined use of CTA and cCTA in comparison to CTA alone provided additional information in the assessment of the Circle of Willis in 6/16, the M1-segment in 12/16, the M2-segment in 14/16, and the collateralization status in 15/16 of the patients. Leptomeningeal collaterals were most favorably visualized on the 40- (3.53±0.63), followed by the 60- (3.36±0.50), and the 20mm-MIP (2.92±1.09). The occlusion site was most favorably represented on the 20- (2.71±1.12), followed by the 40- (2.54±1.09), and the 60mm-MIP (1.87±1.20).

CONCLUSION
cCTA yields a comprehensive and easy-to-read overview of the cerebral hemodynamics. It provides additional information with respect to collateralization status and occlusion site.

CLINICAL RELEVANCE/APPLICATION
CCTA is a simple and robust technique that demonstrates cerebral hemodynamics at a glance. It might be beneficial for a fast and reliable assessment of the collateralization status in patients with acute ischemic stroke.
Carotid CT Angiography: Comparison among Low-tube-Voltage Imaging, Monochromatic Imaging and Conventional Imaging with Different Contrast Injection Rate

Yunjing Xue MD (Presenter): Nothing to Disclose, Qing Duan MD: Nothing to Disclose, Jin Wei: Nothing to Disclose, Lin LIN: Nothing to Disclose

PURPOSE
To compare the image quality, radiation dose and contrast medium (CM) dose of Gemstone spectral imaging (GSI) protocol with 3ml/s injection rate, a 100-kVp protocol with 4ml/s rate and a conventional 120-kVp protocol with 5ml/s rate in carotid CTA.

METHOD AND MATERIALS
With local ethical committee approval, 63 patients were prospectively enrolled in the study, CM (320 mg I/mL) were used: 21 were scanned with parameters of 120 kVp, 240 mAs, using CM of 320 mgI/mL with 5ml/s injection rate, another 22 were scanned with 100 kVp, 288 mAs, 50% ASiR, using the same CM with 4ml/s injection rate, and the other 20 were scanned with GSI mode, 315 mAs, 50% ASiR with 3 ml/s injection rate. Monochromatic images of 60keV were evaluated in GSI group. Image quality (IQ) of the three groups was compared in terms of arterial enhancement, noise, signal-noise-ratio (SNR) and contrast-to-noise ratio (CNR). The effective dose (ED) of radiation and contrast dose were calculated and compared. Data were analyzed by using One-way ANOVA test.

RESULTS
The 100-kVp group (443.28±72.58 HU) showed significantly higher enhancement in carotid artery compared to 120-kVp (376.60±62.42 HU) and GSI (365.69±69.43HU) groups (p<0.05, respectively). Both 100-kVp and GSI groups showed significantly lower noise in carotid (11.31±2.20HU, 9.78±2.88HU) and three main branches of thoracic aorta arteries (19.21±3.61HU, 19.05±4.04HU) than 120-kVp group (26.69±4.68HU) (p<0.05, respectively) whereas there was no significant difference in CNR and SNR among three groups (all of them P>0.05). Compared with 120-kVp group (3.21±0.30mSv, 67.5±13.72ml), the ED and CM dose reduced 10.9 % and 26.79 % in GSI group (2.86±0.07mSv, 49.42±8.91ml), and 25.86% and 12.89 % in 100-kVp group (2.38±0.002mSv, 58.80±9.81ml), respectively. There was significant difference in comparison between any two groups both in ED and CM dose (all of them P<0.05).

CONCLUSION
Among these three protocols, the GSI (50%ASiR, 3ml/s) used the lowest CM dose while the 100-kVp (50%ASiR, 4ml/s) protocol had the lowest radiation dose. Both GSI and 100-kVp could reduce noise of carotid and three main branches of thoracic aorta and therefore improve IQ.

CLINICAL RELEVANCE/APPLICATION
Compared with the 100-kVp protocol, GSI protocol can provide more information. We can balance the image quality, useful information, radiation dose and CM dose of 100-kVp or spectral scanning and choose the optimized CTA protocol to achieve the best clinical effect.

Time Resolved CT Angiography of the Brain: 70kVp Outperforms 80kVp

Reade Andrew De Leacy MBBS : Nothing to Disclose, Idoia Corcuera Solano MD (Presenter): Nothing to Disclose, Lawrence N. Tanenbaum MD : Speaker, General Electric Company Speaker, Bracco Group Speaker, Bayer AG Speaker, Siemens AG

PURPOSE
Lower kVp settings for brain CTA offer improved contrast resolution and signal to noise at lower radiation dose. We evaluated the efficacy of 70 kVp and 80 kVp time resolved/4D whole brain CTA extracted from perfusion studies obtained in patients with suspected acute stroke.

METHOD AND MATERIALS
The institutional review board approved this retrospective study. 37 patients who underwent CTP/ TR CTA of the brain for the investigation of stroke between 12/2012 and 11/2013 were enrolled in this study. 17 patients were imaged using an 80kVp protocol and 20 patients using a 70kVp protocol. Independent subjective assessment of image quality against expected standards of quality for CTA was performed in a blinded fashion by a consensus read of two Neuroradiologists in 16 out of 37 cases (8 from each of the 70kVp and 80kVp groups) using a 5-point scale. The remaining 21 cases could not be qualitatively assessed, as the isotropic data were not preserved in archive. CTDI values for all 37 studies were recorded and the 70 and 80 kVp studies compared. Signal to noise ratios were calculated from the peak arterial phase of the dynamic datasets. Quantitative variables were assessed using Mann-Whitney U test analysis. Qualitative variables were compared using the Student t test for unpaired samples with Welch's correction.

RESULTS
Both 70 and 80 kVp CTA groups provided image quality that matched or exceeded expectations. The 70kVp CTA provided statistically significant higher SNR with greater contrast enhancement at 45% lower CTDIvol compared to 80kVp.

CONCLUSION
Time resolved CTA studies at both 70 kVp and 80kVp provide acceptable image quality in the assessment of acute stroke. The 70 kVp studies provided greater enhancement and higher SNR and were lower in dose than...
those at 80 kVp.

**CLINICAL RELEVANCE/APPLICATION**

Time resolved CTA can be extracted from whole brain perfusion studies avoiding the radiation and iodine dose of a dedicated exam and providing critical dynamic information unobtainable with a static study. This evaluation proves these studies are acceptable in quality and could replace dedicated CTA studies in this setting. Comparison of the efficacy of the 70 kVp studies to those obtained at 80 kVp reveals greater contrast enhancement efficacy and lower dose. This validation study may encourage the widespread adoption of 70kVp CTP/Dynamic 4D CTA techniques in patients with suspected stroke.

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**SSE16-05**

**X-ray Phase-contrast Computed Tomography: Characterization and Classification of Human Carotid Atherosclerosis**

Holger Hetterich MD (Presenter): Nothing to Disclose, Marian Willner: Nothing to Disclose, Julia Herzen: Nothing to Disclose, Sandra Fill: Nothing to Disclose, Fabian Bamberg MD, MPH: Speakers Bureau, Bayer AG Speakers Bureau, Siemens AG Research Grant, Siemens AG, Tobias Saam MD: Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG, Franz Pfeiffer: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose

**PURPOSE**

X-ray imaging of vascular pathology relies on X-ray absorption as the source of tissue contrast. However, X-rays are also subject to other physical phenomena including phase-shift, which holds promise to provide substantially improved contrast in low-absorbing materials like biological soft tissue. Techniques for plaque characterization and classification in both in-vivo and ex-vivo imaging have been a major focus in cardiovascular research in the last decade. This study aims to provide evidence for the potential of phase contrast computed tomography (PCT) for tissue characterization and plaque classification in human carotid arteries.

**METHOD AND MATERIALS**

Human carotid artery specimens were examined at an experimental set-up consisting of X-ray tube (35kV) grating interferometer and detector. Histopathology served as standard of reference. In PCT important plaque components including fibrous (FIB), lipid-rich (LIP) and calcified (CAL) tissue were identified and plaques were classified according to modified AHA criteria as normal intima/type I-II, III, IV/V, VI, VII or VIII by reviewers blinded to histopathology data. Diagnostic accuracies for the detection and differentiation of plaque components and types were evaluated.

**RESULTS**

In total 81 corresponding PCT/histopathology sections were evaluated. FIB, LIP and CAL were detected with sensitivity, specificity and accuracy of ≥0.91. In histopathology normal intima/type I-II was present in 23 (28.4%), type III in 8 (9.9%), type IV/V in 12 (14.8%), VI in 10 (12.3%), type VII in 20 (24.6%) and type VIII in 8 (9.9%) of all cross-sections. Sensitivity, specificity and accuracy were high for all analyzed plaque types (all >0.88) with a good level of agreement (κ=0.81). Inter-observer variability was excellent with an intraclass correlation coefficient of 0.91 (κ=0.85).

**CONCLUSION**

Carotid atherosclerotic plaques can accurately be evaluated by PCT in an ex-vivo setting. Future studies will have to evaluate its potential in-vivo.

**CLINICAL RELEVANCE/APPLICATION**

Phase-contrast computed tomography holds promise for improved, comprehensive assessment of cardiovascular disease including atherosclerotic plaque characterization.

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**SSE16-06**

**CT Angiography of the Carotid Arteries: Comparison of Lower-tube-Voltage CTA with Lower Iodinated Contrast Injection Rate and Conventional CTA**

Yunjing Xue MD (Presenter): Nothing to Disclose, Qing Duan MD: Nothing to Disclose, Jin Wei: Nothing to Disclose, Lin LIN: Nothing to Disclose

**PURPOSE**

To investigate the clinical value of using a 100-kVp protocol with 50% adaptive statistical iterative reconstruction (ASiR) and with lower contrast injection rate (4ml/s) in carotid CTA by comparison with a conventional 120-kVp protocol with normal contrast injection rate (5ml/s).

**METHOD AND MATERIALS**

With local ethical committee approval, 43 patients were prospectively enrolled in the study: 21 were scanned with parameters of 120 kVp, 240 mAs, using contrast medium (CM) of 320 mg I/ml, with 5ml/s injection rate, and the other 22 were scanned with 100 kVp, 288 mAs, 50% ASiR using the same contrast of 4ml/s injection rate. Image quality (IQ) of the two groups was compared in terms of HU of enhanced arterial, noise, signal-noise-ratio (SNR) and contrast-to-noise ratio (CNR). The effective dose (ED) of radiation and contrast...
RESULTS

The carotid artery in 100-kVp (50% ASiR, 4ml/s) group (443.28±72.58HU) demonstrated higher enhancement than that of 120-kVp group (376.60±62.42HU), (P<0.05). Both carotid and three main branches of thoracic aorta showed lower image noise in 100-kVp (11.31±2.20HU, 19.21±3.61HU) than that of 120-kVp group (14.29±2.81HU, 26.69±4.68HU), (P<0.05, respectively). The CNR and SNR of carotid artery and three main branches of thoracic aorta has no significant differences statistically between two groups (all of them P>0.05), respectively. The effective dose and contrast dose of the 100-kVp with 4ml/s protocol (2.38±0.002 mSv, 58.80±9.81ml) was 25.86% and 12.89% lower than that of the 120-kVp with 5ml/s protocol (3.21±0.30 mSv, 67.5±13.72 ml), respectively. There was significant difference statistically in effective dose of radiation and contrast dose between two groups (P<0.05), respectively.

CONCLUSION

The use of 100 kVp with 50% ASiR and lower injection rate of CM could provide higher artery enhancement and superior image quality than that of 120-kVp protocol with a smaller amount of iodine and a lower radiation dose.

CLINICAL RELEVANCE/APPLICATION

A low tube voltage with ASiR technique and lower injection rate has a potential clinical application prospect by moderately decreasing radiation and contrast agent doses with superior image quality at carotid CTA.

SSE17

Neuroradiology (Parkinson's Disease)

PURPOSE

To investigate the discriminability of combined MRI R2* and diffusion tensor imaging (DTI) in differentiating Parkinson's disease (PD) from two atypical Parkinsonisms (PSM): multiple system atrophy (MSA) and progressive supranuclear palsy (PSP).

METHOD AND MATERIALS

High resolution MRI (T1-, T2-weighted, T2*, and DTI) were obtained from 15 Controls, 15 PD patients, 13 MSA-P patients, and 14 PSP patients. R2*, fractional anisotropy (FA), and mean diffusivity (MD) values in the putamen, caudate, global pallidus, substantia nigra (SN), and red nucleus (RN) were obtained from each subject using an automatic labeling software followed by manual correction of the regions of interest. Repeated measures MANCOVA was used to assess differences in imaging measurements between groups adjusting for age and gender. Logistic regression and receiver operational characteristic curves then were used to quantify discrimination ability of R2* and DTI measures individually and in combination.

RESULTS

Compared with Controls, both PD and PSM showed increased R2* values (p=0.0137 for PD; p=0.0014 for MSA; p<0.0001 for PSP) and decreased FA values (p=0.0088 for PD; p=0.0004 for MSA; p<0.0096 for PSP) in the SN. Only PD demonstrated increased R2* values the RN (p=0.0105) compared to Controls. Interestingly, only PSM showed decreased FA values in the putamen (p<0.0001 for MSA, p<0.0001 for PSP) and the caudate (p<0.0001 for MSA, p<0.0001 for PSP) compared to Controls. Combined R2* and DTI (c-statistic=0.763) showed an improved performance in differentiating PD from PSM compared to either R2* (c-statistic=0.615) or DTI (c-statistic=0.71) alone.

CONCLUSION

Combined R2* and Diffusion Tensor Imaging Differentiate Parkinson’s Disease from Atypical Parkinsonism

Sangam Gurudas Shet Kanekar MD (Presenter): Nothing to Disclose, Guangwei Du MD, PhD : Employee, Siemens AG, China, Mechelle Lewis : Nothing to Disclose, Lan Kong : Nothing to Disclose, Xuemei Huang : Nothing to Disclose

SSE17-01

Combined R2* and Diffusion Tensor Imaging Differentiate Parkinson’s Disease from Atypical Parkinsonism

Sangam Gurudas Shet Kanekar MD (Presenter): Nothing to Disclose, Guangwei Du MD, PhD : Employee, Siemens AG, China, Mechelle Lewis : Nothing to Disclose, Lan Kong : Nothing to Disclose, Xuemei Huang : Nothing to Disclose

PURPOSE

To investigate the discriminability of combined MRI R2* and diffusion tensor imaging (DTI) in differentiating Parkinson’s disease (PD) from two atypical Parkinsonisms (PSM): multiple system atrophy (MSA) and progressive supranuclear palsy (PSP).

METHOD AND MATERIALS

High resolution MRI (T1-, T2-weighted, T2*, and DTI) were obtained from 15 Controls, 15 PD patients, 13 MSA-P patients, and 14 PSP patients. R2*, fractional anisotropy (FA), and mean diffusivity (MD) values in the putamen, caudate, global pallidus, substantia nigra (SN), and red nucleus (RN) were obtained from each subject using an automatic labeling software followed by manual correction of the regions of interest. Repeated measures MANCOVA was used to assess differences in imaging measurements between groups adjusting for age and gender. Logistic regression and receiver operational characteristic curves then were used to quantify discrimination ability of R2* and DTI measures individually and in combination.

RESULTS

Compared with Controls, both PD and PSM showed increased R2* values (p=0.0137 for PD; p=0.0014 for MSA; p<0.0001 for PSP) and decreased FA values (p=0.0088 for PD; p=0.0004 for MSA; p<0.0096 for PSP) in the SN. Only PD demonstrated increased R2* values the RN (p=0.0105) compared to Controls. Interestingly, only PSM showed decreased FA values in the putamen (p<0.0001 for MSA, p<0.0001 for PSP) and the caudate (p<0.0001 for MSA, p<0.0001 for PSP) compared to Controls. Combined R2* and DTI (c-statistic=0.763) showed an improved performance in differentiating PD from PSM compared to either R2* (c-statistic=0.615) or DTI (c-statistic=0.71) alone.

CONCLUSION

Combined R2* and Diffusion Tensor Imaging Differentiate Parkinson’s Disease from Atypical Parkinsonism
The pattern of MRI changes (across modalities and locations) in PD and PSM suggests that MSA and PSP involve more diffuse MRI alterations that include the putamen and caudate, whereas the changes in PD are more focused on the SN. Combining R2* and DTI measures improved the discrimination between PD and PSM.

**CLINICAL RELEVANCE/APPLICATION**

The current study highlights that imaging measurements, in particular R2* and DTI measures, may reflect different aspects of the neurodegenerative process and may be useful to separate PD from MSA-P and PSP.

**SSE17-02**

**Evaluating Regional T2* Values in the Early Diagnosis of Parkinson Disease Using Susceptibility Weighted Imaging**

Bo Wang MMed (Presenter): Nothing to Disclose, Kunhua Wu MMed: Nothing to Disclose

**CONCLUSION**

Abnormal brain iron deposition was observed at the subclinical stage of PD patients. Pathologic iron deposition locations included SNc, SNr and RN, but not GP, PUT, CN, THA or FWM. SWI provide useful information in the detection of brain iron deposition, therefore, it may be applied in the early diagnosis of PD.

**Background**

Parkinson disease (PD) is a degenerative disease of CNS which has great impact on elderly people. The purpose of this study is to quantitatively evaluate the variations of T2* values in several cerebral regions and to devise a potential applicable method for the early diagnosis of Parkinson disease (PD) applying susceptibility weighted imaging (SWI).

**Evaluation**

Fifty-nine hemi-PD patients and Fifty-nine healthy control subjects were recruited and underwent routine scanning and SWI on 3T (GE Signa HD, WI). The age and gender of the subjects were matched between patient and control groups. T2* value was measured bilaterally in substantia nigra pars compacta (SNc), substantia nigra pars reticulata (SNr), red nucleus (RN), globus pallidus (GP), putamen (PUT), head of caudate nucleus (CN), thalamus (THA) and frontal white matter (FWM).

**Discussion**

T2* values varied significantly in the region of SNc (P<0.05) between two groups, whereas no statistical significant differences were observed in GP, PUT, CN, THA or FWM ipsilaterally. Comparing ipsilateral hemi-PD patients with contralateral control subjects, T2* values were significantly different in SNc (P<0.01) and SNr (P<0.05), whereas no statistical significant differences were observed in GP, PUT, CN, THA or FWM. Comparing hemi-PD patients contralaterally with control subjects contralaterally, T2* values were significantly different in the regions of SNc and RN (P<0.05), with no observed differences in GP, PUT, CN, THA or FWM. No significant difference of T2* values was demonstrated in any targeted regions between hemi-PD patients contralaterally and control subjects ipsilaterally. Fig. Cerebral SNc, SNr, RN magnified color figure of T2* and its graphics resolution of ROI in the normal subjects.

**SSE17-03**

**Chemical Exchange Saturation Transfer MR Imaging of Parkinson’s Disease at 3 Tesla**

Chunmei Li MD (Presenter): Nothing to Disclose, Shuai Peng: Nothing to Disclose, Rui Wang: Nothing to Disclose, Jinyuan Zhou PhD: Nothing to Disclose, min chen: Nothing to Disclose

**PURPOSE**

To demonstrate the feasibility of using chemical-exchange-saturation-transfer (CEST) imaging to detect Parkinson’s disease (PD) in patients at 3 Tesla.

**METHOD AND MATERIALS**

27 PD patients (17 men and 10 women; age range, 54-77 years) and 22 age-matched normal controls (13 men and nine women; age range, 55-73 years) were scanned on a Philips 3 Tesla MRI system. Magnetization transfer spectra with 31 different frequency offsets (-6 to 6 ppm) were acquired at two transverse slices of the head, including the basal ganglia and midbrain. The quantitative image analysis and comparison between PD patients and normal controls were performed by two radiologists. The FLAIR image was used as the anatomical reference to draw regions of interest (substantia nigra, red nucleus, globus pallidus, putamen, caudate, gray matter and white matter of frontal lobe and occipital lobe of both hemispheres). MTRasym (3.5 ppm), MTRtotal (the integral of the MTRasym spectrum in the range of 0 to 4 ppm) and MTRtotal (3.5 ppm) were measured for each region. The values of each side were recorded as a separate sample. Independent t-tests were used to compare the differences in CEST imaging signals between PD patients and normal controls.

**RESULTS**

The MTRtotal in the substantia nigra was significantly lower in PD patients than in normal controls (P = 0.006), which could be associated with the loss of dopaminergic neurons. The protein-based CEST imaging signals at the frequency offset of 3.5 ppm in the globus pallidus, putamen, caudate and frontal gray matter were significantly increased in PD patients, compared to normal controls (P < 0.001, P = 0.003, P < 0.001, P=0.005, respectively). The MTRtotal in the occipital gray matter was significantly lower in PD patients than in normal controls (P = 0.005). No significant differences in the MTRasym (3.5 ppm) and MTRtotal were found between PD patients and normal controls for the frontal white matter and occipital white matter. No significant differences in MTR (15.6 ppm) were found between PD patients and normal controls for all these regions.

**CONCLUSION**
CEST imaging signals could potentially serve as imaging biomarkers to aid in the non-invasive molecular diagnosis of PD.

**CLINICAL RELEVANCE/APPLICATION**

CEST imaging signals could provide information additional to conventional MR imaging and potentially serve as imaging biomarkers to aid in the non-invasive molecular diagnosis of PD.

### SSE17-04

**High Nigral Iron Deposition in LRRK2 and Parkin Mutation Carriers Measured Using MRI R2* Relaxometry**

Nadya Pyatigorskaya (Presenter): Nothing to Disclose, Michael Sharman: Nothing to Disclose, Jean-Christophe Corvol: Speaker, H. Lundbeck A/S Speaker, Allon Therapeutics Inc Speaker, Biogen Idec Inc Speaker, Impax Laboratories, Inc Speaker, Novartis AG, Romain Valabregue: Nothing to Disclose, Alexis Brice: Nothing to Disclose, Stephane Lehericy MD, PhD: Nothing to Disclose

**PURPOSE**

The goal of this work was investigating iron deposition in the basal ganglia and thalamus of the patients with affected and presymptomatic Leucine-rich repeat kinase 2 (LRRK2) and Parkin-associated Parkinson’s disease (PD) using T2* relaxometry.

**METHOD AND MATERIALS**

Twenty genetic PD subjects (4 symptomatic and 2 non-symptomatic Parkin subjects, 9 symptomatic and 5 non-symptomatic LRRK2 subjects) were compared with 20 patients with idiopathic PD (IPD) and 20 healthy subjects. Images were obtained at 3 Tesla using multi-echo T2 and T2* sequences. R2 and R2* values were calculated in the substantia nigra (SN), striatum, globus pallidus, and thalamus.

**RESULTS**

In the SN, R2* values increased in IPD and mutation-carrying patients as compared to controls (p<0.0001) and in mutation-carrying patients as compared to IPD patients (p=0.0023). Asymptomatic mutation carriers showed R2* values higher than in controls (p = 0.021), but not significantly different from those in IPD patients (p = 0.58). Randomization-permutation methods allowed separate analysis of LRRK2 and Parkin groups, which showed significant increase of R2* in each group in both symptomatic (p = 0.003 for LRRK2 and Parkin) and asymptomatic (p= 0.003 for LRRK2 and p=0.01 for Parkin) mutation careers. There were no changes in the other structures or in R2 values. No significant correlation was found between clinical variables in IPD and symptomatic mutation carriers and between R2* obtained using the mean left and right SN values or the most affected hemisphere separately. As expected, in IPD patients, the HY disability score correlated significantly with age, disease duration, and the UPDRS score. The UPDRS score also correlated with disease duration.

**CONCLUSION**

The results are consistent with increased iron load in LRRK2- and Parkin-mutation carriers; R2* measurements may be used to investigate nigrostriatal damage in preclinical mutation-carrying patients. Increased R2* in asymptomatic PD-mutation carriers and the lack of correlation with disease duration indicate iron deposition in the early pre-clinical phase of the disease, while the lack of clinical correlations suggest that R2* may not be a reliable marker of disease severity.

**CLINICAL RELEVANCE/APPLICATION**

R2* rate measured by MRI is suggested as a promising biomarker of nigrostriatal damage in mutation-carrying PD patients. Its causal relationships and prognostic values should be investigated in longitudinal studies.

### SSE17-05

**Application of Apparent Diffusion Coefficient Values Derived from Ultra-high b-value in Parkinson’s Disease**

Xueying Ling PhD (Presenter): Nothing to Disclose, Hao Xu: Nothing to Disclose, Zhou-Shu ZHAO: Nothing to Disclose, chang-zheng shi: Nothing to Disclose, Zhong-Ping Zhang MMedSc: Nothing to Disclose, Li Huang: Nothing to Disclose

**PURPOSE**

To investigate the value of ultra-high b values in evaluating brain damage in PD, based on the previous findings that apparent diffusion coefficient (ADC) derived from ultra-high b values possessed more diagnostic value than that from standard b values.

**METHOD AND MATERIALS**

Twenty PD patients and 18 controls underwent diffusion-weighted imaging (DWI) with standard b values (0, 1000 sec/mm²) and fifteen multiple b values (0, 30, 50, 100, 200, 300, 500, 800, 1000, 1500, 2000, 3000, 3500, 4000, 5000 sec/mm²). ADCst map was calculated from standard b-values, and ADCuh was calculated from extra-high b values (2000-5000 sec/mm²), respectively. Moreover, the maps of pure diffusion coefficient (D) and pseudo-diffusion coefficient (D*) were derived from high (200-2000 sec/mm²) and low (0-200 sec/mm²) b values, respectively. ADCst, ADCuh, D, D* of globus pallidus (GP), putamen (P), substantia nigra (SN) were achieved and compared between PD patients and controls, respectively.

**RESULTS**
ADC$_{uh}$ of GP, P and SN in PD patients was significantly lower than that in the control subjects ($P = 0.000$ or $P = 0.001$ $p<0.001$), while no significant difference was observed in ADC$_{st}$, D, D* of GP, P and SN between PD patients and the controls ($P > 0.05$).

CONCLUSION

ADC$_{uh}$ of GP, P and SN were observed to decrease in PD patients, indicating that ADC$_{uh}$ might be an parameter for evaluating brain damage in PD patients.

CLINICAL RELEVANCE/APPLICATION

ADC$_{uh}$ can be applied as a parameter to demonstrate brain damages in specific brain areas in PD patients.

**Abnormal Patterns of Iron Deposition in the Striatonigral Tract in Parkinson's Disease**

Miriam Peckham MD (Presenter): Nothing to Disclose, Barbara Ann Holshouser PhD : Nothing to Disclose, Khashayar Dashtipour MD : Nothing to Disclose, Alexander Boscanin BS : Nothing to Disclose, Nicole Gatto PhD, MPH : Nothing to Disclose, Camellia Kani : Nothing to Disclose, Sheri L. Harder MD : Nothing to Disclose

PURPOSE

To determine if susceptibility (iron deposition) in the striatonigral tract in patients with Parkinson's Disease is different from age matched controls.

METHOD AND MATERIALS

MRI's of the brain were obtained from 22 patients consisting of 12 Parkinson's Disease (PD) patients and 10 age-matched controls. Susceptibility measurements were made along the striatonigral tract (SNT) using SWI mapping software (SWIM) by investigators blinded to the status of the patients. Maximum and mean values were recorded from both SNT in each 2 mm axial slice spanning from its origin at the globus pallidus to its junction with the substantia nigra (SN). Measurements stopped being acquired at the level where the red nucleus was no longer visualized. Values were analyzed by an unblinded statistician to evaluate iron deposition patterns of the tract and at the SNT/SN junction.

RESULTS

Measurements obtained of the SNT showed a trend of increased susceptibility at the inferior aspect of the tract in comparison to the more superior aspect of the tract in PD patients, while the control patients had a more homogeneous appearance. The standard deviation of maximum values related to the right SNT were significantly increased in PD patients compared to controls ($p$-value $<0.05$). The right SNT/SN junction in PD patients demonstrated significantly increased susceptibility.

CONCLUSION

There was significantly increased iron deposition at the most inferior levels of the SNT in PD patients compared to controls, as measured by susceptibility changes.

CLINICAL RELEVANCE/APPLICATION

The abnormal distribution of iron deposition along the SNT may be related to dysfunction of axonal transport and play a role in the pathogenesis of PD.
PURPOSE

Collateral circulation is an important predictor of outcomes in acute ischemic stroke. Perfusion imaging may provide a unique opportunity to measure collateral flow prior to angiography. Using the IMS III data, we assessed the relationship between CT perfusion (CTP) parameters and leptomeningeal collateral flow.

METHOD AND MATERIALS

CTP was not a prerequisite for entry or patient selection in IMS III, however a total of 104 subjects received a baseline CTP study. We analyzed the CTP studies using Olea medical software to quantify core (dual threshold of rCBF less than 30% and Tmax >6 sec.), critically hypoperfused volumes (Tmax >6 sec) and mismatch ratios. Collateral grade on conventional angiograms (DSA) before treatment were assessed on a 5-point scale. Collaterals on baseline CT angiogram (CTA) were categorized as good, intermediate and poor. Spearman correlation test was used to measure the strength of association.

RESULTS

Of total of 104 baseline CTP studies, 95 were diagnostic. 33 patients were randomized to IV tPA only, 62 to endovascular therapy. Of 95 subjects, 85 (89.5%) had a concurrent baseline CTA; 59 (62.1%) had a conventional angiogram. Median age was 69 years, baseline NIHSS17.0, and baseline ASPECTS 8.0. Of 85,76 (89.4%) had baseline intracranial occlusions; 16 ICAT, 39 M1, 17 M2, and 4 other occlusions. The median (range) CTP core volume was 5.8 (0-81.6) ml and hypoperfused volume was 55.8 (0-383.4). Among 53 subjects, the CTA collateral grade was poor in 17 (32.1%), intermediate in 15 (28.3%) and good in 21 (39.6%). Among 41 subjects, the DSA collateral grade was 0 in 3 (7.3%), 1 in 8 (19.5%), 2 in 15 (36.6%), 3 in 12 (29.3%) and 4 in 3 (7.3%). Hypoperfused volumes correlated with baseline NIHSS (p =0.0382) and core volumes correlated well with baseline ASPECTS (p). 

CONCLUSION

Higher CTP mismatch ratios and smaller cores were significantly associated with robust baseline collaterals in IMS III.

CLINICAL RELEVANCE/APPLICATION

CTP may be used as a non-invasive tool to predict collateral status, however warrants further investigation.
**PURPOSE**

We sought to determine whether limited cerebrovascular reactivity (vascular reserve) is associated with reduced neuronal density, or a loss of neuronal integrity, using NAA/Cr as a surrogate measure for neuronal health.

**METHOD AND MATERIALS**

Single voxel MR spectroscopy for NAA/Cr (N-acetylaspartate:creatinine) ratio (TR 1500, TE 144 ms) was undertaken in 32 patients undergoing cerebrovascular reactivity (CVR) imaging. Cerebrovascular reactivity was measured using blood oxygen level dependent (BOLD) MR imaging with a carbon dioxide stimulus. Mirror image paired spectroscopy voxels, one voxel per hemisphere, were typically selected for each patient. Voxels were centered over normal appearing cortical parenchyma as seen on conventional imaging, in locations which maximized the CVR difference between voxels of a pair as seen on CVR maps. Mean CVR values within the volume of parenchyma corresponding to each spectroscopy voxel were measured. The correlation between NAA/Cr and CVR was assessed. The NAA/Cr in the voxels with limited CVR was compared to the NAA/Cr in the relatively spared voxels in the opposite hemisphere.

**RESULTS**

There was a weak but statistically significant correlation between CVR and NAA/Cr (n=32, r=0.322; P=0.010). In patients in whom there was visually obvious unilateral CVR reduction with contralateral sparing (n=13), the mean NAA/Cr ratio was lower in voxels with reduced CVR compared to the spared voxels in the opposite hemisphere (Mean NAA/Cr in voxels with reduced CVR = 1.849, SD 0.312; Mean NAA/Cr in voxels with spared CVR = 1.982, SD 0.282; P=0.027).

**CONCLUSION**

These results suggest that there may be reduced neuronal density or neuronal degradation in areas of reduced vascular reactivity. The weak correlation could relate to several factors including limited patient numbers, and the variable fraction of grey and white matter included within voxels.

**CLINICAL RELEVANCE/APPLICATION**

A reduced vascular response (CVR) may result in damaging effects on the health of grey matter, which is inconspicuous on conventional imaging. This may have clinical implications such as cognitive impairment and dementia.

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**SSE18-04**

Assessment of Brain-blood Barrier (BBB) Permeability after Local Brain Cooling with Dynamic Contrast Enhanced MRI in Transient Middle Cerebral Artery Occlusion (MCAO) Rat Model

Eun Soo Kim (Presenter): Nothing to Disclose, Seung-Koo Lee MD, PhD: Nothing to Disclose, Hye Jeong Kim MD: Nothing to Disclose, Kwanseop Lee: Nothing to Disclose

**PURPOSE**

To evaluate effect of local brain cooling by quantification of the permeability parameters (Ktrans, Kep, Ve, and Vp) presenting the microvascular BBB permeability using dynamic contrast enhanced MRI at a transient middle cerebral artery occlusion (MCAO) rat model

**METHOD AND MATERIALS**

31 Adult Sprague-Dawley rats (280-300 gram) were used in transient middle cerebral artery occlusion (MCAO) and underwent DCE-MRI on a 3T MRI scanner with 8-channel SENSE wrist coil. MCAO was induced by an intra-luminal filament. For one hour, middle cerebral artery was occluded at rat model. In the stroke control group without treatment, a 1-h MCA occlusion was induced and followed by 3 hour of reperfusion. Immediate MRI was performed and 24 hour of reperfusion was followed. The next day, the second MRI was done. In the stroke control group without treatment, a 1-h MCA occlusion was induced and followed by 3 hour of reperfusion. Immediate MRI was performed and 24 hour of reperfusion was followed. The next day, the second MRI was done. In the local saline infusion group, after a 1-h MCA occlusion, 3ml of cold and warm saline (20°C or 37°C) through the hollow filament for about 10 minutes was infused before the onset of 3 hour of reperfusion. Immediate MRI was also performed and 24 hour of reperfusion was followed. The next day, following MRI was done. In all animals, the rotarod test was performed before MCAO and after MCAO for 1 to 9 days. The following day, all animals were euthanized and their brains were sectioned. To detect BBB breakdown after MCAO, we performed immunohistochemistry for myeloperoxidase (MPO) to identify infiltrating neutrophils associated with the inflammatory response. Data post-processing of permeability parameter was performed using Pride tools provided by Philips Medical system.

**RESULTS**

There was a statistically significant decrease of Ktrans and Kep at infarction area in cold saline (20°C) group compared with no treatment control group and a borderline decrease of Kep in cold saline (20°C) group, compared with warm saline (37°C) group. The behavior test was no statistically significance between three groups. Compared to total mixed inflammatory cells, the number of MPO-positive cells was significantly higher in control group than in cold and warm saline (20°C or 37°C) groups. In addition, the MPO-positive cells in cold saline (20°C) group are statistically lower than warm saline (37°C) group.

**CONCLUSION**

Local brain hypothermia induced by local saline infusion at stroke make a stable environment as decrease of BBB breakdown.

**CLINICAL RELEVANCE/APPLICATION**
CTARS is a reliable method of assessing recanalization of PIAOL and its’ distal vasculature. Future studies should

**RESULTS**

Agreement on PIAOL location varied from excellent proximally (ICA, M1, proximal M2) to poor for more distal sites. Agreement was moderate to substantial (Kw=0.67, 0.49, 0.55) and fair to moderate on DTB (Kw=0.41, 0.17, 0.31) at baseline. Reliability was excellent for PIAOL debulking (Kw=0.87, 0.90, 0.92), residual flow change (Kw=0.91, 0.88, 0.86), and moderate to substantial for follow-up DTB (Kw=0.78, 0.43, 0.51). Near perfect agreement was obtained on final CTARS (Kw=0.90, 0.96, 0.88).

**CONCLUSION**

CTARS is a reliable method of assessing recanalization of PIAOL and its distal vasculature. Future studies should

**PURPOSE**

Diffusion kurtosis imaging (DKI) is a quantitative measure of the non-Gaussianity of diffusion process in both white matter and gray matter; it has more advantages over DTI and can yield additional kurtosis information, so DKI may better characterize the complexity or heterogeneity of the tissue microenvironment. The purpose of this study is to investigate the temporal evolution of DKI-derived parameters and their application value in ischemic stroke.

**METHOD AND MATERIALS**

114 patients with ischemic stroke were recruited in the study, including 8 cases of hyperacute infarction (<6hours), 14 acute infarction (7~24hours), 60 early subacute infarction (1~7days), 20 late subacute infarction (8~14days), and 12 chronic infarction (15days~2months). All the patients underwent DWI and DKI scan (b=0,1250,2500s/mm²). ADC and DKI-derived parameters were obtained within the lesions and contralateral mirror areas with ROI methods. The quantitative parameters includes Mk, k, K, MD, D and D.

**RESULTS**

MK, k, k showed heterogeneous high signal in Infarcted area. MK, k, k were elevated to a peak in acute, early subacute phase, then gradually reduced, and tends to normalize. MK value in infarcted area (1.445 ± 0.432) was higher than that in the contralateral mirror area (0.870 ± 0.174)(paired t-test), and so was k and K. Except for hyperacute phase, the percent change of k was higher than k and D has more lower amplitude than D. In about each phase of ischemic stroke, the amplitude of percent change of MK, k, K was over 50%, MK, k exceeded 100% in acute phase, while the percent change of MD, D, D were all lower than 50%.

**CONCLUSION**

Based on the results above, it can be predicted that it is more sensitive to identify ischemic lesions in hyperacute, acute phase with MK, k, k than with ADC, MD, D, D. The diffusion change parallel to the axons is greater than that perpendicular to the axons (e.g. myelin). When infarction occurs, axonal injury was the primary cause of infarction, which can be expressed as axonal swelling, endoplasmic reticulum and other intracellular fine structure. The decrease of ADC in infarcted area was mainly due to axonal damage.

**CLINICAL RELEVANCE/APPLICATION**

Diffusion kurtosis imaging can better reflect the microstructure changes in tissue, and is more sensitive in discovering diffusion restricted areas, and can be a complementary method in clinical diagnosis.

CTA Recanalization Score – A Reliable Measure of Recanalization

**METHOD AND MATERIALS**

Data is from INTERReCT, a multi-center prospective study, examining clot characteristics associated with early recanalization. Three raters assessed CTA of 30 randomly selected patients at baseline and 2-6h later. Baseline scans were scored for site of primary intracranial arterial occlusive lesion (PIAOL), residual flow through PIAOL and distal thrombus burden (DTB). Recanalization was assessed on follow-up CTA using PIAOL debulking, change in residual flow, and DTB. A CTA Recanalization Score (CTARS) consisting of 8 categories was used to summarize recanalization of PIAOL and its distal vasculature. Reliability was quantified using kappa (weighted when appropriate).

**RESULTS**

Agreement on PIAOL location varied from excellent proximally (ICA, M1, proximal M2) to poor for more distal sites. Agreement was moderate to substantial on residual flow (Kw=0.67, 0.49, 0.55), and fair to moderate on DTB (Kw=0.41, 0.17, 0.31) at baseline. Reliability was excellent for PIAOL debulking (Kw=0.87, 0.90, 0.92), residual flow change (Kw=0.91, 0.88, 0.86), and moderate to substantial for follow-up DTB (Kw=0.78, 0.43, 0.51). Near perfect agreement was obtained on final CTARS (Kw=0.90, 0.96, 0.88).

**CONCLUSION**

CTARS is a reliable method of assessing recanalization of PIAOL and its’ distal vasculature. Future studies should

**DCE MRI can demonstrate the microvascular BBB permeability in stroke research.**
focus on prospective scale validation and performance with other imaging modalities.

**CLINICAL RELEVANCE/APPLICATION**

A reliable CTA recanalization assessment method will help in comparing novel thrombolytic agents vs. current standard of care in acute stroke management.

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**SSE19**

**Nuclear Medicine (Neuroimaging)**

*Scientific Papers*

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Mon, Dec 1 3:00 PM - 4:00 PM Location: SS05A

**Participants**

Moderator
Richard K.J. Brown MD : Investor, RadExchange, LLC

Moderator
Jacob G. Dubroff MD, PhD : Nothing to Disclose

**Sub-Events**

**SSE19-01**

The Value of 18F-FDG PET/CT in Hypothalamic-Pituitary-Adrenal Axis in Differentiation of Blast-related Mild Traumatic Brain Injury (mTBI) and Post-traumatic Stress Disorder (PTSD) from Blast-related Mild TBI Alone in a Post-acute Veteran Population

Osama A. Raslan MD, MBBCh (Presenter): Nothing to Disclose, Thomas Matthew Malone BA : Nothing to Disclose, Diane M. Whiston MPH : Nothing to Disclose, Razi Muzaffar DO : Nothing to Disclose, P. Tyler Roskos PhD : Nothing to Disclose, Patrick V. Kelly PhD : Nothing to Disclose, Richard R. Bucholz : Nothing to Disclose, Medhat M. Osman MD : Speaker, Koninklijke Philips NV

**PURPOSE**

Differentiating PTSD from mTBI can be challenging for clinicians due to symptom overlap between conditions. Additionally, many of these patients present with normal structural neuroimaging. It is suspected that the hypothalamic-pituitary-adrenal (HPA) axis plays an important role in PTSD; however, there is limited neuroimaging research that has systematically examined this in the Veteran population. The objective of this study is to evaluate use of FDG PET/CT in differentiating PTSD from mTBI based on metabolic activity in the pituitary and hypothalamic regions.

**METHOD AND MATERIALS**

We retrospectively reviewed 159 dedicated brain FDG PET/CT studies. All PET images were acquired in the morning and according to standard brain PET/CT protocol. MRI scans of the brain were subsequently done and were interpreted as structurally normal for all subjects by a fellowship-trained neuroradiologist. Cases were divided into 3 groups that were age and gender matched: normal control, TBI, and TBI+PTSD. Patients with TBI were further stratified by severity based on criteria from the Department of Defense and Veterans Affairs Consensus Definition of TBI in 2009. PET/CT scans were read by 2 board certified nuclear medicine physicians blinded to the groups, and a log recorded the SUV max and SUV mean of the pituitary gland and the hypothalamus. Since distributions were approximately normal and sample sizes were sufficiently large, parametric tests were performed (independent sample t-tests and ANOVA with post hoc comparisons).

**RESULTS**

The SUVmax from the hypothalamus was significantly lower in TBI-only patients compared to the normal controls (5.78 vs. 6.46 (p=0.0388)). When TBI was stratified by severity and limited to military Veterans, the SUVmean in the pituitary was significantly higher in the mild TBI+PTSD group compared to mild TBI-only group (3.08 Vs. 2.54 (p=0.0418)).

**CONCLUSION**

SUVmean in the pituitary region is a promising objective tool for differentiating mild TBI+PTSD patients from mild TBI-only patients in a post-acute Veteran population.

**CLINICAL RELEVANCE/APPLICATION**

PTSD represents an increasing public health issue that is difficult to diagnose. PET/CT activity in pituitary/hypothalamus may provide an objective method to diagnose and differentiate PTSD from mTBI.

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**SSE19-02**

PET/CT in Autism- A Diagnostic Tool
There is no specific marker to diagnose autism. Morphologically brain shows no abnormalities on imaging studies. However PET CT can determine the uptake of cerebral blood flow and with help of standard uptake value, areas of hypoperfusion can be quantitatively mapped.

METHOD AND MATERIALS

23 autistic patients with DSM-IV TR diagnostic criteria, pre stem cell were included in this study. Youngest patient was 3 years old and oldest was 26 years. Two patients were adults with age 20 and 26 years. Neuro PET scan was performed after 1 hour of injection of 7 mCi of 18 FDG. Images were obtained on 64 slice CT and PET system based third generation rare earth detectors with uniform, across the field of vision resolution of 2.0 mm. CT was used for attenuation correction, localization and diagnosis. Quantitative parameter used is SUV which was measured using body weight. Imaging data were processed using proprietary Scenium software before final image reconstruction. SUV values of patients were compared with normal age control with two standard deviation. Deviation below -2 was considered as low uptake and above +2 as high uptake.

RESULTS

Out of 23 patients with autism 95% (22) patients had reduced uptake in one or both hippocampus while 82% (19) patients had reduced uptake in bilateral hippocampi. 82% (19) patients had low uptake in one or both amygdala while 65% (15) patients had low uptake in bilateral amygdala. Only 39% (9) patients had low uptake in one or both parahippocampal region while only 26%(6) patients showed low uptake in bilateral parahippocampal region. 65% (15) patients had low uptake in one or both mesial temporal lobes while 52% (12) patients had reduced uptake in bilateral mesial temporal lobe. 56% (13) patients had low uptake in one or both cerebellum and 47%(11) had reduced uptake in bilateral cerebellum. There was no increase in uptake in hippocampus, amygdala and mesial temporal lobes on both sides. There was increased uptake in 74% (17) patients in one or more frontal lobes whereas 61% (14) had increased uptake in bilateral frontal lobes. Only 2 patients showed low uptake in both frontal lobes.

CONCLUSION

There is significantly low uptake in majority of autistic patients in hippocampus and amygdala followed by mesial temporal lobe and cerebellum with high uptake in frontal lobes.

CLINICAL RELEVANCE/APPLICATION

PET CT can prove to be potential diagnostic tool in autism.

SSE19-03

Serial Semiquantitative Brain SPECT Imaging in Evaluating Treatment Response to Human Embryonic Stem Cells in Chronic Lyme’s Disease

Purpose

Lyme disease (Lyme borreliosis) is an infectious disease caused by the bite of infected ticks carrying bacteria belonging to the genus Borrelia. Patients with Chronic Lyme’s Disease (CLD) may have neuropsychiatric symptoms even after standard courses of antibiotic therapy. Human embryonic stem cell therapy has shown promise in clinical trials and is sought by many patients with CLD. Brain perfusion studies with single photon emission computed tomography (SPECT) have been applied in these patients and have been evaluated either by visual interpretation or using semiquantitative analysis. Several processing protocols for 3D voxel-by-voxel analysis of brain perfusion SPECT have been applied, mainly the 3DSSP, SPM and recently the NeuroGam software. There is negligible literature till now concerning the interval changes in perfusion in cortical functional areas, pre and post therapy. The present study was to evaluate the treatment response (improvement or deterioration) in perfusion of specific areas of the brain cortex using Tc-ECD brain SPECT.

Method and Materials

A total of 40 individuals who met the clinical definition of CLD underwent SPECT scanning of the brain using 99mTc-ECD and standard nuclear imagine techniques. The results were elaborated as mild improvement when 10%-30% changes were noted, moderate improvement when 30%-60% changes were noted and significant improvement when 60%-90% changes were noted.

Results

All patients demonstrated abnormalities in perfusion to various areas of the brain, most notably the frontal, temporal, and parietal lobes. Patients considered to be seropositive and those considered seronegative had similar rates, types, and severity of perfusion defects. Treatment with Human Embryonic Stem Cells resulted in resolution or improvement of abnormalities in 100% of patients over a 1- to 2-year period. None of the patient in the series showed deterioration or no improvement.

Conclusion

Brain SPECT scans can be used to provide objective evidence in support of the clinical diagnosis of Chronic Lyme’s Disease. The use of Human Embryonic Stem Cells seems to provide improvement in both clinical status and SPECT scans.

Clinical relevance/application

SSE19-03
Brain SPECT is an extremely useful tool in monitoring the treatment response to therapy in patients of CLD. It showed changes at the molecular level, hence indicating improvement even before the clinical changes were manifested.

**SSE19-04**

**11C-PIB PET for Evaluation of Concurrent Alzheimer’s Disease in Post Stroke Dementia**

Sireng Chen (Presenter): Nothing to Disclose, Yim Lung Leung : Nothing to Disclose, Thomas KC Cheng
MBBS : Nothing to Disclose, Ka Nin Wong : Nothing to Disclose, William Cheung : Nothing to Disclose, Man Ki Cheung : Nothing to Disclose, Vincent Mok : Nothing to Disclose, Chi Lai Ho : Nothing to Disclose

**PURPOSE**

Concurrent Alzheimer’s Disease (AD) pathology is common in post stroke dementia (PSD). Clinical assessment or structural imaging for differentiation is difficult as typical AD features may co-exist with post-stroke changes in vascular dementia (VD). We aim to use 11C-PIB PET for evaluation of concurrent AD in PSD by detection of PIB binding in brain areas known to accumulate high β-amyloid (Ab) plaques in early AD.

**METHOD AND MATERIALS**

39 PSD patients (M: 21; F: 18; age range: 58-89y, mean=77±6.7y) were referred from the Neurology clinic. 39 age and sex matched early AD (age range: 51-87y, mean=76±10.9y) and 39 normal subjects (age range: 49-88y, mean=72±9.1y) were recruited as control. All patients underwent PET/CT at 5 and 35 min after 11C-PIB injection (~15mCi). The target regions: frontal gyrus, gyrus rectus, superior parietal lobe, posterior cingulate, precuneus, lateral temporal lobe, occipital lobe, caudate, putamen, were drawn automatically on 2 sets of PET. Global PIB binding (GBP) composing of the above regions normalized to cerebellum was calculated.

ROC analysis was performed between AD and normal subjects for defining the GBP cut-off for AD. PSD patient with visually increased PIB uptake at posterior cingulate, precuneus, frontal, parietal and/or lateral temporal cortex, supported by GBP≥cut-off was considered as having concurrent AD.

**RESULTS**

The GBP cut-off for AD was 1.42. Visual assessment supported by GBP≥1.42 identified 14/39 (35.9%) PSD patients having concurrent AD. Compared with the AD control, PSD patients with concurrent AD showed great similarity in GBP (1.73±0.14 vs 1.71±0.12, P>0.05) and PIB distribution, both having significantly higher GBP than normal control (1.28±0.09, both P<0.05). On the contrary, pure VD patients (25/39) showed great similarity to normal subjects (GBP=1.29±0.07 vs 1.28±0.09, P>0.05) but significantly lower GBP than AD control (P<0.05). Concurrent AD showed significantly higher GBP than pure VD in PSD patients (1.71±0.12 vs 1.29±0.07, P<0.05).

**CONCLUSION**

11C-PIB PET is valuable for evaluation of concurrent AD pathology in PSD in vivo. Concurrent AD is common in PSD, which may warrant specific treatments targeting Ab plaques in these patients.

**CLINICAL RELEVANCE/APPLICATION**

11C-PIB PET is valuable for evaluation of concurrent AD pathology in PSD in vivo. Apart from prevention of recurrent stroke, treatments targeting Ab plaques might benefit this group of PSD patients.

**SSE19-05**

**Metabolism and Perfusion in Drug-resistant Epileptic Patients Assessed by Simultaneous Acquisition of PET and Arterial Spin Labelling MR**

Maria Vittoria Mattoli MD (Presenter): Nothing to Disclose, Francesco Fraioli MD : Nothing to Disclose, Ilaria Boscolo Galazzo : Nothing to Disclose, Francesca Pizzini MD : Nothing to Disclose, Jamshed Bomanji : Nothing to Disclose, Ashley McAllister Groves MBBS : Investigator, GlaxoSmithKline plc Investigator, General Electric Company Investigator, Siemens AG

**PURPOSE**

The aim of this study was to assess the concordance between perfusion, as measured with arterial-spin-labelling (ASL) MR, and metabolism, as measured with FDG-PET SUV interictically in refractory focal epileptic patients.

**METHOD AND MATERIALS**

Seventeen consecutive patients with drug-resistant focal epilepsy discordant in localisation with ictal scalp EEG-video telemetry (EEG-VT) recordings were studied in simultaneous PET/MR scanner. Standardized uptake values (SUVs) were extracted and Cerebral Brain Flow (CBF) maps were estimated with ASL. CBF and SUV maps were registered to individual high-resolution anatomical images and normalized to the Montreal Neurological Institute brain template (MNI). Asymmetry index (AI) were calculated voxel-wise as the difference in SUV or CBF between corresponding voxels in the right and left hemisphere, normalized by the mean value of the two. Subsequently, a z-score map was calculated based on mean and standard deviation of all AI values across the brain. Voxels with a z-score greater or lower than 1.64, corresponding to p<0.05, were considered to be significantly different between hemispheres, indicating abnormal asymmetry of cerebral metabolism or perfusion. The concordance between ASL, PET and EEG-VT data was assessed.

**RESULTS**

Data from 15 patients (6 right-sided, 9 left-sided ictal onset) were available (two patients excluded for movement artefacts). PET showed hypometabolism in the same hemisphere and lobe of EEG-VT in 11/15 patients. ASL maps showed hypoperfusion in 12/15 patients, which correctly lateralised and localized the same lobes as EEG-VT and PET in 8 patients. In one PET negative patient the ASL correctly lateralised but not
localised the affected lobe. Five patients, all with normal MRIs, showed complete concordance in side and lobe for PET, ASL and EEG-VT. In three patients with discordant MRI and EEG-VT findings, both PET and ASL were concordant in lateralisation and localization in two patients and both normal in one patient.

**CONCLUSION**

The combined simultaneous acquisition of ASL and PET provides concordant and complimentary non-invasive information about seizure-foci in patients with refractory focal epilepsy.

**CLINICAL RELEVANCE/APPLICATION**

PET/MR allows the simultaneous acquisition of information about perfusion and metabolism in refractory focal epileptic patients by using a modality with low ionization radiation exposure.

**SSE19-06**

Complementarity of Visual and Voxel-based FDG-PET Analysis to Detect MCI-like Hypometabolic Patterns in Elderly Patients with Hypertension and Isolated Memory Complaints

Axel Van Der Gucht (Presenter): Nothing to Disclose, Antoine Verger: Nothing to Disclose, Yalçin Yagdigil: Nothing to Disclose, Sylvain Poussier: Nothing to Disclose, Laure Joly: Nothing to Disclose, Ghassan Watfa: Nothing to Disclose, Athanase Benetos: Nothing to Disclose, Gilles Karcher: Nothing to Disclose, Pierre-Yves Marie MD, PhD: Nothing to Disclose

**PURPOSE**

18F-FDG PET can be used to aid in the diagnosis of AD and clarify the diagnosis and prognosis of patients with mild cognitive impairment (MCI). The goal of this study was to compare the results of a quantitative analysis of FDG-PET brain images to a standard visual analysis with regards to the detection of MCI-like hypometabolic patterns in elderly patients with hypertension and subjective, isolated memory complaints.

**METHOD AND MATERIALS**

FDG-PET brain was performed in 71 patients (mean age: 76.4 ± 5.1 years, female: 53.5%). Images were analyzed for the presence of an MCI-like hypometabolic pattern using an SVA by 2 physicians and a voxel-based quantitative analysis (Statistical Parametric Mapping) that compared each patient's images to normal reference samples from 19 elderly individuals obtained using the same PET camera. The reliability of these analyses was evaluated according to neuropsychological assessment results, including the Grober and Buschke Free and Cued Selective Reminding Test, and a combined analysis by a neuropsychologist.

**RESULTS**

An MCI-like hypometabolic pattern was documented in 8 patients (11%) by SVA and 7 patients (10%) by quantitative SPM analysis; however, only 3 of these patients were selected by both methods. The group characteristics of the 7 patients identified by the quantitative method were consistent with the MCI-pattern, which included a higher rate of abnormal GB-FCSRT in Free Recall (57% vs. 9%, p<0.05) or in Total Recall (29% vs. 8%, p<0.05) when compared with other patients. In contrast, the group identified by SVA did not exhibit these characteristics.

**CONCLUSION**

A combined visual and quantitative analysis improves the diagnostic accuracy to detect an MCI-like hypometabolic pattern in elderly patients with hypertension and subjective, isolated memory complaints.

**CLINICAL RELEVANCE/APPLICATION**

A combined visual and quantitative analysis improves the diagnostic accuracy to detect an MCI-like hypometabolic pattern in elderly patients with hypertension and subjective, isolated memory complaints.
SSE20-01

**Pediatrics Keynote Speaker: Whole Brain Connectivity in Children**

Michael John Paldino MD (Presenter): Nothing to Disclose

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SSE20-02

**Analysis of Brain Development for the First Year of Life Using Non-rigid Image Registration and Finite Strain Theory**

Jeongchul Kim PhD (Presenter): Nothing to Disclose, Li Wang: Nothing to Disclose, Guorong Wu: Nothing to Disclose, Lucile Bompard: Nothing to Disclose, Minjeong Kim: Nothing to Disclose, Yasheng Chen PhD: Nothing to Disclose, Dinggang Shen PhD: Nothing to Disclose, Weili Lin PhD: Nothing to Disclose

**PURPOSE**

MR has been widely utilized to identify complex morphological changes and maturation processes of postnatal brain development. However, previous studies have largely focused on global and regional volumetric changes, which may not provide detailed characterization of the nonlinear and inhomogeneous growth patterns of early brain development processes. Using non-rigid image registration and finite strain theory, brain development characteristics for the first year of life were evaluated.

**METHOD AND MATERIALS**

18 subjects underwent longitudinal MR imaging starting from birth, and every three months during the first year of life. Brain atlases at each time point were established using unbiased groupwise registration. Images from individual subjects at different ages were registered onto the corresponding atlas. Through the estimated global transformation matrix and local displacement fields, deformation gradient tensor was estimated across the population (0-3, 3-6, 6-9, 9-12 month). Deformation parameters, including Jacobian determinant and Green-Lagrange strain were calculated using finite strain theory. Regional characterization was performed using infant atlas with automated anatomical labeling for 90 ROIs.

**RESULTS**

Consistent with dramatic brain volume increase during the first three months of life (from 607cc to 908cc), whole brain volume expansion is observed (1.47 < Jacobian determinant (JD) < 1.76, Figure). In particular, the sensory/motor, prefrontal, temporal and occipital areas exhibit the largest volume expansion. While JD for all ROIs indicated volumetric expansion (1.02 < JD < 1.25) between 3-6 months, we noted that slight volumetric contraction also exists in sub-ROI level. The precentral, inferior frontal, occipital gyri continue to exhibit volume expansion (JC > 1.15) while partial volume contraction is observed in the parietal and prefrontal cortices (JD=1.12), which was also observed between 6-9 mons (JD=1.13). Finally, the extent of volume expansion and contraction is substantially reduced between 9-12 months (1.08 < JD < 1.17).

**CONCLUSION**

Regional characterization of brain volumetric expansion and contraction during the first year of life provides quantitative insight into relationship between mechanical parameters and brain development.

**CLINICAL RELEVANCE/APPLICATION**

Our results provide biomechanical insights into early brain development, which may offer biological underpinnings of neurodevelopmental disorders.

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SSE20-03

**"Diffusion Tensor Imaging of the Cerebellum-prefrontal Area in ADHD Children". The Follow Up and the Conclusions**

Pilar Dies-Suarez MD (Presenter): Nothing to Disclose, Silvia Hidalgo MBBS, PhD: Nothing to Disclose, Benito De Celis: Nothing to Disclose, Eduardo Barragan: Nothing to Disclose, Porfirio Ibanez: Nothing to Disclose, Manuel Obregon: Nothing to Disclose

**PURPOSE**

Attention deficit hyperactivity disorder (ADHD) is the most common neurological disorder in children and adolescents (prevalence of 7% worldwide). Diffusion tensor imaging (DTI) is an MR imaging modality that provides information about the direction and integrity of neural fiber tracks in the brain in-vivo. Here we performed DTI studies on inattentive children, who had received clinical treatment for a whole year and compared the results to previous studies in which the same subjects had been imaged before the start of medication.

**METHOD AND MATERIALS**

Eleven children with ADHD (inattentive subtype, ages 7-12 years old), after one year of treatment were examined. Imaging performed on a 1.5T imager (Philips Intera-Achieva). Diffusion Tensor Imaging (DTI) data was acquired using a SE-EPI sequence with: TR/TE = 9491/75 ms, FOV=230x230x140 mm3, voxel size=1.60x1.60x2mm3, slice number= 70, fat suppressed. Diffusion weighted gradients were applied along 15 non-collinear directions with a bvalue of 800 s/mm2. High-resolution anatomical images were acquired using 3D-T1 Gradient Sequence with the following parameters: TR/TE=25/3.88ms, slice thickness 2mm, and NEX=1. Tractography: preprocessing steps correcting for head movements and eddy currents. The diffusion tensor (DT) was then fitted to a linear least-square, and using MedINRI, diffusion tensors were analyzed to obtain Mean Diffusivity values as well as the Fractional Anisotropy (FA) with an FA threshold of 0.2 and smoothness factor of 20 out of 100. Segmentation of the cerebellum was manually performed drawing on the anatomical midline sagittal 3D-T1 images.

**RESULTS**

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Results of white matter connectivity (tracts) connecting the cerebellum to prefrontal areas are presented. **One year after treatment** we found great recovery of these fronto-cerebellar tracts in patients with ADHD, was also reflected on FA values which were similar to those of healthy controls.

**CONCLUSION**

With this follow-up study it was possible to distinguish between children with true ADHD and other pathologies (i.e., bipolar disorder). It was expected that with the results of this protocol, we have more tools to diagnose and follow-up a precise type of ADHD patients. It could be argued that MRI generated a quantitative value (FA, tract number) to give precise diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

This work will allow MDs to provide an appropriate treatment and follow up and dismiss any other disorder with similar symptoms to ADHD.

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**SSE20-04**

**Myelination Age: Validation of a Histogram-based Fractional Anisotropy Metric across Multiple Scanners and Field Strengths with Longitudinal Follow-up**

*Eric Chin (Presenter): Nothing to Disclose, Asim F. Choudhri MD: Nothing to Disclose*

**PURPOSE**

We have previously developed fractional myelination (FM), a histogram-based diffusion tensor imaging (DTI) metric which attempts to quantify global myelin maturity beyond the age of 3 years, which is not possible with conventional MRI. Here we investigate whether FM can be interpreted as fully quantitative 1) across scanners of differing field strength and 2) longitudinally.

**METHOD AND MATERIALS**

Cross-scanner validation: Six months of MRI scans (N=914) in a primarily pediatric population from a single institution were evaluated. Contiguous datasets were then identified for both 1.5T and 3T scanners (from two vendors). Longitudinal follow-up: All patients (N=40) who had multiple MRI scans at least 2 years apart since the start of routine DTI use (July 2011) were identified. Progression of FM over all DTI scans was tracked for these patients. FM calculation: Studies were excluded if there was any definable structural abnormality as determined by neuroradiologist review. All included studies had a volumetric T1 weighted sequence as well as DTI with 12 to 25 non-collinear directions of encoding, a b-value of 1000 msec and a single b-0 acquisition. Registration and segmentation were performed automatically using SPM8. FA was analyzed for intracranial white matter as a whole. FM, a ratio of mature to total white matter volume was then calculated based on the FA histograms of each patient. Nomograms of FM over age using the two scanners were then calculated and compared. Regression was based on an exponential model $FM(FA,t) = FM_{max} - Ae^{-t/\tau}$ with 5th and 95th percentile bounds based on a Student's t-distribution.

**RESULTS**

Mean FA and FM both show exponential convergence to adult values with age in all subgroups, in agreement with findings in previous studies. FM shows better contrast-to-noise and better fit to an exponential model than mean FA. Using FM, curves obtained do not differ significantly across scanners or field strengths. FM of patients with follow-up largely tracked predicted percentile curves.

**CONCLUSION**

Statistical analysis of histogram-based DTI metrics confirms the ability to follow myelin maturation from infancy through adolescence. FM may serve as the foundation for automated myelination age determination.

**CLINICAL RELEVANCE/APPLICATION**

Histogram-based DTI metrics offer the ability to follow myelin maturation from birth through adolescence and may serve as the foundation for automated myelination age determination.

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**SSE20-05**

**Connectivity Strength between Homologous Brain Regions May Reflect Brain Functional Maturation during the First Two Years of Life**

*Lucile Bompard: Nothing to Disclose, Sarael Alcauter: Nothing to Disclose, Wei Gao: Nothing to Disclose, Weili Lin PhD (Presenter): Nothing to Disclose*

**PURPOSE**

One of the common features reported in the adult resting fMRI studies is the presence of strong functional connectivity between the homologous regions of the two hemispheres. To this end, we postulate that the presence of homologous connectivity may reflect maturation of brain functional networks. To test this hypothesis, the growth trajectory of functional connectivity strengths between homologous regions of the brain from birth to two years was evaluated.

**METHOD AND MATERIALS**
65 (35 girls) healthy children underwent resting state fMRI scan using a 3T MR scanner (Siemens Medical systems) starting from birth, followed by every three months during the first and every 6 months during the second year. After wrapping images onto the Montreal Neurological Institute (MNI) space, the left-right correspondence was established based on non-linear registration. Bilateral symmetric functional connectivity between pairs of homologous voxels was evaluated. The voxel-wise growth trend was modeled using a linear mixed effect model with correlation coefficients as the dependent variable. Regional growth trajectories were determined based on Automatic Anatomical Labeling (AAL) atlas masking.

RESULTS

With the exception of the superior and inferior medial frontal and medial occipital areas, most of brain regions show a low symmetrical functional connectivity at birth, suggesting an immature brain. In addition, there appears an inverse relation between the connectivity strengths at birth and the growth rate of symmetric connectivity with age. That is, regions with a low functional connectivity at birth (bottom 25th percentile) are typically associated with a high slope and vice versa. Brain regions met the former condition include 6 regions in the parietal and temporal lobes, respectively. In contrast, regions met the latter condition include 5 in frontal, 4 in subcortical, 3 in occipital and 1 in parietal regions, respectively.

CONCLUSION

Our results suggest that highly connected homologous regions at birth are typically associated with a low slope and vice versa.

CLINICAL RELEVANCE/APPLICATION

Assessments of functional connectivity between homologous brain regions may shed light on the status of brain functional maturation.

SSE20-06

Aberrant Functional Brain Connectome in Pediatric Posttraumatic Stress Disorder

Xueling Suo (Presenter): Nothing to Disclose, Lei Li: Nothing to Disclose, Du Lei: Nothing to Disclose, Fuqin Chen: Nothing to Disclose, Qiyong Gong: Nothing to Disclose

PURPOSE

Posttraumatic stress disorder (PTSD) is a debilitating psychiatric disorder, and children are more vulnerable to developing PTSD after experiencing trauma than adults. Traumatic childhood experience may adversely influence brain development. Recently, graph theoretical approaches have been employed to investigate the aberrant topological organization of brain networks in various neuropsychiatric disorders. To our knowledge, there was no study reporting small-world topology of pediatric PTSD.

METHOD AND MATERIALS

We recruited 24 pediatric survivors of the 2008 Sichuan earthquake between 8 and 15 months after the event and 24 age- and sex-matched trauma-exposed non-PTSD controls. The whole-brain functional networks were constructed by thresholding partial correlation matrices of 90 brain regions, and graph theory-based approaches were then performed to investigate their aberrant topological properties. Nonparametric permutation tests were further used for group comparisons of topological metrics.

RESULTS

Both the patients and controls showed small-world topology in brain functional networks. However, the patients showed significantly increased in clustering coefficient C_p, local efficiency E_loc and normalized characteristic path length λ. Furthermore, the patients exhibited enhanced nodal centralities in the default-mode network (DMN) including bilateral temporal lobe, and the salience network (SN) including bilateral putamen, pallidum, thalamus and right caudate. The altered nodal centralities in bilateral pallidum were positively correlated with Clinician-Administered PTSD Scale (CAPS).

CONCLUSION

The pediatric PTSD patients exhibited a tendency toward regular networks characterized by significantly increased local efficiency and decreased global efficiency, and increased nodal centralities in SN and DMN contributing to disruption in cognitive function. Overall, our results demonstrated for the first time that pediatric PTSD is reflected in a disrupted topological organization in large-scale brain functional networks, thus providing valuable information for better understanding the pathogenesis of this disorder.

CLINICAL RELEVANCE/APPLICATION

Aberrant topological organization of brain functional networks may help in diagnosis of pediatric PTSD and decide whether to employ early intervention which may attenuate adverse brain development.
Applications

Multisession Courses

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| AMA PRA Category 1 Credits ™: 1.50
| ARRT Category A+ Credits: 1.50
| Mon, Dec 1 3:30 PM - 5:00 PM   Location: S405AB |

Participants

Moderator
Satoshi Minoshima MD, PhD: License agreement, General Electric Company Research Grant, Koninklijke Philips Electronics NV Research Grant, Hitachi, Ltd Research Consultant, Hamamatsu Photonics KK Grant, Nihon Medi-Physics Co, Ltd Research Grant, Astellas Group Research Grant, Seattle Genetics, Inc

LEARNING OBJECTIVES

1) To discuss new molecular brain imaging techniques that are available in the clinic. 2) To explain how basic research has been translated to clinical applications. 3) To discuss approval processes that are necessary to establish clinical molecular brain imaging.

Sub-Events

MSMI24A  Amyloid Imaging: Translational Research to Clinical Applications


LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI24B  How Molecular Imaging Contributes to Movement Disorders? Current and Future


LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI24C  Quantitative Analysis and Interpretation of Molecular Brain Imaging

Satoshi Minoshima MD, PhD (Presenter): License agreement, General Electric Company Research Grant, Koninklijke Philips Electronics NV Research Grant, Hitachi, Ltd Research Consultant, Hamamatsu Photonics KK Grant, Nihon Medi-Physics Co, Ltd Research Grant, Astellas Group Research Grant, Seattle Genetics, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI24D  Making Molecular Brain Imaging Available in the Clinic: FDA and CMS

Peter Herscovitch MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPDL21

RSNA Diagnosis Live™: Chest/Abdomen/Neuroradiology

Special Courses

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| AMA PRA Category 1 Credits ™: 1.50
| ARRT Category A+ Credit: 0
| Mon, Dec 1 4:30 PM - 6:00 PM   Location: E451B |

Participants
LEARNING OBJECTIVES
1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

SPDL31
RSNA Diagnosis Live™: Body, Cardiac, MSK, Neuro, ENT Potpourri

Special Courses

AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 0
Tue, Dec 2 7:15 AM - 8:15 AM   Location: E451B

Participants
Adam Eugene Flanders MD (Presenter): Nothing to Disclose
Sandeep Prakash Deshmukh MD (Presenter): Nothing to Disclose
Christopher Geordie Roth MD (Presenter): Author, Reed Elsevier

LEARNING OBJECTIVES
1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

SPSC30
Controversy Session: Head and Neck Modality Roulette: What's the Best Imaging Option?

Special Courses

AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 1.00
Tue, Dec 2 7:15 AM - 8:15 AM   Location: E451A

Participants
Moderator
Deborah Rachelle Shatzkes MD : Nothing to Disclose

Sub-Events
SPSC30A  4DCT in Parathyroid Adenoma Search: Is It Worth the Dose?
C. Douglas Phillips MD (Presenter): Stockholder, MedSolutions, Inc Consultant, Guerbet SA , Laurie A. Loevner MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
We will discuss the contribution of 4D-CT to imaging parathyroid adenomas and parathyroid hyperplasia and whether or not the technique is of value in the current radiation-conscious era.

ABSTRACT
A physician wishing to accurately diagnose and localize parathyroid tissue for minimally invasive parathyroid surgery (MIPS) has a number of potential choices. They may choose to not image the patient. They may utilize Tc-99m SESTAMIBI imaging with or without SPECT or CT fusion, they may order US, MRI, or CT studies. 4D-CT has gained attention as an accurate and reliable test to localize parathyroid tissue for MIPS. The questions regarding this technique are 1) does it answer the question reliably? and 2) is it worth the dose to an individual patient?

SPSC30B  Surveillance Imaging in Head and Neck Cancer: Should PET/CT be the First-line Modality?
Barton F. Branstetter MD (Presenter): Nothing to Disclose , Hugh D. Curtin MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) List 3 advantages to using PET/CT for surveillance of treated Head and Neck Squamous Cell Carcinoma. 2)
List 3 disadvantages to using PET/CT for surveillance of treated Head and Neck Squamous Cell Carcinoma. 3) Describe the optimal frequency and duration of PET/CT for surveillance of treated Head and Neck Squamous Cell Carcinoma.

ABSTRACT

In patients with head and neck squamous cell carcinomas, PET/CT has proved useful at several different stages of patient care. PET/CT is used for staging a newly-discovered malignancy (or re-staging of recurrence); it is used to monitor response to therapy; it is used to assess suspicious signs and symptoms in treated patients; and it is used for surveillance of treated patients who have no evidence of residual disease. The appropriate application of PET/CT in these clinical scenarios is controversial. Some of the advantages and disadvantages of PET/CT for surveillance are undisputed, but the details of how to apply the technique have not been fully optimized in the current radiology literature. In this presentation, advantages and disadvantages of surveillance PET/CT (relative to CT) are described, and areas of controversy and ongoing research are delineated.

SPSC30C

MRI of the IAC: Do We Need Gadolinium?

William P. Dillon MD (Presenter): Nothing to Disclose, Franz J. Wippold MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) the various MR high resolution techniques for imaging the internal auditory canal. 2) the evidence supporting the use of contrast material with MR imaging in the evaluation of hearing loss. 3) the evidence supporting the use of non contrast MR imaging in the evaluation of hearing loss.

ABSTRACT

This presentation will highlight the evidence in favor and opposed to the use of gadolinium contrast administration in the setting of hearing loss from suspected vestibular schwannoma. Authors will demonstrate the use of high resolution non contrast MRI techniques tailored to the IAC, and show case examples where the use of gadolinium is useful in detecting diseases other than schwannoma.

MSCC31

Case-based Review of Nuclear Medicine: PET/CT Workshop—Head and Neck Cancers (In Conjunction with SNMMI) (An Interactive Session)

Multisession Courses

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 8:30 AM - 10:00 AM Location: S406A

Participants

Rathan M. Subramaniam MD, PhD (Presenter): Speakers Bureau, Eli Lilly and Company

LEARNING OBJECTIVES

1) To understand the value of PET/CT in the care process of managing head and neck cancer. 2) To review illustrative cases and pitfalls of interpretation.

MSRO31

BOOST: Head and Neck—Oncology Anatomy (An Interactive Session)

Multisession Courses

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 8:30 AM - 10:00 AM Location: S103AB

Sub-Events

MSRO31A

Imaging of Nasopharynx Cancer

Suresh K. Mukherji MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal anatomy of the nasopharynx. 2) Discuss the relationship between staging and imaging. 3) Describe common spread patterns of nasopharyngeal carcinoma.
This session will review the normal anatomy of the nasopharynx. We will also discuss the common spread patterns of nasopharyngeal carcinoma and the important relationship between imaging and staging.

**Contouring based on Patterns of Spread for Nasopharynx Cancer**

Sung Kim MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn the patterns of spread of nasopharyngeal cancer, and how to contour accordingly

**Common Pathways of Perineural Spread**

Suresh K. Mukherji MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe common pathways of perineural spread. 2) Review the imaging findings of perineural spread. 3) Describe the proper imaging technique for being able to detect perineural spread.

**Perineural Spread and Implications for Radiation Oncology**

Sung Kim MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn about indications and contouring for perineural invasion.

---

**Alzheimer's Disease**

*Refresher/Informatics*

Instruction

*AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.00
Tue, Dec 2 8:30 AM - 10:00 AM  Location: N227AB*

**Participants**


**Sub-Events**

**RC305A**

Neurobiology and Imaging Research in Alzheimer's Disease

Sterling Johnson PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To gain a broad overview of the disease symptom picture of AD and its associated neuropathology and imaging features. 2) To review the cognitive and biomarker profiles in AD and discuss ways that new research may inform the clinical diagnosis. 3) To gain an overview of the research being done in the presymptomatic phase of AD including emerging neuroimaging and biomarkers changes that occur prior to overt symptom onset.

**ABSTRACT**

Alzheimer's Disease (AD) is the disease of our time. It affects over 35 million worldwide, and the numbers will rise as society ages. The health care costs of AD are staggering. While other common causes of death in the elderly are declining, AD is increasing. This symposium will provide an overview of the disease from multiple angles and discuss insights gained from the latest advances in research on its neurobiology and early diagnosis.
LEARNING OBJECTIVES

1) Apply the concept of mixed pathologies to the clinical diagnosis of persons with dementia. 2) Describe the range of cerebral infarct pathology in the brain. 3) Describe dementia-related pathologies that are visible and not currently visible by conventional neuroimaging.

Multimodal Amyloid Imaging

Mykol Larvie MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand current evidence regarding the amyloid hypothesis with respect to Alzheimer's disease. 2) Understand the major Alzheimer's disease syndromes, including early onset AD, late onset AD and AD related to specific mutations. 3) Understand the concept and development of amyloid PET imaging radiotracers. 4) Understand the application of amyloid PET imaging in the evaluation of neurodegenerative disease. 5) Understand the roles of interpretation of amyloid PET imaging. 6) Understand the correlation of amyloid PET imaging with multi-modal MRI and FDG PET imaging.

Active Handout


Sinonasal and Orbital Imaging

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM  Location: E451B

Sub-Events

Sinonasal Inflammatory Disease

Christine M. Glastonbury MBBS (Presenter): Investor, Amirsys, Inc

LEARNING OBJECTIVES

1) Review the imaging features of sinonasal (SN) inflammatory disease starting with acute and chronic rhinosinusitis. 2) Understand the pathogenesis and imaging manifestations of critical complications of these processes. 3) Learn the key distinguishing features that indicate more aggressive SN processes such as invasive fungal sinusitis, granulomatous disease and SN malignancy.

Sinonasal Tumors

Hilda Elie Stambuk MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the imaging features of benign and malignant sinonasal tumors. 2) Understand the role and specific utility of imaging modalities in the diagnosis of sinonasal tumors. 3) Learn the imaging characteristics of pathways of spread of malignant sinonasal tumors. 4) Understand important imaging features relevant to treatment and post-treatment surveillance of sinonasal tumors.

ABSTRACT

Tumors of the paranasal sinuses and nasal cavity are rare, constituting only about 3% of all upper respiratory tract tumors. The majority of patients present with non-specific symptoms and radiologists are often challenged to make the clinician aware of the potential for an ominous disease process such as a malignant tumor. It is therefore crucial to understand the role of imaging modalities such as CT, MRI and PET scan in order to optimize the benefits of imaging against the risks of misdiagnosis. Contrast-enhanced CT in axial and coronal planes is an excellent initial study for evaluation of sinus neoplasms because bone destruction is more easily seen on CT. Early stage tumors present as unilateral masses that generally do not densely enhance on CT. Bony destruction is a common feature of squamous cell carcinoma (SCC), whereas regressive remodeling of adjacent bone occurs more frequently in benign and less aggressive lesions. Most tumors have low to intermediate signals on T1W MRI. Because they generally are highly cellular with little water content, they have intermediate signal on T2W images and are therefore easy to differentiate from postobstructive sinus secretions, which are hyperintense on T2W MRI. Some minor salivary gland tumors, schwannomas, and inverted papillomas have sufficient water content and can be bright on T2W MRI. Postcontrast T1W MRI is particularly important in identifying dural/intracranial extension of tumors. PET scan is the first-line modality in monitoring patients...
after therapy because of very high negative predictive value. False-positive results can however occur because of
infection, inflammation, and early treatment-related changes that take up to 3 months to resolve. This
lecture will discuss the salient features of common benign sinonasal tumors and illustrate the anatomic patterns
of spread for malignant tumors including perineural spread.

**Orbital Differential Diagnosis**

**Jenny K. Hoang MBBS (Presenter):** Nothing to Disclose

**LEARNING OBJECTIVES**

1) To apply a systematic approach to orbital masses. 2) Provide differentials for orbital masses based on
location. 3) Appreciate overlapping imaging findings of orbital pathologies. 4) Recognize characteristic clinical
and imaging features of orbital pathologies.

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**RC317**

**MR Neurography and New Methods to Image Pain**

**Refresher/Informatics**

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**AMA PRA Category 1 Credits ™:** 1.50

**ARRT Category A+ Credits:** 1.50

**Tue, Dec 2 8:30 AM - 10:00 AM  Location: SS04CD**

**Participants**

**Moderator**

**Sandip Biswal MD:** Co-founder, SiteOne Therapeutics Inc Consultant, General Electric Company Stockholder, Atreus Pharmaceuticals Corporation

**Sub-Events**

**RC317A**

**MR Neurography of the Brachial Plexus and Upper Extremities**

**Amelie Margarete Lutz MD (Presenter):** Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the role of indications for MR neurography in the multidisciplinary diagnostic work-up of brachial plexus and upper extremity nerve pathologies. 2) To understand the technical requirements and challenges of MR neurography in the brachial plexus and upper extremities. 3) To get familiar with the anatomy and normal MR imaging appearance of the brachial plexus and upper extremity nerves. 4) To recognize commonly encountered pathologies and their differential diagnoses in brachial plexus and upper extremity nerves.

**ABSTRACT**

Continuous improvements in magnetic resonance scanner, coil, and pulse sequence technology have resulted in the ability to perform routine, high-quality imaging of the brachial plexus and upper extremity nerves. MR neurography has evolved into a very helpful diagnostic tool in the work-up of peripheral nerve and plexus pathologies. It is commonly used for the detection and preoperative staging of neural mass lesions, in evaluating inflammatory and traumatic brachial plexus changes, confirming and/or complementing electrophysiologic exams. This talk will focus on the technical requirements for imaging the brachial plexus and upper extremities, discuss the anatomy, and demonstrate relevant examples of normal and abnormal findings.

**RC317B**

**MR Neurography of the Lumbar Plexus and Lower Extremities**

**Avneesh Chhabra MD (Presenter):** Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc

**LEARNING OBJECTIVES**

1) Employ new techniques for LS plexus and lower extremity evaluation. 2) Understand the difference between normal and abnormal imaging appearances of LS plexus and lower extremity peripheral nerves. 3) Discuss the differential diagnosis of various LS plexus and lower limb nerve pathologies based on available clinical history and imaging findings. 4) Learn how to incorporate the MRN modality in the diagnostic algorithm of plexopathies and related peripheral neuropathies in a multi-disciplinary fashion.

**ABSTRACT**

Lumbosacral plexus has a complex anatomy with a number of nerve convergences and divergences resulting in formation of multiple essential peripheral nerves that provide motor and sensory function to the pelvis and lower extremities. Due to the deep location and complexity, MR neurography (MRN) plays a major role in evaluation of its normalcy and pathologic states. This talk will discuss current state of the art techniques available for LS plexus evaluation and show normal and abnormal imaging appearances of various common and uncommon pathologic states involving LS plexus and its branch nerves. The talk will specifically address new 3D
techniques that suppress vessel signal effectively while preserving effective nerve visualization. Role of MRN in chronic pelvic pain, nerve injuries and its incremental value over conventional lumbar spine imaging will be discussed. Current role of functional DTI in qualitative and quantitative assessment of nerve pathology and tumors will be highlighted.

**LEARNING OBJECTIVES**

1) Identify the basic microanatomy of peripheral nerves, main pathologic conditions, and physiologic principles of diffusion-weighted tensor imaging (DTI). 2) Apply diffusion-weighted tensor imaging (DTI) to imaging protocols for peripheral neuropathies, used for both, research and clinical practice. 3) Analyze diffusion-weighted tensor imaging (DTI) images both quantitatively and qualitatively. 4) Understand the current applications but also limitations of diffusion-weighted tensor imaging (DTI) of peripheral nerves.

**ABSTRACT**

Diffusion tensor imaging (DTI) is an MR imaging technique which uses the random motion (diffusion) of water molecules within biologic tissues. Due to the tissues’ distinct structural properties, the diffusion is hindered in some directions but at the same typically not hindered in other directions. DTI is a well known imaging technique in the brain and central nervous system, but its application to the peripheral nervous system was limited in the past due to multiple technical reasons. However, numerous recent studies show now that the technique cannot only be applied successfully to image peripheral nerves, but they also showed that the technique is very sensitive and specific for the detection of peripheral nerve injuries and other neuropathies. DTI may also serve as a biomarker for the demyelination of axons and the extend of nerve fiber loss. The refresher course will cover the basic principles of DTI, the challenges and limitations for imaging protocols, as well as the evaluation of DTI images (both quantitatively and qualitatively). MR tractography of peripheral nerves will also be covered.

**PET and MR Methods to Image Pain**

Sandip Biswal MD (Presenter): Co-founder, SiteOne Therapeutics Inc Consultant, General Electric Company Stockholder, Atreus Pharmaceuticals Corporation

**LEARNING OBJECTIVES**

1) Understand the challenges of current conventional imaging approaches in diagnosing peripheral pain generators. 2) Understand the basis for identifying specific molecular and cellular biomarkers of pain and how these biomarkers can be exploited with molecular and cellular imaging techniques. 3) Demonstrate both clinical and pre-clinical PET/MR or advanced MRI approaches in identifying pain generators.

**ABSTRACT**

Chronic pain is now the prevalent disease in the world. The chronic pain sufferer is currently faced with a lack of objective tools to identify the source of their pain. The goal of this session is to describe new clinical molecular imaging and emerging molecular/cellular imaging methods to more accurately localize chronic pain generators/drivers so that we may objectively identify and more intelligently act upon the cause in a pain sufferer. Successful imaging of pain is relying heavily upon a multidisciplinary effort that include expertise from of a number of scientists and clinicians in the fields of synthetic chemistry, radiochemistry, magnetic resonance physics/engineering, molecular pain neurobiology, clinical pain, radiology and others. A number of clinical and emerging pre-clinical approaches in positron emission tomography (PET) and magnetic resonance imaging (MRI) will be described. These imaging methods will demonstrate how the site of increased nociceptive activity is highlighted in the peripheral nervous system and spinal cord.

**3D Printing: A Powerful Tool for Applied Imaging Science**

**Participants**

Moderator
Frank John Rybicki MD, PhD: Research Grant, Toshiba Corporation

**LEARNING OBJECTIVES**

1) To review current applications for 3D printing in biomedical imaging science. 2) To discuss clinical problems in radiology for
which imaging science with 3D printing can potentially improve patient care.

ABSTRACT

In broad terms, 3D printing can be used for to enhance clinical care and to enable investigation that would otherwise not be possible. This talk focuses on those research applications. For example, 3D models of individual phantoms will enable studies in CT that may be limited by radiation concerns, the delivery of large volumes of contrast, or both. In addition, research can be used to simulate individual organ systems. Finally, complicated pathophysiology may be amenable to 3D models and thus 3D technologies can expand current research in multiple applications.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

Sub-Events

RC353A Validation of Coronary Contrast Gradients Using 3D Coronary Phantoms
Dimitris Mitsouras PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

3D printed models are poised to expand current investigations toward accurate functional CT and MR imaging that will likely open new horizons for diagnostic tool development that is not otherwise feasible due to patient considerations such as radiation burden, scan time, and monetary cost. 3D printing can produce hollow structures (e.g. vessels and airways) that, with appropriate selection of the printing technology (particularly with respect to the so-called "support" material) can replicate human physiology, including at the moment vascular compliance. Vascular phantoms have been successfully created from rotational digital subtraction angiography, CR, and MRI data sets. Early attempts begun with negative molds, namely 3D printing of a solid lumen to be used as mold around which to cure a silicon "vessel" wall. At present, the "vessel" wall can be printed with high accuracy.

RC353B Blood Flow in the Thoracic Aorta Elucidated with 3D Models
Michael Markl PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Flow sensitive MRI offers the ability to assess anatomy as well as flow characteristics in healthy and pathological blood vessels and is therefore an attractive tool for the diagnosis of vascular diseases. However, in-vivo studies do not allow the prediction of hemodynamic changes due to vascular modifications. Realistic vascular in-vitro 3D phantoms in combination with MRI flow measurements allow to model different vascular deformations and evaluate their effect on blood flow dynamics. This presentation will provide a review of the methods for the in-vitro simulation of aortic 3D blood flow with realistic boundary conditions and review previously reported application for the simulation of common aortic pathologies and their impact on aortic hemodynamics.

RC353C 3D Printing in Interventional Radiology and Vascular Surgeries
Matthew D Tam FRCR (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe potential workstream flows from CTA to a 3D printed model of the aorta. 2) Discuss the potential role of solid and hollow models of the vasculature to aid procedure planning, procedure execution and patient outcomes. 3) Gain an insight into future developments of the 3D printing industry.

ABSTRACT

3D printing has a major role to play in healthcare - procedure planning and execution, implant and device design, as well as facilitating better patient communication strategies and patient outcomes. Anatomically accurate patient-specific models of the vasculature can be constructed using 3D printing technologies. CT angiograms and DICOMS can be processed and the data converted into computer-aided design files using a range of different techniques and software. CAD files can then be 3D printed. In the setting of endovascular aneurysm repair, solid models of the lumen can be created and may be used to better understand complex anatomy. Hollow models can be created which can facilitate procedure execution through patient-specific rehearsal. 3D printing technologies will have further impact upon vascular and interventional radiology as both software, hardware and material science improves.

RC353D 3D Printing in Otolaryngology
Glenn E. Green MD (Presenter): Nothing to Disclose, Maryam Ghadimi Mahani MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES

View learning objectives under main course title.

3D Printing of Viable Tissues

Roger R. Markwald PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the development of the use of 3D applications in support of surgical reconstruction. 2) Describe the use of 3D Medical Applications in the support of Wounded Warrior Care.

ABSTRACT

Digital design and manufacturing technologies have been leveraged by the military in support of Wounded Warrior care since before the year 2000. A dedicated service for medical modeling was developed at the WRNMMC to provide 3D planning and manufacturing in the support of the DOD and wounded warrior care, expanding services to surgical simulations, development of surgical guides and custom implants, as well as support of research, occupational health and prosthetics world-wide. The purpose of this presentation is to present a review of the development of the use of digital design, digital manufacturing, and the establishment of 3D Medical Applications Center in support of Wounded Warrior Care.

URL's

http://www.wrnmmc.capmed.mil/ResearchEducation/3DMAC/SitePages/home.aspx

Future Applications in 3D Printing

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

1) To review the current innovative literature in 3D printing related to radiology. 2) To hypothesize and discuss future applications in 3D printing for radiology.

ABSTRACT

One of the main applications of 3D visualization is to enhance diagnoses for which the anatomy in question is complex. Additionally, the planning for a specific intervention often requires a volumetric assessment. 3D printing in radiology is rapidly growing as a means to realize real 3D objects in 2D surfaces. The promise of this technology in the near future has spawned several new hypotheses that may define future applications. The purpose of this lecture is to review the literature and discuss novel ways that printed models can enhance radiology diagnoses and investigations.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

MSRO32

BOOST: Head and Neck—Integrated Science and Practice (ISP) Session

Multisession Courses

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM  Location: S103AB

Participants

Moderator
Clifton David Fuller MD, PhD : In-kind support, General Electric Company Research Grant, Elekta AB
Bronwyn Elizabeth Hamilton MD : Nothing to Disclose

Sub-Events

MSRO32-01  Invited Speaker:
John Christopher Grecula MD (Presenter): Research Grant, Teva Pharmaceutical Industries Ltd Research
Radiotherapy-Treated Early Glottic Cancers: 15-Year Regional Cancer Center Experience

Jennifer Kwan BS (Presenter): Nothing to Disclose, Wilma M Hopman MA: Nothing to Disclose, Steve Hall MD, MSc: Nothing to Disclose, Timothy E Owen MD, FRCP: Nothing to Disclose, Khaled Osman Zaza MD, FRCP: Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Accurate staging is the most important factor guiding the management of patients with localized glottic cancers. To date, CT has served as the primary imaging modality used for staging of laryngeal cancers, but it is known that MRI has a higher sensitivity to detect cartilage invasion. It is hypothesized that use of MRI provides improved staging accuracy and better outcomes for early glottic cancers. This study reports our 15-year regional cancer center outcomes of treatment for T1-2N0 glottic cancers. Findings reflect our unique experience with early adoption of MRI for tumor staging, which began in the 1990s. In addition, based on the poorer outcomes of patients of low-socioeconomic status described in literature, it was hypothesized that these patients may have a different set of prognostic factors than the general population. Our cancer center serves a large proportion of rural and low-income residents; this allowed for the identification of relevant prognostic factors for this population.

Materials/Methods: Medical records of 64 patients with T1-2N0 glottic cancers, treated from 1997-2012 at our institution, were retrospectively reviewed for patient, tumor, and treatment characteristics. Univariate analyses were performed and Kaplan-Meier curves were generated for 5-year disease-free (DFS), laryngectomy-free (LFS), disease-specific (DSS), cancer-specific (CSS), and overall (OS) survivals. National Cancer Institute definitions of survival outcomes were used.

Results: 59 patients received radiation and 5 received surgery as definitive treatment for T1-2N0 glottic cancers. Of the 59 patients who received radiation, 13 (22.0%) had a local recurrence of cancer, which was retreated in 9 cases with total laryngectomy, 2 with hemilaryngectomy, 1 with hemicolectomy, and 1 case was not operated on. The median time to recurrence was 12.3 months. 5-year DFS, LFS, DSS, CSS, and OS were 79.7%, 84.7%, 94.9%, 84.7%, and 79.7% respectively for radiation-treated cancers. Patients treated with upfront surgery had comparable outcomes with 5-year DFS, DSS, CSS, and OS of 75.0%, 100.0%, 100.0%, and 75.0% respectively. On univariate analysis, top factors relating to poor overall survival from radiation included supraglottic extension (p=0.01), use of feeding tube (p=0.02), and higher T stage (p=0.05).

Conclusion: This study describes optimal survival outcomes for patients with T1-2N0 glottic cancers that parallel or surpass CT-staged outcomes described in literature, despite the rural and low-income backgrounds of the study population. Results suggest that use of MR imaging to stage laryngeal cancers may be beneficial for achieving accurate staging and improved survival outcomes. Prognostic factors have also been identified for this unique patient population.

A Randomized Phase III Study of Adverse Events between Sequential (SEQ) versus Simultaneous Integrated Boost (SIB) Intensity Modulated Radiation Therapy (IMRT) in Nasopharyngeal Carcinoma; Preliminary Result

Anussara Songthong MD (Presenter): Nothing to Disclose, Danita Kannarunimit MD: Nothing to Disclose, Chakkapong Chakkabat MD: Nothing to Disclose, Chawali Lertbutsayanukul MD: Nothing to Disclose

PURPOSE

Simultaneous integrated boost intensity modulated radiation therapy (SIB-IMRT) is widely used in treatment of nasopharyngeal carcinoma (NPC). Higher dose per fraction leads to increased tumor control probability despite higher risk of normal tissue complications. The purpose of this study is to investigate acute and late toxicities comparing SEQ-IMRT versus SIB-IMRT in patient with NPC.

METHOD AND MATERIALS

 Newly diagnosed stage I-IVB NPC patients were stratified and randomized to receive SEQ-IMRT or SIB-IMRT. SEQ-IMRT consisted of two sequential radiation treatment plans; 2Gy x 25 fractions to low-risk planning target volume (PTV-LR) followed by 2Gy x 10 fractions to high-risk planning target volume (PTV-HR). In contrast, SIB-IMRT consisted of only one treatment plan; 2.12Gy and 1.7Gy x 33 fractions to PTV-LR and PTV-HR, respectively. All patients received concurrent weekly cisplatin followed by three cycles of adjuvant cisplatin and 5FU. Dosimetric data was compared between two IMRT plans. Toxicities were evaluated according to CTCAE version 4.03.

RESULTS

Between October 2010 and November 2013, 130 eligible patients were randomized between SEQ-IMRT (59 patients) and SIB-IMRT (71 patients). Dosimetric data showed significant difference in PTV-LR dose as well as median one parotid gland dose. With median follow-up time of 460 days (17-1211 days), there was no significant difference in toxicities between both IMRT techniques. During chemoradiation, the most common grade 3-5 acute toxicities were mucositis (14% vs 13.2%, SEQ vs SIB, p=0.897) followed by dysphagia (8.8% vs 10.3%, p=0.774) and xerostomia (8.8% vs 7.4%, p=0.512). During adjuvant chemotherapy period, 23.8% and 34.6% experienced grade 3 weight loss in SEQ-IMRT and SIB-IMRT (p=0.255). At 1 year, grade 3 weight loss was not significantly different between two arms. One-year overall survival (OS) and progression-free survival (PFS) were 93.9% and 96% in SEQ-IMRT and 98% and 88.8% in SIB-IMRT, respectively (p =0.406 for OS and 0.053 for PFS).

CONCLUSION

This randomized phase III trial comparing SIB-IMRT versus SEQ-IMRT in NPC showed no statistically significant...
difference between both IMRT techniques in terms of acute and late adverse events. Short-term tumor control and survival outcome were promising.

**CLINICAL RELEVANCE/APPLICATION**

SIB-IMRT (dose painting technique) resulted in similar adverse events compared with SEQ-IMRT (shrinking field technique) in NPC.

**MSRO32-04 Post-Operative Simultaneous Integrated Boost-Intensity Modulated Radiation Therapy in Head and Neck Cancer: Outcomes From a Single Institution Series**

**ABSTRACT**

**Purpose/Objectives:**

Despite aggressive post-operative radiotherapy with or without chemotherapy for advanced head and neck cancer, locoregional recurrence rates remain suboptimal. With respect to radiation treatment, patients are generally treated with sequential planning radiation treatment in which the same dose is delivered to shrinking tumor volumes. Accelerated hypofractionated schedules with the simultaneously integrated boost-intensity modulated radiation therapy (SIB-IMRT) technique have gained increased interest in hopes of obviating tumor repopulation. This study aimed to assess toxicities and outcomes in patients with head and neck cancer treated with SIB-IMRT post-operatively at a single institution.

**Materials/Methods:**

Between 2003 and 2012, 25 patients (21 males, mean age 57) with head and neck cancer were treated with post-operative SIB-IMRT at a single institution. Seventeen patients (68%) received chemotherapy. The median KPS at the time of treatment was 80 (80-100). Toxicities were recorded according to the Common Terminology Criteria for Adverse Events Version 4.0. Kaplan-Meier survival analyses were used to estimate local control (LC) and overall survival (OS) rates. The multivariate Cox regression method was used to model predictors of outcome.

**Results:**

The median follow-up after SIB-IMRT was 36 months (7-112 months). Four percent of patients had stage II disease while 20% and 76% of patients had stage III and IV disease, respectively. The majority of patients had laryngeal (40%) and oropharyngeal (20%) cancer, while remaining patients had oral cavity, hypopharynx, paranasal sinus, salivary, and unknown primary cancers. The median prescription dose was 66.0 Gy (60.0-70.4 Gy) delivered in 30 fractions (30-35 fractions). High-risk tumor volumes received a median dose of 2.12 Gy (2.00-2.25 Gy) per fraction while the low-risk volumes received a median dose of 1.80 Gy (1.64-2.00 Gy) per fraction. The 1/2/4-year LC, OS, and distant metastasis-free survival rates were 95.8/85.1/71.4%, 91.0/81.3/75.1%, and 95.0/95.0/88.0%, respectively. Five patients (20%) experienced acute grade 3 toxicity and one patient (4%) had late grade 3 toxicities. No acute or late grade 4 toxicity was reported. On univariate analysis, no risk factors were identified as significant predictors of local failure or OS.

**Conclusion:**

Post-operative SIB-IMRT is an effective and safe technique in the treatment of patients with head and neck cancer with or without concurrent chemotherapy. Our results with respect to outcome and toxicity are comparable to those obtained with conventional radiotherapy. For select patients, SIB-IMRT is a reasonable alternative strategy with potential clinical and operational advantages.

**MSRO32-05 The Role of PET/CT in the Nodal Management of Squamous Cell Carcinoma of the Oral Cavity**

**PURPOSE**

Standard treatment for oral cavity squamous cell carcinoma (OCSCC) is surgical resection followed by adjuvant therapy based on pathologic analysis. Pre-operative imaging has been used to determine nodal involvement and has guided determination of the need for a neck dissection (ND). We sought to evaluate the patterns of failure when a ND was omitted due to pre-operative PET/CT showing no nodal involvement.

**METHOD AND MATERIALS**

From 2003-2013, we treated 761 patients with OCSCC. A pre-operative PET/CT was performed for 333 patients, of which 260 were retrospectively reviewed. ND was omitted in 41 of these patients, which comprised the cohort for this analysis. Factors analyzed included demographics, imaging and pathologic data, treatment with adjuvant radiotherapy (RT), and patterns of failure. The Kaplan-Meier rates of local recurrence (LR), regional recurrence (RR), and overall survival (OS) were calculated.

**RESULTS**

Median follow-up was 37 months. Subsites included: 59% oral tongue, 22% alveolar ridge, 15% floor of mouth, 2% lip, 2% buccal mucosa, 2% retromolar trigone, and 0% hard palate. 41% were T1, 39% were T2, 12% were T3, and 7% were T4. ND was omitted due to a node-negative (NN) PET/CT in 44% or due to perineural invasion (PNI) seen at biopsy indicating a need for adjuvant RT in 29%. Other reasons included co-morbidities and the potential for complications. 46% of patients received adjuvant RT. At median follow-up, OS was 80%, LR was 20%, and RR was 22%. LR was associated with tumor size >2.5 cm (p=0.02) and close margins (p=0.06). Decreased OS was associated with tumor size >2.5 cm (p=0.01), close margins (p=0.06), and node-positive (NP) PET/CT (p=0.01). Of the 12 patients who had a NP PET/CT, the reason for ND omission was PNI in 6 patients, early stage disease in 1 patient, potential complications in 3 patients, and unclear reasons in 2 patients. 33% of the RR occurred in patients with a NP PET/CT.

**CONCLUSION**

This data shows a significant risk of RR in patients with OCSCC with ND omission on the basis of a NN PET/CT. Furthermore, decreased OS was seen in patients with a NP PET/CT with ND omission on the basis of meeting pathologic indications for adjuvant RT. This suggests that ND may play an important therapeutic role in the management of patients with OCSCC irrespective of PET/CT findings.
**Prediction Response to Intensity-Modulated Radiotherapy of Nasopharyngeal Carcinoma: A Dynamic Contrast-Enhanced MR Imaging Study at 3T**

Dechun Zheng MS (Presenter); Nothing to Disclose, Chen Yunbin MD: Nothing to Disclose, Xiangyi Liu BS: Nothing to Disclose, Weibo Chen PhD: Nothing to Disclose, Queenie Chan PhD: Nothing to Disclose, Chaobin Huang: Nothing to Disclose, youping xiao: Nothing to Disclose, Wang Ren: Nothing to Disclose, Jianji Pan: Nothing to Disclose

**PURPOSE**

To prospectively evaluate dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) as a tool for assessing short-term control of chemoradiotherapy (CRT) in nasopharyngeal carcinoma (NPC).

**METHOD AND MATERIALS**

Fifty patients with local advanced NPC scheduled for neoadjuvant chemotherapy (NAC) following intensity-modulated radiation therapy (IMRT) were studied. DCE-MRI was performed within one week before NAC and repeated one week after IMRT treatment using a 3T clinical scanner system (Achieva TX, Philips Healthcare). Clinical response was evaluated after completed CRT according to the RECIST criteria. Four kinetic parameters (Ktrans, Kep, Vp, and Vb) were measured based on extended Tofts’ Model and compared to different clinical response groups using student T or Mann-Whitney U test.

**RESULTS**

Ktrans and Kep values were reduced after one week IMRT in patients with clinical treatment response after NAC and CRT treatment. The pretreatment Ktrans value, percentage change and difference values of Ktrans and Kep (Ktrans(Perc) and Kep(Perc)), ΔKtrans and ΔKep between pretreatment and after one week IMRT, and tumor regression after one week IMRT were all significantly larger in complete response (CR) patients than those with residual disease (partial response, PR) after radical CRT (Table 1, P < 0.05). We found out in boxplot analysis that ΔKtrans, Ktrans(Perc) and Kep(Perc) metrics were predictive imaging markers for response assessment of NPC subjects who treated with CRT, which demonstrated that patients who were CR after CRT clustered in separate regions from those were PR (Figure 1). The receiver operating characteristic (ROC, Figure 2) analyses proved that diagnosis efficacies of single Ktrans, ΔKtrans, ΔKep, Ktrans(Perc) and Kep(Perc) values ranging from 71.8 - 87.0%. And combined with tumor shrink ratio with above parameters yielded the highest diagnosis efficacy (90.2%) as well as the highest sensitivity (92.3%) and specificity (81.1%), respectively.

**CONCLUSION**

DCE-MRI has the potential to predict short-term control of locally advanced NPC by mean of earlier evaluating changes of tumor vascularization and volume during treatment. The Ktrans may be potential markers for predicting the response to CRT of NPC.

**CLINICAL RELEVANCE/APPLICATION**

DCE-MRI study prior and during IMRT process is available to early predict clinical response of local advanced NPC treated with CRT. Ktrans might become non-invasive prognostic markers of NPC.

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**Prognostic Interplay of Positron Emission Tomography (PET)-based Metrics and Human Papillomavirus (HPV) Status in Oropharyngeal Squamous Cell Carcinoma (OP-SCC)**


**PURPOSE**

To investigate the prognostic interplay of HPV status and PET-based metrics including maximum standardized uptake value (SUVmax), peak SUV (SUVpeak), metabolic tumor volume (MTV), and tumor glycolytic activity (TGA) in OP-SCC.

**METHOD AND MATERIALS**

With IRB approval, we identified 352 patients with OP-SCC treated with radiotherapy from 1990-2010. Patients with pre-treatment PET scans and known HPV status were identified. SUVmax, SUVpeak, MTV (all tumor above 50% of SUVmax), and TGA (MTV*SUVmean) were obtained for both primary tumor (P) and lymph nodes (N). Means were compared using the t-test. Kaplan-Meier log-rank test and Cox regression analysis were performed for freedom from recurrence (FFR) and overall survival (OS); patients distributed across median values.

**RESULTS**

125 patients had PET scans available for analysis (mean follow-up 2.8 years), of which HPV status was available...
for 72 patients (60 positive, 12 negative). The mean P- and N- SUV\textsubscript{max}, SUV\textsubscript{peak}, MTV, and TGA values were not significantly different between the HPV positive and negative groups. Measures predictive of 3-year OS included low P-TGA (92 v. 76%, p=0.02) and low P-MTV (90 v. 85%, p=0.05). Low P-TGA was also predictive of improved FFR (94 v. 77%, p=0.01). Non-significant but distinct separation of FFR survival curves was seen with P-SUV\textsubscript{max}, SUV\textsubscript{peak}, and MTV. Similar separation was noted in P-FFR and distant-FFR by using primary tumor metrics, while nodal-metrics did not appear to display any trends. On Cox regression analysis for FFR, HPV status was the dominant factor when compared to each of the PET-metrics individually, except P-TGA which was also independently significant (HR: 0.19, p=0.01) and P-SUV\textsubscript{max} (HR: 0.3, p=0.09). In addition to HPV status, both P-TGA and P-SUV\textsubscript{max} provided additional stratification of patients into four separate cohorts based on FFR, with significant stratification effect in the HPV positive population.

CONCLUSION

While the dominant prognostic impact of HPV status is clearly noted, PET-metrics, particularly P-TGA and P-SUV\textsubscript{max}, may provide additional prognostic information in OP-SCC. The interplay of these important prognostic factors will be further defined using large prospective databases.

CLINICAL RELEVANCE/APPLICATION

PET imaging metrics provide additional stratification of patient cohorts beyond HPV status. This prognostication, if validated prospectively, could help further individualize treatment recommendations.

MSRO32-08

Low Baseline Lymphocyte Count and Lymphocyte to Neutrophil Ratio May Predict Poorer Overall Survival in Patients with Head and Neck Cancer Treated with Radiation Therapy: Role of Immunofunction?

Junjian Huang BS (Presenter): Nothing to Disclose, Joseph Kaminski MD: Nothing to Disclose, Jeff Campbell: Nothing to Disclose, Jing Zhao: Nothing to Disclose, Paul Stanton: Nothing to Disclose, Ahmad Al-Basheer PhD: Nothing to Disclose, Byron Grady Dasher MD: Nothing to Disclose, Jerry W. Howington MD: Nothing to Disclose, Jed Weems Howington MD: Nothing to Disclose, John Stewart: Nothing to Disclose, William Dean Martin MD: Nothing to Disclose, Chris Sheils MD: Nothing to Disclose, Feng-Ming Kong MD, PhD: Nothing to Disclose

PURPOSE

Low total lymphocyte count and lymphocyte to neutrophil ratio are directly related to immunofunction and have been reported as poor prognostic indicators for multiple cancers at various stages after anticancer treatment. We hypothesized that baseline lymphocyte count and lymphocyte to neutrophil count correlate with overall survival in patients with head and neck cancer treated with radiation based therapy.

METHOD AND MATERIALS

This is a retrospective analysis of consecutive patients with non-metastatic Stage I-IV head and neck cancer who were treated with radiation therapy from January of 2003 to October of 2013. Pre-treatment complete white blood count, demographic, and clinical variables were extracted from medical records and vital status was obtained by using the Social Security Death Index. Variables and outcomes were analyzed using tests of R.

RESULTS

Of the 348 patients reviewed, 254 had baseline complete blood counts (Median age 57, Male 178, Female 76, 201 received chemotherapy). The median follow-up duration is 22 months. Higher baseline lymphocyte count and lymphocyte to neutrophil ratio were significantly associated with lower mortality (HR: 0.34, 95% CI 0.23-0.53, p<0.000001 and HR: 0.91, 95% CI 0.84-0.97 p=0.005). The 2 year survival rates for patients with normal lymphocyte counts versus patients with abnormal counts were 65% (CI: 0.724-0.865, 0.567-0.745) and 51% (CI: 0.714-0.941, 0.476-0.783), respectively. Furthermore, higher neutrophils (HR: 1.07 95% CI 1.001-1.141, p=0.047) and seg counts (HR: 1.04, p=0.0007) were correlated with increased mortality. Stage IV cancer patients had worsened overall survival compared to Stage I-III (HR 2.2, CI: 1.3-3.6, P=0.0026). Other variables such as chemotherapy(HR: 0.7, p=0.174), age, and gender were not significantly associated with overall survival.

CONCLUSION

This study demonstrates that baseline lymphocyte count and lymphocyte to neutrophil ratio is directly correlated with overall survival in patients with head and neck cancers treated with radiation therapy. This result suggests immune function may play an important role in overall survival of head and neck patients. Prospective studies are needed to validate this interesting funding.

CLINICAL RELEVANCE/APPLICATION

To advocate the property of pre-treatment baseline lymphocyte count and lymphocyte to neutrophil ratio as prognostic indicators for overall survival in HEENT cancer patients treated with radiation therapy.

MSRO32-09

Criteria for a Prophylactic Gastrostomy in Head and Neck Cancer Patients Receiving Concurrent Radiochemotherapy

Edwin Boelke (Presenter): Nothing to Disclose
ABSTRACT

Purpose/Objective(s): Concurrent chemoradiation for head-and-neck cancer (HNC) may lead to increased rates of long term dysphagia as a severe side effect. Percutaneous endoscopic gastrostomy (PEG) may be indicated in numerous situations in HNC patients undergoing chemoradiation when normal nutrition becomes impossible. It is still under debate, which predictive factors for prophylactic PEG tube insertion are useful.

Materials/Methods: From an institutional database, 101 patients (72 male, 29 female, mean age 59.5 years) with concurrent radiochemotherapy for HNC were included in this study. Clinical factors (ECOG performance status, age, TNM stage), administration of chemotherapy and several organ-at-risk dosimetric parameters (oropharynx + 1cm margin, superficial pharyngeal constrictor muscle, larynx, oral cavity) were correlated with the need for tube feeding or parenteral nutrition for more than 4 days using a multiple logistic regression model.

Results: Whereas several dosimetric and clinical factors were significant predictors for the need of artificial nutrition on univariate analysis, on multivariate analysis only three factors remained independently significant: Mean dose to the oropharynx +1 cm circumferential margin, ECOG performance state and the use of chemotherapy.

Conclusions: Using a multiple logistic regression model we could distinguish HNC-patients with different risk factors for the need of additional feeding during radiochemotherapy.

SSG10

Neuroradiology/Head and Neck (Thyroid & Parathyroid Imaging)

Scientific Papers

US | CT | NR | HN
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM  Location: N226

Participants

Moderator

Jenny K. Hoang MBBS : Nothing to Disclose
Moderator

Ashok Srinivasan MD : Author, Amirsys, Inc

Sub-Events

SSG10-01

Lifetime Attributable Risk of Cancer from Radiation Exposure during Parathyroid Imaging: Comparison of 4DCT and Sestamibi Scintigraphy

Jenny K. Hoang MBBS (Presenter): Nothing to Disclose, Robert E. Reiman MD : Nothing to Disclose, Giang Huong Nguyen MD, PhD : Nothing to Disclose, Natalie Januzis : Nothing to Disclose, Carolyn R. Lowry BS : Nothing to Disclose, Bennett B. Chin MD : Nothing to Disclose, Terry T. Yoshizumi PhD : Nothing to Disclose

PURPOSE

The aim of this study was to measure the effective dose and organ doses for parathyroid 4DCT and sestamibi scintigraphy, and to estimate the lifetime attributable risk (LAR) of cancer incidence based on the measured radiation doses.

METHOD AND MATERIALS

We measured the organ radiation doses for 4DCT and sestamibi scintigraphy (with SPECT-CT) based on scanning with our institution’s protocols. An anthropomorphic phantom with MOSFET detectors was scanned to measure radiation dose from CT. Organ doses from the radionuclide for scintigraphy were based on NUREG/CR-6345. Effective dose was calculated for 4DCT and scintigraphy, and used to estimate the LAR of cancer incidence for patients differing in age and gender with the approach established by the Biologic Effects of Ionizing Radiation VII report. A 55-year-old female was selected as the standard patient based on demographics of patients with primary hyperparathyroidism.

RESULTS

The organs that received the highest radiation dose for 4DCT were the thyroid (150 mGy), salivary glands (137 mGy) and the esophagus (87 mGy). For sestamibi scintigraphy, the highest organ doses were to the colon (42 mGy), gall bladder (35 mGy) and the kidneys (32 mGy). The effective dose was 26 mSv for 4DCT compared to 12 mSv for sestamibi scintigraphy. The baseline lifetime incidence of any cancer in the unexposed standard patient was 46438/100,000. In the exposed patient, the LAR for cancer incidence was 172/100,000 for 4DCT and 66/100,000 for sestamibi scintigraphy. This resulted in an increase in lifetime incidence of cancer over baseline risk of 0.46% for 4DCT and 0.18% for sestamibi scintigraphy. In a 25-year-old female (nonstandard) the increase in the lifetime incidence of cancer over baseline risk was higher at 0.94% for 4DCT and 0.36% for sestamibi scintigraphy.

CONCLUSION

Effective dose from 4DCT is double that of sestamibi scintigraphy, but both studies cause negligible increases in lifetime risk of cancer. Clinicians should not allow concern for radiation-induced cancer influence decisions regarding workup in older patients with primary hyperparathyroidism. In younger women, 4DCT should not be the first-line imaging modality given a substantially higher LAR from 4DCT compared to scintigraphy.

CLINICAL RELEVANCE/APPLICATION
Clinicians should not allow concern for radiation-induced cancer influence decisions regarding workup in older patients (≥ 55 years) with primary hyperparathyroidism.

**SSG10-03**

**TIRADS and Ultrasound Elastography: Useful Tools in Recommending Repeat FNA for Solid Thyroid Nodules with Nondiagnostic Fine Needle Aspiration Cytology**

Vivian Youngjean Park MD (Presenter): Nothing to Disclose, Eun-Kyung Kim: Nothing to Disclose, Jin Young Kwak MD: Nothing to Disclose, Jung Hyun Yoon MD: Nothing to Disclose, Hee Jung Moon MD: Nothing to Disclose

**PURPOSE**

We aimed to evaluate the role of the thyroid imaging reporting and data system (TIRADS) and elastography in recommending repeat fine-needle-aspiration (FNA) for solid thyroid nodules with nondiagnostic FNA cytology.

**METHOD AND MATERIALS**

A total of 143 solid thyroid nodules in 141 patients were included. Each was classified according to the TIRADS; solid component, hypoechoogenicity or marked hypoechoogenicity, microlobulated or irregular margins, microcalcifications, and taller-than-wide shape were considered suspicious US features. Nodules with one, two, three or four, or five suspicious US features were classified as category 4a, 4b, 4c or 5 respectively. Elastography scores were classified according to the Rago and Asteria criteria. We investigated the malignancy risk for each TIRADS category and the corresponding sensitivity, specificity, negative predictive value, positive predictive value and accuracy of elastography.

**RESULTS**

Of 141 nodules, 25 were malignant, 79 were benign, and 39 were not confirmed. None of the US features, frequencies of TIRADS categories or classification according to the Rago and Asteria criteria significantly differed between benign and malignant nodules. The malignancy risk for TIRADS category 4a, 4b, 4c and 5 were 6.7% (1/15), 15.8% (6/38), 20.7% (17/82) and 12.5% (1/8) respectively, when including nonconfirmed nodules in the denominator. When analyzing confirmed nodules, elastography showed the highest negative predictive value for TIRADS category 4a: sensitivity, specificity, negative predictive value, positive predictive value and accuracy were 0% (0/1), 85.7% (6/7), 85.7% (6/7), 0% (0/1), 75% (6/8) for the Rago criteria and 100% (1/1), 85.7% (6/7), 100 (6/6), 50% (1/2) and 87.5% (7/8) for the Asteria criteria. The Asteria criteria accurately classified the 1 malignant nodule in the TIRADS category 4a as malignant.

**CONCLUSION**

Observation may be considered for solid thyroid nodules with nondiagnostic cytology that are classified as TIRADS category 4a and benign based on Asteria criteria, due to their low malignancy risk and high negative predictive value of elastography. Repeat FNA is warranted for TIRADS category 4b, 4c or 5, regardless of elastography features.

**CLINICAL RELEVANCE/APPLICATION**

Elastography is a useful tool in recommending repeat FNA for solid thyroid nodules with initial nondiagnostic cytology, when no other suspicious US features are present.

**SSG10-04**

**Ultrasound Elastography Using Carotid Artery Pulsation in Differential Diagnosis of Sonographically Indeterminate Thyroid Nodules**

Bongguk Yim (Presenter): Nothing to Disclose, Woo Jung Choi MD: Nothing to Disclose, Jeong Seon Park MD: Nothing to Disclose, Hye Ryoung Koo MD: Nothing to Disclose, Soo-Yeon Kim: Nothing to Disclose

**PURPOSE**

The purpose of this study was to evaluate the diagnostic performance of gray-scale ultrasound (US) and a new method of thyroid US elastography using carotid artery pulsation in the differential diagnosis of sonographically indeterminate thyroid nodules.

**METHOD AND MATERIALS**

A total of 102 thyroid nodules with indeterminate gray-scale US features from 102 patients (20 men and 82 women; age range, 16-74 years, mean age: 51 years) were included. Gray-scale US images were reviewed and scored from 1 (low) to 5 (high) according to the possibility of malignancy. US elastography was performed using carotid pulsation as a compression source. The elasticity contrast index (ECI), which quantifies local strain contrast within a nodule, was automatically calculated. The radiologist reassessed scores after concurrently reviewing gray-scale US and elastography. Receiver operating characteristic curve analysis was used to evaluate the diagnostic performances of each data set and to compare the Az values of gray-scale scoring, ECI, and combined assessment scoring.

**RESULTS**

Malignant thyroid nodules were more hypoechoic than benign nodules. The ECI was significantly higher in
malignant nodules than in benign thyroid nodules. The Az values of each data set were 0.755 (95% CI, 0.660-0.835) for gray-scale, 0.835 (95% CI, 0.748-0.901) for ECI, and 0.853 (95% CI, 0.769-0.915) for combined assessment. The Az value for the combined assessment of gray-scale and ECI was significantly higher than for gray-scale alone (p = 0.022).

CONCLUSION

Combined assessment with gray-scale US and elastography using carotid artery pulsation is helpful for differentiating sonographically indeterminate thyroid nodules.

CLINICAL RELEVANCE/APPLICATION

Thyroid US elastography using carotid artery pulsation may be a useful adjunctive parameter for the differential diagnosis of sonographically indeterminate thyroid nodules.

SSG10-05

Parathyroid Adenomas and Hyperplasia on 4DCT: Grading System for Degree of Confidence

Manisha Bahl MD, MPH (Presenter): Nothing to Disclose, Ali R. Sepahdari MD : Nothing to Disclose, Julie A. Sosa MD : Nothing to Disclose, Jenny K. Hoang MBBS : Nothing to Disclose

PURPOSE

Prior to performing minimally-invasive parathyroidectomy, preoperative imaging is required to localize parathyroid adenomas with a high degree of confidence. Several signs on 4DCT can be used to determine degree of confidence. The purpose of this study is to evaluate the performance of a confidence grading system for parathyroid lesions on 4DCT.

METHOD AND MATERIALS

We retrospectively reviewed preoperative 4DCT scans in 63 consecutive patients from November 2012 to December 2013 with pathologically-proven parathyroid adenomas or hyperplasia. Two radiologists reviewed the CT images to localize parathyroid lesions. Lesions detected on imaging and confirmed by surgery were categorized by a three-category confidence grading system based on four enhancement patterns (Types A-D) and three secondary signs. "Consistent with" was defined as Type A/B enhancement with >/=1 secondary findings. "Suspicious" was Type A/B enhancement without secondary findings or Type C/D enhancement with >/=1 secondary findings. "Possible" was Type C/D enhancement without secondary findings. The enhancement patterns required the lesion to be lower in attenuation than the thyroid gland on the noncontrast phase but differed on the arterial and delayed phases. Secondary findings were size >/=1 cm, a cystic component, and the polar vessel sign. We calculated and compared the prevalence and positive predictive values (PPV) of each grading system category.

RESULTS

63 patients had 75 lesions. 54 patients had single adenomas and nine patients had multigland disease with 21 lesions. The sensitivities for single gland and multigland disease were 94% and 52%, respectively. 74 lesions (including four false positives) could be categorized by the grading system. "Consistent with" was seen in 51% of lesions and had 100% PPV. "Suspicious" represented 37% of lesions and had 96% PPV. Finally, "possible" represented 11% of lesions and had the lowest PPV (73%).

CONCLUSION

A grading system allows radiologists to communicate the degree of confidence when a lesion is detected on 4DCT, which is valuable for preoperative planning. The proposed system performs as intended in that the highest confidence grade has the highest PPV and the lowest grade has the lowest PPV.

CLINICAL RELEVANCE/APPLICATION

A 4DCT grading system can communicate degree of confidence for parathyroid adenomas, and detection of a lesion with the highest confidence grade may reduce the need for further imaging.

SSG10-06

Intra-reader Agreement for Color Based Elastograms in Thyroid Elastography

Manjiri K. Dighe MD (Presenter): Research Grant, General Electric Company, Jeff Thiel : Nothing to Disclose, Theodore J. Dubinsky MD : Nothing to Disclose

PURPOSE

To assess intra-reader agreement in evaluation of the color elastograms in thyroid elastography using Shear-Wave elastography

METHOD AND MATERIALS

After IRB approval, elastograms were obtained by Shear-wave elastography from 77 individuals, with a total of 96 thyroid nodules. Elastography data was acquired without any external compression using the Supersonics Aixplorer machine. Each nodule had multiple color elastograms saved per nodule. 1 reader blinded to the final cytopathology results was asked to score the elastogram images based on a standard 5-point scale. The reader
was then asked to rescore the elastograms after a period of 15 days and was also blinded to the prior results. Results were also compared to the cytopathology diagnosis based on Bethesda classification. In addition, since each nodule had multiple images, variability of scoring within a single nodule was also evaluated.

RESULTS

There was overall good intra-reader agreement in scoring the elastograms with a concordance correlation coefficient of 0.83, a weighted kappa of 0.71 with a 95% confidence interval of 0.66 to 0.76 and a mean Intraclass correlation coefficient (ICC) of 0.83 and 0.90. The Area under the curve for accurate diagnosis of the nodule as being benign or malignant was 0.82. The variability in the scoring between the benign nodules was less than that in the malignant nodules with a variance of 0.64 and 1.38 respectively.

CONCLUSION

Our study indicates that there was good overall intra-reader agreement for qualitative scoring of the elastograms. The overall variance in the scoring of benign nodules was less than that in the malignant nodules. There could be bias in this since the number of malignant nodules in our study was smaller than benign nodules. Since Shearwave elastography provides quantitative values for the stiffness in the nodule, there would be less of a discordance and less variance compared to scoring color elastograms for thyroid nodule elastography.

CLINICAL RELEVANCE/APPLICATION

Decreasing the intra-reader variability in thyroid elastography is important. We also evaluated the variance in scoring each individual nodule since in every exam multiple images are acquired per nodule and it is important to know which particular score should be assigned to a nodule to be able to provide accurate diagnosis.

SSG10-07

Preoperative Differentiation of Thyroid Adenomas and Thyroid Carcinomas Using High Resolution Contrast-enhanced Ultrasound (CEUS)

Ernst Michael Jung MD (Presenter): Nothing to Disclose, Stefan Schleder MD: Nothing to Disclose, Lena Dendl: Nothing to Disclose, Christian Roland Stroszcynski MD: Nothing to Disclose

PURPOSE

To evaluate the impact of high-resolution contrast-enhanced ultrasound (CEUS) in combination with Color Coded and Power Doppler Sonography (CCDS/PD) in the preoperative differentiation of thyroid adenomas and thyroid carcinomas.

METHOD AND MATERIALS

A total of 111 patients (60 female, median age 54 years) underwent surgery for thyroid adenoma and thyroid carcinoma. CCDS/PD and CEUS were performed in all patients by an experienced examiner using multifrequency linear transducer (6-9 MHz) and were digitally stored. Reading of the ultrasound images was performed by two experienced radiologists in consensus. For CEUS a bolus injection of 1 ml Sulfurhexafluoride-Microbubbles (SonoVue®) was used. A histopathological evaluation was obtained as standard of reference in all patients.

RESULTS

80 thyroid adenomas and 31 thyroid carcinomas were detected. Mean diameter of thyroid adenomas and thyroid carcinomas was 27 mm and 25 mm, respectively. The differences in microcirculation of thyroid adenomas and thyroid carcinomas were statistically highly significant (p <0.01). Representative features for thyroid adenomas were either no wash-out or wash-out with persisting edge in late phase, for thyroid carcinomas a complete wash-out in late phase. Thus, calculation of the sensitivity, specificity, positive and negative predictive value of 82%, 91%, 96% and 63%, respectively, for the differentiation of benignity and malignancy was possible.

CONCLUSION

Dynamic evaluation of microcirculation using CEUS and CCDS/PD enables a more reliable preoperative discrimination between thyroid adenomas and thyroid carcinomas.

CLINICAL RELEVANCE/APPLICATION

CEUS enables a more reliable preoperative discrimination between thyroid adenomas and thyroid carcinomas.

SSG10-08

Dual-energy Multiphasic CT Scan for Localization of Discrepant or Unlocalized Parathyroid Adenomas

Reza Forghani MD, PhD (Presenter): Nothing to Disclose, Michael Roskies MD: Nothing to Disclose, Michael Hier MD: Nothing to Disclose, Alex Mlynarek: Nothing to Disclose, Mark Levental MD: Nothing to Disclose

PURPOSE

Accurate pre-operative localization of parathyroid adenomas (PAs) is essential for successful, minimally invasive
surgery, and is typically based on two concordant studies. 4-dimensional MDCT is increasingly used for localization of PAs. There are also isolated reports of dual-energy CT (DECT) for localization of PAs but no systematic evaluation of this technique. DECT has the potential to increase accuracy of PTA detection by enabling more accurate iodine content evaluation and to eliminate the need for an unenhanced scan, reducing radiation exposure. In this study, we evaluated the utility of multiphasic DECT for PA localization in a group of patients having discrepant or unidentified PAs.

**METHOD AND MATERIALS**

20 patients with primary hyperparathyroidism having either discrepant or unlocalized PAs underwent a multiphasic DECT in a 64-slice scanner (GE Discovery CT750HD). Scans were obtained at 25, 55, and 85 sec after injection of 80 mL of iopamidol at 3.5 mL/sec. DECT scans were reconstructed as 70 keV monochromatic images and source images transferred to a dedicated workstation for reconstruction of virtual monochromatic images. The scans were prospectively reviewed by 2 attending head and neck radiologists. The final results were compared with localization during minimally invasive surgery and histopathologic confirmation.

**RESULTS**

Out of 20 patients, 11 had negative and 9 discordant standard imaging. DECT identified PAs in 8 of 11 and 7 of 9 patients, respectively. Of the 15 PAs, 7 were prospectively identified as PA candidates but characterized as atypical, based on absence of rapid arterial phase enhancement and early washout and/or presence of internal low attenuation areas. 7 patients have so far undergone surgery, and DECT correctly localized the PA in 6 of 7 patients, for a total of 7 PAs (one patient had bilateral PAs).

**CONCLUSION**

3-phase DECT without an unenhanced scan can accurately localize PAs in a significant proportion of unlocalized or discrepant cases. Although perfusion characteristics are important, a high proportion of PAs lacked typical perfusion characteristics in this patient population but were identifiable based on other features.

**CLINICAL RELEVANCE/APPLICATION**

Multiphasic DECT without an unenhanced scan can accurately localize a significant number of PAs not localized by conventional imaging enabling successful minimally invasive surgery with reduced surgical exploration and associated patient morbidity.

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**SSG10-09**

**4DCT in the Evaluation of Hyperparathyroidism: Predictors of Parathyroid Single Gland and Multigland Disease**

Ali R. Sepahdari MD (Presenter): Nothing to Disclose, Manisha Bahl MD, MPH : Nothing to Disclose, Jenny K. Hoang MBBS : Nothing to Disclose

**PURPOSE**

Parathyroid multigland disease (MGD) is a challenging problem for radiologists. Other lesions in the patient may be missed after the first lesion is detected because they are small or not suspected. We aim to compare 4DCT findings of single gland (SG) and MGD to identify findings that may predict MGD.

**METHOD AND MATERIALS**

We retrospectively reviewed 35 patients with MGD and 129 patients with SG lesions who had preoperative 4DCT scans at two institutions between September 2011 and December 2013. The following data were recorded: presurgical calcium and PTH levels, number of candidate lesions identified with 4DCT, and longest measurement of abnormal glands seen on CT. Parametric and non-parametric statistical tests were applied in order to determine features or combinations of features that could predict MGD.

**RESULTS**

Mean size of MGD was 8.8 mm and significantly smaller than mean size 11.8 mm for SG lesions (p .001). MGD also had lower serum PTH (P=.03). Fisher's exact test showed that identification of only 1 abnormal gland, versus no abnormal glands or multiple abnormal glands, was strongly predictive of single gland disease (P<.0001, likelihood ratio [LR] = 5). The finding of only 1 abnormal gland was 86% specific for single gland disease (14% missed MGD). Adding the requirement that the abnormal gland measure at least 10 mm in maximal dimension resulted in 94% specificity for SG disease (6% missed) (P<.0001, LR 8.5).

**CONCLUSION**

Identification of a single abnormal gland measuring at least 10 mm on 4DCT is highly specific for single gland disease. Conversely, when the candidate lesion is less than 1cm, the radiologists should be more suspicious for MGD and review the scan closely for another lesion. This information can help radiologists to improve the sensitivity of future 4DCT interpretations for MGD.

**CLINICAL RELEVANCE/APPLICATION**

Improving the detection of MGD or raising suspicion for MGD to the surgeons allows for a more informed clinical management plan and appropriate selection of patients for minimally invasive surgery.
Age-related Brain Activity Difference during Arithmetic Testing: An fMRI Investigation

Li Sun (Presenter): Nothing to Disclose, Jiliang Fang: Nothing to Disclose, Kuncheng Li: Nothing to Disclose

PURPOSE
To investigate the neural basis for aging effect on single-digit multiplication using functional magnetic resonance imaging (fMRI).

METHOD AND MATERIALS
Nineteen younger and twenty aged subjects were required to perform single-digit multiplication and control tasks in magnetic resonance (MR) scanner.

RESULTS
For behavioral measures, our results revealed no differences in two age groups in accuracy and reaction time (RT) performance. For fMRI analysis, single-digit multiplication, relative to detecting-zero, yielded multiple frontal, temporal and parietal activations for both younger and aged participants, however, aged adults exhibited more extensive activation in medial frontal areas and less extensive activation in temporal and parietal lobes as compared with younger adults. Direct group comparisons showed that aged adults exhibited greater activity in right and left supplementary motor area (SMA), and weaker activity in bilateral parahippocampal gyri together with a cluster in right middle temporal gyrus.

CONCLUSION
Our findings indicate that, healthy aged adults enhance control of fact retrieval in SMA to compensate the deficits in temporal lobe memory system. Moreover, our findings provide supportive evidence for posterior-anterior shift in aging (PASA) pattern in arithmetic problem solving domain.

CLINICAL RELEVANCE/APPLICATION
fMR can demonstrate the neural basis of cognitive alteration in normal aging and patient. It has the potential to diagnose neurodegenerative disease in early stage.

Genetic Frontotemporal Dementia with TDP-43 Inclusions: Distinct Radiological Phenotypes between Patients with PGRN and C9ORF72 Mutations

Anne Bertrand MD, PhD (Presenter): Nothing to Disclose, Fatima Ameur MD: Nothing to Disclose, Paola Caroppo MD: Nothing to Disclose, Didier Dormont MD: Nothing to Disclose, Alexis Brice: Nothing to Disclose, Isabelle Le Ber: Nothing to Disclose, Olivier Colliot: Nothing to Disclose

PURPOSE
To study the MR phenotypes of the 2 most frequent genetic forms of frontotemporal dementia: PGRN and C9ORF72 mutations.

METHOD AND MATERIALS
2 readers retrospectively reviewed axial FLAIR and 3DT1 images of 27 patients with a genetic form of frontotemporal dementia: 17 patients with C9ORF72 mutation and 10 patient with PGRN mutation. The severity of FLAIR hyperintensity was rated using the Fazekas & Schmidt score. The type of FLAIR hyperintensities was rated using a 3-level score: A- vascular type; B- vascular type predominating in the areas of atrophy; C-non vascular type. The presence of regional atrophy was scored as follow: presence or absence of an
RESULTS
Interrater agreement was moderate for Fazekas & Schmidt score (0.50 (0.16-0.68)) and high for the type of FLAIR intensities (0.79 (0.56-0.91)), the presence of anteroposterior gradient of atrophy (0.78 (0.61-1)) and the presence of left-to-right or right-to-left gradient of atrophy (0.73 (0.52-0.94)) (weighted kappa tests). Atypical FLAIR hyperintensities (type B-C) were present in 90% of patients with PGRN mutation, while only 12% with C9ORF72 mutation. Asymmetrical anterior atrophy, characteristic of frontotemporal dementia, was present in 70% of patients with PGRN mutation, while only 18% with C9ORF72 mutation.

CONCLUSION
Major phenotypic differences distinguish on brain MRI C9ORF72 and PGRN mutations, which are both related to frontotemporal dementia with TDP-43 inclusions. This result demonstrates that gene-related effects can overpass lesion-related effects in the phenotypic expression of frontotemporal dementias.

CLINICAL RELEVANCE/APPLICATION
In patients presenting with frontotemporal dementia, neuroradiologists should raise the possibility of a genetic form linked to PGRN mutation when atrophy is particularly marked, and associated with atypical FLAIR hyperintensities, predominating in the areas of atrophy.

SSG11-03
Cognitive Dysfunctional in Patients with Early Type 2 Diabetes: A Preliminary BOLD fMRI and MR Spectroscopy and DTI Study
Xiang Liu MD (Presenter): Nothing to Disclose, Wei Tian MD, PhD: Nothing to Disclose

PURPOSE
There are few studies about cognitive impairment in early type 2 diabetes using fMRI technique. To evaluate cognitive dysfunction in early type 2 diabetes patients with psychological tests and BOLD fMRI. To analyze MR spectroscopy change in prefrontal cortex (PFC) and white matter abnormal by DTI.

METHOD AND MATERIALS
Twenty-five patients with early type 2 diabetes mellitus and 15 demographically similar, healthy subjects were enrolled. A series cognitive function tests including Wechsler memory scale-revised (WMS-R) were assessed; DTI, Bold fMRI (using nback working memory task) and single-voxel MRS with TE 30 on bilateral PFC were performed. The statistic differences of psychological tests and MRS result between the two groups were evaluated by SPSS. The MR data were analyzed by SPM2. DTI data were processed using FSL package, Tract-Based Spatial Statistics (TBSS) to detect the FA/MD group difference.

RESULTS
(1) psychological tests showed that the scores of cognitive tests in diabetes group were significantly lower than those in control group. (2) fMRI examinations revealed that the activation pattern in diabetes group was similar with the control group, but less activation in prefrontal, parietal lobe. There was additional activation in right temporal lobe (including inferior temporal gyrus and parahippocampus gyrus) and anterior cingulate cortex in diabetes group. (3) MRS data showed that comparing with control group, Glx/(Cho+Cr) were significantly elevated in bilateral PFC; NAA/Cho,Glx/Cho,Glx/Cr were significantly elevated in the right PFC. Transit memory was negatively correlated with Glx/Cho (F=-0.546, P value =0.013) and Glx/(Cr+Cho) (F=-0.471, P value = 0.036). 4) DTI: patients group showed significant MD increase in right temporal WM and right superior longitudinal fasciculus (SLF) and right anterior internal capsule , FA showed decrease trend in those area in patients group.

CONCLUSION
Advanced neuroimaging techniques could detect microstructure and functional abnormalities in type 2 diabetic patients with normal appearing on conventional MR. The hypofunction in PFC in fMRI, abnormal white matter connectivity in DTI, and Glx elevation in MRS correlated with cognitive memory dysfunction, and may reveal early pathophysiological process and corresponding compensation.

CLINICAL RELEVANCE/APPLICATION
Advance functional MRI technique could detect early brain cognitive damage in patient with type 2 diabetes

SSG11-04
Episodic Memory Impairment in Systemic Lupus Erythematosus: Evidences of Thalamic Structures Involvement
Nicolle Zimmermann: Nothing to Disclose, Diogo Goulart Correa MD: Nothing to Disclose, Tania Maria Netto PhD: Nothing to Disclose, Bernardo Canedo Bizzo MD (Presenter): Nothing to Disclose, Rochele Paz Fonseca: Nothing to Disclose, Emerson L. Gasparetto MD: Nothing to Disclose

PURPOSE
Episodic memory deficits in systemic lupus erythematosus (SLE) have been frequently reported, but little is known about the neural correlates of those deficits. In this scenario, studies have been indicating lack of involvement of hippocampal volume associated to memory functioning in SLE, in spite of evidences of a progressive reduction of volume along SLE condition. For this reason, we aimed to explore further differences of critical memory-related brain structures volumes among SLE samples with and without episodic memory deficits and controls.

METHOD AND MATERIALS
Our sample was composed by n=85 individuals distributed in three groups: 1) SLE with episodic memory deficits (SLE+) (n=17); 2) SLE without episodic memory deficits (SLE-) (n=34); 3) controls without episodic memory deficits (n=34). Groups were matched on age, education, sex, MMSE, and SLICC. Episodic memory deficits were defined by performance on Rey Auditory Verbal Learning Test. All the participants were examined on a 1.5 Tesla MRI scanner. The protocol of image acquisition was: FLAIR sequence with axial and sagittal T1 3D MPRAGE. The FreeSurfer software was used to perform the cortical volumetric reconstruction and segmentation. One-way ANOVA and ANCOVA (time of diagnosis as a co-variate) analysis were performed in SPSS software.

RESULTS

Results indicated significant differences between SLE+>SLE- and SLE+>controls in the volume of the third ventricle. Co-variance analysis showed significant minor volume of right and left thalamus in SLE+ when compared to SLE-. No differences among groups were found in focused attention performance.

CONCLUSION

Our findings indicated group effects on right and left thalamus and on the third ventricle volumes. These findings are consistent with evidences of hippocampal-diencephalic interactions associated to episodic memory performance in SLE.

CLINICAL RELEVANCE/APPLICATION

Findings presented here suggest that thalamus may be the first episodic memory-related structure to be affected in the volumetric-anatomical level in SLE when the hippocampus is intact. An additional hypothesis would be that thalamic connections have a critical role in disrupting several neuropsychological processes in SLE.

SSG11-05

Right Arcuate Fasciculus Disruption in Chronic Fatigue Syndrome

Michael Maroun Zeineh PhD, MD (Presenter): Research funded, General Electric Company, James Kang MD: Nothing to Disclose, Scott W. Atlas MD: Nothing to Disclose, Mira Raman: Nothing to Disclose, Allan Reiss MD: Nothing to Disclose, Ian Scott Valencia BS: Nothing to Disclose, Jose Scott Montoya MD: Nothing to Disclose

PURPOSE

(1) Detect microstructural abnormalities underlying chronic fatigue syndrome (CFS) using diffusion tensor imaging (DTI), (2) assess if gray and/or white matter volumes are abnormal utilizing T1-weighted volumetric analysis, and (3) detect suspected global alterations in brain perfusion using pseudo-continuous arterial spin labeling (ASL).

METHOD AND MATERIALS

15 CFS patients and 14 controls provided informed consent in accordance with Stanford's Institutional Review Board and HIPAA. Subjects underwent 3.0T volumetric T1 and T2-weighted imaging, two DTI acquisitions, and ASL. Segmentations of supratentorial gray and white matter and cerebrospinal fluid were used to compare gray and white matter volume fractions and cortical thickness. DTI was processed with automated fiber quantification (AFQ), which compares piecewise fractional anisotropy (FA) along 20 tracks. The FreeSurfer segmentation was used to compare cerebral blood flow.

RESULTS

Bilateral white matter volume and right thalamic volumes were reduced in the CFS population. In CFS, FA was increased in the right arcuate fasciculus, and cortical thickness increased in both of its endpoints: the right middle temporal and right precentral gyri. In right-handers, FA was also increased in the right inferior longitudinal fasciculus, and thickness increased in one endpoint, the right occipital lobe. Within CFS patients, right anterior arcuate FA as well as basal ganglial volumes increased with disease severity. ASL showed no significant differences.

CONCLUSION

Bilateral white matter and right thalamic atrophy are present in CFS. Right hemispheric increased FA and cortical thickness are present, suggestive of a compensatory or pathological network. Right anterior arcuate FA may serve as a biomarker for CFS.

CLINICAL RELEVANCE/APPLICATION

Automated tractography can be useful for studying the microstructure underlying neurological disorders.

SSG11-06

Intrinsic Functional Connectivity of the Default Mode Network is Associated with Symptom Severity in Schizophrenia

Sophia Mueller MD (Presenter): Nothing to Disclose, Daniel Keeser: Nothing to Disclose, Kristina Fast MD: Nothing to Disclose, Christina Fuchs: Nothing to Disclose, Ute Coates: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Thomas Michael Meindl MD: Nothing to Disclose

PURPOSE

Chronic schizophrenia (SCZ) is characterized by decreased intrinsic functional connectivity of the default mode...
network (DMN) as compared to healthy controls. The purpose of the present study was to investigate if intrinsic functional connectivity of the DMN is associated with symptom severity as estimated by the positive and negative symptom scale (PANSS).

**METHOD AND MATERIALS**

Resting state functional connectivity data was obtained from 23 SCZ patients (mean age 37.9 +/- 11.8 yrs, 8 female). Functional EPI sequences and a high-resolution MPRAGE sequence were acquired at 3.0 Tesla (Magnetom VERIO, Siemens, Germany). Preprocessing was performed using FSL 4.16. The DMN of each individual was extracted applying dual regression independent component analysis. Voxel-wise regression coefficients for the psychological test items PANSS (subscales total, positive symptoms and negative symptoms) and trait anxiety were estimated by using a mixed-effects general linear model. Significantly correlated voxels are reported at a threshold of p < 0.005.

**RESULTS**

Within the DMN connectivity of the medial prefrontal cortex was negatively correlated with severity of positive symptoms and anxiety. Connectivity between the DMN and the right striatum was negatively correlated with general symptom severity as measured by the PANSS total score. No correlation between severity of negative symptoms and DMN connectivity was detected.

**CONCLUSION**

Intrinsic functional connectivity of the DMN as measured by resting state functional MRI is not only capable of detecting group differences between SCZ patients and healthy controls but can also provide an imaging correlate for differential symptom severity in SCZ patients.

**CLINICAL RELEVANCE/APPLICATION**

As an imaging correlate of symptom severity in SCZ, DMN connectivity might serve as an imaging marker to monitor treatment effects and as a potential intermediate phenotype for schizophrenia risk genes.

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**SSG11-07**

**Appropriate Imaging Utilization: A Meta-analysis of Neurological Imaging in First Episode Psychosis**

Wilfred Dang BS (Presenter): Nothing to Disclose, Sabina Imran Khan MBBS: Nothing to Disclose, James P. Ross BSc: Nothing to Disclose, Santanu Chakraborty FRCR, DMRD: Speakers Bureau, Merck KGaA Speakers Bureau, Novartis AG Grant, Bayer AG

**PURPOSE**

The low diagnostic yield associated with the usage of CT/MRI imaging in first episode psychosis (FEP) has caused a change in British guidelines to decrease redundant neuroimaging. However, imaging for FEP is still common in North America and remains a point of controversy. The purpose of this study is to assess current literature regarding the diagnostic value for FEP neuroimaging. This will help us determine the necessity of head CTs/MRIs in clinical practice for FEP patients.

**METHOD AND MATERIALS**

Electronic searches were performed in MEDLINE, PSYCHINFO and EMBASE in November 2013. Search criteria consisted of: “Psychotic Disorders”, “Psychosis”, “MRI”, “CT”, “Predictive Value of Tests”, “Differential Diagnosis”, “Biomedical Technological Assessment” and syntax derivatives of these search terms. After duplicates were removed, two reviewers screened 545 articles for inclusion. Studies included needed to meet the following: a) Patients must be presenting with FEP, b) Patients had a CT or MRI at the time of presentation, c) Studies must have reported abnormal or normal image results, and d) The rationale of the scan must be reported. Disputed articles between reviewers were resolved by a senior neuro-radiologist. All statistical analyses were performed using the Comprehensive Meta-Analysis Software. The event rate was computed as the number of patients with abnormal radiological findings possibly accountable for psychosis over the total number of patients that underwent imaging. Event rates for CT and MRI were summarized in separate forest plots, with the corresponding 95% confidence interval for each study.

**RESULTS**

Preliminary results from 8 abstracted studies show that, out of 1,019 CT/MRI scans, 838 scans were completely normal, whereas some abnormalities were observed in only 181 scans. Most abnormalities seen were either benign or incidental and did not have any impact on patient management. The calculated overall rate of abnormal findings that accounted for psychosis was 0.9% (95% CI: 0.5%-1.9%).

**CONCLUSION**

Given the low diagnostic yield of neuroimaging for FEP, more consideration needs to be given to ordering a head CT/MRI for FEP due to radiation and resource utilization concerns.

**CLINICAL RELEVANCE/APPLICATION**

Neuroimaging for FEP has very little value in determining the cause for psychosis and should be re-evaluated in psychiatric guidelines.

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**SSG11-08**

**Investigating the Predictive Value of Whole-brain Structural Neuroimaging in Obsessive Compulsive Disorder: A Multivariate Pattern Classification Approach**

Xinyu Hu (Presenter): Nothing to Disclose, Lihou Chen: Nothing to Disclose, Yi Liao: Nothing to Disclose, Qi Liu: Nothing to Disclose, Fei Li MD: Nothing to Disclose, Yanchun Yang: Nothing to Disclose.
Obsessive-compulsive disorder (OCD) is one of the most common disabling psychiatric disorders. Many magnetic resonance imaging (MRI) studies have already revealed brain structural abnormalities in OCD patients involving both gray matter (GM) and white matter (WM). However, results of those publications were based on average differences between groups, which limited their usages in clinical practice. Multivariate pattern analysis (MVPA) approach is a promising analytical technique which allows the classification of individual observations into distinct groups. Therefore, the aim of this study was to examine whether the application of MVPA to high-dimensional structural MR images would allow accurate discrimination between OCD patients and healthy control subjects (HCS).

METHOD AND MATERIALS

High-resolution T1-weighted volumetric 3D MR images were acquired for 33 OCD patients and 33 demographically matched HCS using a 3.0 T MRI system. Structural images were preprocessed with the Diffeomorphic Anatomical Registration using the Exponentiated Lie algebra (DARTEL) toolbox. Differences in GM volume and WM volume between OCD and HCS were examined respectively using two sorts of well-established MVPA techniques, namely, Support Vector Machine (SVM) and Gaussian Process Classifier (GPC). We also drew a receiver operating characteristic (ROC) curve to help evaluate the performance of each classifier.

RESULTS

Results of SVM and GPC classification between OCD patients and HCS utilizing both GM and WM were shown in the figure. Overall, the classification accuracies for both classifiers regarding GM and WM anatomy were all above 75% and the highest classification accuracy (81.82%, \( P < 0.001 \)) was achieved with SVM classifier using WM information.

CONCLUSION

The current study illustrated that both GM and WM anatomical features might be used to classify OCD patients from HCS. WM volume with SVM approach showed the highest accuracy in current population to reveal group differences, which indicated its potential diagnostic role in helping detecting OCD.

CLINICAL RELEVANCE/APPLICATION

Using multivariate pattern analysis approach, we revealed structural MR images might be used to classify obsessive compulsive disorder from controls and provided supports for its potential role as a diagnostic tool.

Dysconnectivity hypothesis posits that major depressive disorder (MDD) relates to abnormal resting-state connectivity within the default-mode network (DMN). Posterior cingulate cortex (PCC) is believed to have a key role in DMN and be involved in the pathophysiology of MDD. The goal of this study is to investigate whole-brain functional connectivity of PCC during resting state in subjects with MDD.

METHOD AND MATERIALS

A total of 17 patients with first-episode, drug-naive MDD patients and 30 healthy well-matched volunteers were prospectively examined. Resting-state brain functional connectivity analysis was used to examine the correlation between the PCC and whole-brain regions.

RESULTS

Compared with healthy controls, MDD patients showed significantly decreased functional connectivity of the PCC in the left middle temporal gyrus and right superior frontal gyrus. Increased functional connectivity of the PCC was detected in the right insula, right transverse temporal gyrus, left precuneus, right lingual gyrus, left posterior cingulate, left superior/middle frontal gyrus, right cuneus, and right precuneus.

CONCLUSION

Our findings suggested that abnormal functional connectivity of the DMN exist in first-episode, drug-naive MDD and further highlight the importance of the DMN in the pathophysiology of MDD.

CLINICAL RELEVANCE/APPLICATION

Resting-state fMRI can demonstrate functional connectivity of the default mode network in MDD and further highlight the importance of the DMN in the pathophysiology of MDD.
**PURPOSE**

Myelin is a lamellar membranous structure essential for proper function of the nervous system. In this study we aimed to image and quantify myelin in volunteers and patients with multiple sclerosis (MS) using ultrashort echo time (UTE) sequences on a clinical 3T scanner.

**METHOD AND MATERIALS**

The protons in myelin itself have very short T2s and are not detected with clinical sequences. We have implemented a 2D adiabatic inversion recovery prepared dual echo UTE (IR-dUTE) acquisition with a TE of 8 μs to detect signals from these protons. An adiabatic inversion pulse was used to invert and null the long T2 components in white matter. The ultrashort T2 components are not inverted due to fast relaxation, and are detected by subsequent UTE data acquisition. Residual signals from other long T2 signals (e.g., gray matter) are suppressed via subtraction of the 2nd image from the first one, providing selective depiction of the ultrashort T2* components in white matter. Residual signals from other long T2 signals (e.g., gray matter) are suppressed via subtraction of the 2nd image from the first one, providing selective depiction of the ultrashort T2* components in white matter. The IR-dUTE sequence was applied to ten healthy volunteers and 12 MS patients using the following parameters: 24 cm FOV, 5 mm slice, 125 kHz bandwidth, 60°, 1500 ms TR, 420 ms TI, TE=8 μs and 2.2 ms, recon matrix=256X256, 6.5 min scan time. T2* was quantified with two interleaved 4-echo UTE acquisitions (TEs = 0.008/2.2/4.4/6.6 ms, 0.2/3.3/5.5/7.7 ms). T2* was quantified via mono-exponential fitting of the IR-UTE signal decay.

**RESULTS**

High contrast was achieved for myelin both in healthy volunteers and MS patients. Myelinated areas of white matter appeared high signal on IR-dUTE images and areas of presumed myelin loss appeared low signal. Myelin showed an ultrashort T2* of 0.2-0.5 ms. These results suggest that the IR-dUTE sequence can generate high contrast images of myelin, and allow direct assessment of myelin loss and changes in its tissue properties via T2* measurement. Further validation will be performed via IR-UTE imaging of white matter specimens before and after D2O exchange (little or no change in IR-UTE signal would show that myelin is selectively directed).

**CONCLUSION**

The 2D IR-dUTE sequence can directly image and quantify the ultrashort T2* components in white matter of the brain in a clinical setting. There is significantly loss of the ultrashort T2* components, consistent with myelin loss in MS patients.

**CLINICAL RELEVANCE/APPLICATION**

Direct imaging and quantification of myelin may significantly advance the study of white matter diseases, including MS.
(DTI) and probabilistic tractography in a porcine model.

METHOD AND MATERIALS

Two experienced neurosurgeons performed stereotactic brain surgical procedures simulating skull base surgery in human patient in nine adolescent female pigs. Pre- and postsurgical DTI data were acquired on a 3T MRI (Achieva, Philips Healthcare, Cleveland, OH) with a 32-channel cardiac coil using a high-angular resolution protocol with 240x240 mm FOV, 1.9x1.9x2 mm3 voxel, TR/TE/Flip Angle = 8100 ms/67 ms/90°, b = 0/1000 s/mm2, and 60 gradient directions. The DTI data were analyzed with the probabilistic tractography approach using FSL (FMRIB, Oxford, UK). Pre- and postsurgical data were registered with affine linear registration. Fractional anisotropy (FA), mean diffusivity (MD), radial (Dr) and axial diffusivity (Da) were measured on 3x3x3 mm3 seed Region-Of-Interests (ROIs) placed in WM on surgical trajectory (4/animal) and on a reference fiber tract (2/animal) that connects primary and secondary visual cortex. Damage of WM fiber tracts from the surgical seed ROIs was quantified by the fraction of overlap between the pre- and postsurgical fiber volumes (OF = Vprenpost/Vpre). Linear mixed effect model was used for the statistical analysis.

RESULTS

The reference seeds have a mean OF value of 0.38 that reflects the inherent variability of the tractography technique and the registration error due to brain tissue loss, hemorrhage, and ventricular dilation. The surgical seeds have significantly lower OF (0.27, p=3e-8) than the reference seeds. No significant difference was found between pre- and postsurgical FA, MD, Dr or Da values at the site of surgery, suggesting the difference in OF is related to direct mechanical damage to fibers in surgery, not secondary axonal damage or edema.

CONCLUSION

Surgical damage to WM fiber tracts can be effectively detected by DTI and probabilistic tractography within a few hours after brain surgery. Surgical damage to fiber is associated with low OF between pre- and postsurgical fiber volumes but not with any other diffusion parameter.

CLINICAL RELEVANCE/APPLICATION

DTI can be used as an objective quantitative tool for prospective evaluation of brain surgical techniques in animal model, and retrospective assessment of surgical outcome in human patient.

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SSG12-03 Dynamic Associations between Diffusion Indices and Their Underlying Pathology of Wallerian Degeneration in Central Nervous System

Min Zhang (Presenter): Nothing to Disclose, Kuncheng Li MD: Nothing to Disclose, Chunshui Yu: Nothing to Disclose, Wen Qin: Nothing to Disclose

PURPOSE

We aimed to address the exact relationships between the evolution of diffusion indices and its underlying pathology in central nervous system.

METHOD AND MATERIALS

Twenty-five domestic mature Felis catus were included in the present study. The evolution of diffusion indices, including mean diffusivity (MD), fractional anisotropy (FA), primary (λ1) and transverse (λ2,3) eigenvalues of the degenerated corticospinal tract, were observed at baseline (before modeling) and at 2, 4, 6, 8, 10, 15, 20, 25, 30, 45 and 60 days after modeling in 4 cats. Pathological examinations were performed at eight time points mentioned above.

RESULTS

Wallerian degeneration can be detected as early as the 2nd day after modeling by both diffusion tensor imaging and pathology. According to the evolution of diffusion indices, Wallerian degeneration can be classified into 2 stages. During the early stage (within 8 days after modeling), progressive disintegration of axons and myelin sheaths underlies the decreases in FA and λ1 and the increase in λ2,3. However, during the late stage (after 8 days), the gradual increase in FA, MD and λ1 and the unchanged λ2,3 seem to be a comprehensive reflection of the pathological processes including microglia activation, myelin clearance, and astrocytosis.

CONCLUSION

Our findings help the understanding of the altered diffusion indices in the context of pathology and suggest that diffusion tensor imaging has the potential to monitor the processes of Wallerian degeneration in the central nervous system in vivo after acute damage.

CLINICAL RELEVANCE/APPLICATION

DTI has the potential to monitor the processes of Wallerian degeneration in the central nervous system in vivo after acute damage.

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SSG12-04 Cardiovascular Risk Factors Predict the Spatial Distribution of White Matter Hyperintensity

Soham Banerjee BS (Presenter): Nothing to Disclose, Kevin S. King MD: Nothing to Disclose, Roderick SSG12-03

PURPOSE

We aimed to address the exact relationships between the evolution of diffusion indices and its underlying pathology in central nervous system.

METHOD AND MATERIALS

Twenty-five domestic mature Felis catus were included in the present study. The evolution of diffusion indices, including mean diffusivity (MD), fractional anisotropy (FA), primary (λ1) and transverse (λ2,3) eigenvalues of the degenerated corticospinal tract, were observed at baseline (before modeling) and at 2, 4, 6, 8, 10, 15, 20, 25, 30, 45 and 60 days after modeling in 4 cats. Pathological examinations were performed at eight time points mentioned above.

RESULTS

Wallerian degeneration can be detected as early as the 2nd day after modeling by both diffusion tensor imaging and pathology. According to the evolution of diffusion indices, Wallerian degeneration can be classified into 2 stages. During the early stage (within 8 days after modeling), progressive disintegration of axons and myelin sheaths underlies the decreases in FA and λ1 and the increase in λ2,3. However, during the late stage (after 8 days), the gradual increase in FA, MD and λ1 and the unchanged λ2,3 seem to be a comprehensive reflection of the pathological processes including microglia activation, myelin clearance, and astrocytosis.

CONCLUSION

Our findings help the understanding of the altered diffusion indices in the context of pathology and suggest that diffusion tensor imaging has the potential to monitor the processes of Wallerian degeneration in the central nervous system in vivo after acute damage.

CLINICAL RELEVANCE/APPLICATION

DTI has the potential to monitor the processes of Wallerian degeneration in the central nervous system in vivo after acute damage.
PURPOSE

To identify the spatial distribution of white matter hyperintensity (WMH) associated with hypertension, diabetes, hypercholesterolemia.

METHOD AND MATERIALS

MRI brain images were obtained from 2066 adult participants (858 males, 1208 females; mean age: 50) from a population based sample. An automated algorithm generated each participant's WMH distribution registered onto the MNI-152 standard template. For univariate analysis, each risk factor group was compared to the non-risk factor group. Voxels in which WMH frequency was significantly higher (p<0.05) in the risk factor group were mapped. Multivariate analysis consisted of subgroup analysis to minimize confounding of one risk factor on the others.

RESULTS

431891 MNI-space voxels comprised WMH distribution of the entire population. For univariate analysis, 26064 voxels (6%) of these voxels were exclusively associated with hypertension and were prevalent in the anterior frontal lobe. Similarly, 22527 voxels (5%) were exclusively associated with diabetes and were prevalent at the callososeptal interface. 8088 voxels (2%) were only associated with hypercholesterolemia and did not form a discrete spatial distribution. Multivariate results corroborated the univariate findings.

CONCLUSION

Each risk factor was associated with a unique spatial distribution of WMH. Hypertension was associated with WMH in the anterior frontal lobe and diabetes was associated with WMH in the callososeptal interface.

CLINICAL RELEVANCE/APPLICATION

Findings of WMH in the anterior frontal lobe of hypertensives and the callososeptal interface of diabetics should raise concern for end organ damage and consideration for aggressive medical therapy.

Soham Banerjee BS (Presenter): Nothing to Disclose, Kevin S. King MD: Nothing to Disclose, Roderick McColl PhD: Nothing to Disclose, Anthony R. Whitemore MD: Nothing to Disclose, Keith Hulsey: Nothing to Disclose, Ronald M. Peshock MD: Nothing to Disclose

PURPOSE

The impact of antiphospholipid antibodies (aPLAbs) on the brain of neurologically asymptomatic APS women with obstetric manifestations remains controversial [1]. Diffusion tensor imaging (DTI) was used to evaluate the structural integrity of white matter (WM) in women with non-thrombotic pregnancy loss and normal neuropsychiatric history, relative to the presence (APS+) / absence (APS-) of antiphospholipid antibodies (aPL). In addition, diffusion-based indices were compared to the presence/absence of lupus anticoagulant (LA) or aβ2GP1-G antibodies to characterize the level of microstructural alterations.

METHOD AND MATERIALS

A total of 83 women with no record of neuropsychiatric symptoms (17 APS- and 66 APS+ women) were imaged using a 3T MRI scanner (GE Healthcare) with standard T1, FLAIR and TOF sequences and DTI (TR/TE=13000/88ms, 32 directions, b=1000s/mm² and resolution 2×2×2mm³). Patients were tested for LA and/or aβ2GP1-G antibodies (37 APS- and 29 APS+ women). The fractional anisotropy (FA), mean diffusivity (MD) and radial diffusivity (RD) were calculated from DTI. Intergroup comparison of FA, MD and RD was carried out using Tract-Based Spatial Statistics. Regions with significant differences were identified by threshold-free cluster enhancement.

RESULTS

No evidence of WM abnormalities was detected using T1, FLAIR and TOF. However, APS+ patients revealed a significant decrease in FA associated with an increase in MD and RD (p

CONCLUSION

DTI revealed diffused microstructural WM changes in APS women with early non-thrombotic pregnancy loss, compatible with alterations in the axonal structure and myelin sheath. Compared to standard T1, FLAIR and TOF, DTI appears to be more sensitive to subtle WM abnormalities.

REFERENCES


CLINICAL RELEVANCE/APPLICATION

DTI-based indices combined with biological markers determine the level of microstructural WM integrity, leading to improved diagnosis and treatment of asymptomatic APS patients.
Whole Brain Functional Connectivity Changes in Patients with Multiple Sclerosis and Neuromyelitis Optica

Yaou Liu MD, PhD (Presenter): Nothing to Disclose, Yunyun Duan: Nothing to Disclose, Kuncheng Li MD: Nothing to Disclose

PURPOSE

To compare the whole brain functional connectivity (FC) changes between patients with multiple sclerosis (MS) and neuromyelitis optica (NMO).

METHOD AND MATERIALS

Resting-state fMRIs were collected from twenty-seven MS patients, 27 NMO patients and 27 age- and sex-matched healthy controls (HC) at a 3T MRI scanner. Whole brain functional connectivity (FC) in 90 brain regions was compared to investigate the difference among the three groups.

RESULTS

109 functional connectivities were identified significantly different among the three groups. MS patients showed 20 altered functional connectivities compared with HC, while 12 with increased and 8 with decreased connectivities. The increased functional connectivities in MS mainly located in frontal lobe, while the decreased functional connectivities were between thalamus and cortical regions in temporal and occipital lobes. The NMO showed 44 significantly increased functional connectivities compared with HC and 65 increased functional connectivities compared with MS, mainly between deep grey matter such as amygdala, caudate, parahippocampus and widespread cortical regions.

CONCLUSION

Different whole brain functional connectivity pattern were observed between the patients with MS and NMO. Functional damage and plasticity coexist in MS, while NMO patients show more widespread functional reorganization than MS patients.

CLINICAL RELEVANCE/APPLICATION

This study revealed different whole brain functional connectivity pattern in MS and NMO. It helps understand the different pathophisiological basis of the two diseases.

Multimodal Quantitative Magnetic Resonance Imaging of Thalamus in Multiple Sclerosis and Neuromyelitis Optica

Yaou Liu MD, PhD (Presenter): Nothing to Disclose, Yunyun Duan: Nothing to Disclose, Kuncheng Li MD: Nothing to Disclose, Jinhui Wang: Nothing to Disclose

PURPOSE

To compare the structural and functional alterations in thalamus between neuromyelitis optica (NMO) and multiple sclerosis (MS) by combining multimodal MRI techniques; and to investigate the correlations between different modalities and clinical variables.

METHOD AND MATERIALS

We studied the whole thalamus in 33 MS, 38 NMO patients and 40 well-matched healthy controls. Six measurements were obtained for the whole thalamus and seven thalamic subregions of each participant including the gray matter volume (GMV), fractional anisotropy (FA), mean diffusivity (MD), amplitude of low-frequency fluctuation (ALFF), cross-correlation coefficient of spontaneous low-frequency (COSLOF) and weighted functional connectivity strength (wFCS) from multimodality MRI data. All of the measurements were compared among groups using multiple one-way analyses of covariance (ANCOVA). Correlation between MRI-based measures and clinical variables was investigated by multiple partial correlation analyses. At last we performed a receiver operating characteristic curve analysis to determine the power of the observed between-group differences to classify the groups.

RESULTS

Significant group effects were detected in the GMV and WM integrity (FA and MD) of the whole thalamus (P < 10^-3), while only MS patients showed decreased COSLOF and wFCS than HC, no significant functional parameters were found between NMO and HC. Significant correlation was identified between structural measurements, but not between structural and functional measurement in both MS and NMO. The observed differences in structural GMV and FA/MD of the thalamus exhibited fair-to-good-excellent discriminative power indistinguishing the three groups (Figure1).

CONCLUSION

Widespread alterations of thalamic structure and function were identified in patients with MS, while NMO showed milder structure damage without significant functional abnormalities. The thalamic structural parameters showed fair-to-good-excellent discriminative power with very high specificity in three groups, which serves as potential MRI biomarkers to distinguish MS, NMO and HC.
This study revealed different patterns of thalamus involvement by multimodality MRI in MS and NMO. It helps understand the different pathophysiological basis of the two diseases and improve the differential diagnosis.

Emanuele Pravata MD (Presenter): Nothing to Disclose, Carlo Sestieri PhD: Nothing to Disclose, Massimo Caulo MD, PhD: Nothing to Disclose, Gianna Riccitelli PhD: Nothing to Disclose, Chiara Zecca MD: Nothing to Disclose, Alessandro Cianfoni: Nothing to Disclose, Claudio Gobbi MD: Nothing to Disclose

PURPOSE

To investigate changes of the resting-state functional connectivity (RS-FC) MRI induced by the execution of a cognitively effortful task in patients with relapsing-remitting multiple sclerosis (RRMS) with cognitive fatigue (CF).

METHOD AND MATERIALS

22 clinically stable RRMS patients, 11 with CF (F) and 11 without CF (nF) according to the Fatigue Scale for Motor and Cognitive Functions (FSMC) and 12 age- and gender-matched healthy control subjects (HS). RS-FC scans were acquired on a 3T MR scanner immediately before (t0), immediately after (t1) and 20 minutes after (t2) execution of the Paced Auditory Serial Addition Test (PASAT). Differences in the RS-FC strength between each brain voxel and the rest of the gray matter between F, nF and HS were investigated at each time point using a data-driven intrinsic connectivity contrast technique [Martuzzi et al, Neuroimage 2011] and 1-way between-subjects ANOVAs. The presence of a correlation between significant t2 and t2-t0 RS-FC differences and neuropsychological measures across patients was investigated. Structural and diffusion-tensor (20 gradient directions) data were acquired to evaluate atrophy, lesion load and white matter microstructure.

RESULTS

T2-hyperintense lesion load and brain atrophy did not differ between F and nF. Self-reported CF after PASAT (PASAT-F) was significantly higher in F than nF patients and HS (p=0.016, Mann-Whitney U test). Compared to nF and HS, F patients presented stronger RS-FC at t2 between the left dorsolateral prefrontal cortex (L-DLPFC) and pre-motor (Figure), secondary visual, left frontal and temporal areas (p=0.01, FDR-corrected). The RS-FC strength of these links at t2 and t0-t2 difference positively correlated with FSMC (rho=0.65-0.73, p=0.001) and PASAT-F (rho=0.4-0.59, p=0.044-0.02). Tractographic reconstructions of cortico-thalamic projection fibers, using L-DLPFC as a seed region, showed reduced fractional anisotropy in F compared to nF patients (0.39 vs. 0.43, p=0.047).

CONCLUSION

In RRMS patients, the degree of CF is related to persistence of hyperconnectivity within fronto-temporo-occipital networks despite relax after mental effort, and to disconnection of thalamo-cortical projection links.

Identification of functional imaging biomarkers of CF, explaining RRMS patients' reduced resilience, may help clinical diagnosis and response assessment to specific medical and rehabilitative treatments.
deposition in concentrations up to 2 mM, IR based gradient echo sequences, such as MP-RAGE can generate high contrast images of iron deposition in concentrations up to 5 mM, while the IR-UTE sequence provides high contrast images of iron deposition in concentrations up to 20 mM. The in vivo study shows that the IR-UTE sequence is capable of detecting iron deposition in MS patients. In the two MS patients shown in Figure 1, one patient shows near zero signal in the thalamus while the other shows high signal in the thalamus consistent with increased iron deposition.

CONCLUSION

The preliminary results show that the IR-UTE sequence can generate high contrast images of iron deposition in concentrations up to 20 mM in phantom studies. This sequence is also capable of high contrast imaging of iron deposition in the brain of patients with MS using a clinical 3T scanner.

CLINICAL RELEVANCE/APPLICATION

High contrast imaging of iron deposition may significantly advance the study of neuro-degenerative diseases including MS.

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**SSG16**

**ISP: Radiation Oncology & Radiobiology (Central Nervous System and Pediatric Tumors)**

**Scientific Papers**

**PD RO NR**

AMA PRA Category 1 Credits™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM  Location: S104A

**Participants**

Moderator
Stephanie A. Terezakis MD: Nothing to Disclose

Moderator

**Sub-Events**

**SSG16-01**  Factors Impacting Survival in a Multi-institutional Study of High-risk Neuroblastoma

Atmaram Pai Panandiker (Presenter): Nothing to Disclose

**ABSTRACT**

**Purpose/Objective:** To evaluate factors impacting survival in patients with stage 4 abdominal neuroblastoma. **Materials/Methods:** Between April 2007 and May 2013, 41 children with neuroblastoma received IMRT to the primary tumor bed as part of a curative protocol. Event-free and overall survival (EFS and OS) were measured from date of diagnosis to death or local/distant first failure as determined by CT scan, MR imaging, or meta-iodobenzylguanidine (mIBG) scintigraphy. The association between outcome and risk factors such as age at diagnosis, gender, cumulative loco-regional radiation dose, MYCN amplification, extent of resection, number of mIBG avid sites pre-induction, and pre-RT was studied using a Cox-regression model. **Results:** With a median follow-up of 3.5 years from diagnosis, twelve patients died of disease. The 3-year EFS and OS were 61.5% ± 8.8% and 74% ± 7.8%, respectively. Twenty-one (51%) patients exhibited chemorefractory disease post-induction chemotherapy and ten (24%) patients had macroscopic residual disease post-surgery. Six (29%) of 21 children with post-induction chemorefractory distant metastatic disease obtained less than a gross total resection. No loco-regional progression was observed while distant first failure occurred in 14 patients, predominantly in skeletal sites. There was no association between outcome and age, gender, extent of resection, or MYCN amplification. However, a significant association between the number of mIBG avid sites at diagnosis and EFS. **Conclusion:** The number of mIBG avid sites at diagnosis is prognostic of outcome. In contrast to recently published literature, the number of mIBG avid lesions after induction chemotherapy did not associate with outcome.

**SSG16-02**  Radiation Oncology & Radiobiology Keynote Speaker: Peds/CNS Tumors

Martin Colman MD (Presenter): Nothing to Disclose

**SSG16-03**  A Multidisciplinary Approach In Childhood Craniopharyngioma: Impact on Neuropsychological Functions

Anna Rita Alitto (Presenter): Nothing to Disclose
SSG16-04

Patterns of Failure for Pediatric Glioblastoma Multiforme Following Radiation Therapy

Jacob Shabason (Presenter): Nothing to Disclose, David Lustig MD: Nothing to Disclose, Christine Hill-Kayser: Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Despite aggressive multimodal therapy for pediatric glioblastoma multiforme (GBM), survival remains poor. Retrospective adult studies have shown that most GBMs recur within the high-dose radiation field. To our knowledge, no such studies have been performed in the pediatric population. As such, this study aims to evaluate the patterns of failure in pediatric patients with GBM after radiation therapy (RT). Materials/Methods: We conducted a retrospective review of 13 pediatric patients treated with RT for GBM from 2007-2013. Patients were treated with intensity-modulated radiation therapy (IMRT) or proton therapy, with treatment volumes defined using residual disease, surgical bed, edema, and 2 cm margin. First failure MRI scans were reviewed. Patterns of failure were defined as: in-field (> = 95% of recurrence volume in the 95% isodose of the volume >= 45 Gy), marginal ( = 95% of recurrence volume in the 95% isodose of the volume >= 45 Gy), and distant (> = 95% of recurrence volume in the 95% isodose of the volume >= 45 Gy). Results: The patients had a mean age of 12.2 years (range 2-22) and were 53.8 % female. Seven patients (53.8%) underwent gross total resection (GTR), 5 (38.5%) had subtotal resection (STR), and 1 (7.7%) had a biopsy only. Twelve patients were treated with IMRT, and 1 was treated with proton therapy. Patients were treated to a mean total dose of 56.7 Gy (range 50.4 Gy-60 Gy), with dose reduced below 54 Gy for 2 patients who received prior radiation for other types of malignancies. Most patients (92.3%) were treated with concurrent chemotherapy: 10 with temozolomide, 1 with capecitabine, and 1 with temozolomide and bevacizumab. With a median follow up of 73 months from diagnosis (53-117) and of 49 months from RT (27-81), One patients presented recurrence at 3 months from radiotherapy. 5 yrs PFS is 89%, while median PFShas not yet reached. Conclusions: Specific neuropathological diagnoses seems acceptable in long time survivors. These data demonstrate the importance of multidisciplinary and expert approach to childhood glioblastoma multiforme. This time of approach also allows systematic and specific interventions in selected cases.

SSG16-05

Survival Outcomes for Unresected Non Metastatic Osseous Ewing’s Sarcoma in Pediatric Patients Treated with Combined Modality Treatment: A Single Institution Experience

Pablo Munoz Schuffenegger (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To evaluate the outcomes of unresected non metastatic Ewing’s sarcoma in pediatric patients treated with 3DCRT and chemotherapy at a single institutionMaterials/Methods: The records of 21 patients diagnosed with non-metastatic Ewing’s sarcoma who did not undergo surgical resection and were treated with induction chemotherapy including vincristine, doxorubicin, cyclophosphamide, ifosfamide and etoposide) followed by definitive chemo and CT based radiation therapy to the primary site between 1997 and 2013 were reviewed. All patients received chemotherapy. Results: Twenty patients met the inclusion criteria and were included in this analysis. Median age was 13 years (range: 4-16). 17 patients had a primary located in the axial skeleton, 1 in the lower extremity, and 3 in the upper extremity. Doses ranged from 14.4 to 51.8 Gy (median: 43.4 Gy). Actuarial 3 year local control was: 80%. 3 year overall survival was: 70%. The median follow up for surviving patients was 132 months (range: 4.8 - 229.2 months). Long term analysis did not revealed any grade 4 or higher side effectConclusions: In this cohort of unresected non metastatic Ewing’s sarcoma patients, definitive radio/chemotherapy-based treatment provided adequate local control. Local control as well as overall survival compares favorably to that reported in the literature.

SSG16-06

Outcomes of CNS Germ Cell Tumor Patients Treated with Intensity Modulated Radiation Therapy and Volumetric Modulated Arc Therapy to Whole Ventricle

Ana Carolina Rezende (Presenter): Nothing to Disclose, Eduardo Weltman : Nothing to Disclose, Juliana Karassawa Helito : Nothing to Disclose, Michael Chen : Nothing to Disclose, Nasija Saba : Nothing to Disclose, Andrea Cappellano : Nothing to Disclose, Jose Carlos Cruz : Nothing to Disclose, Roberto Sakuraba : Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Primary aim was to estimateneurocognitive and psychological morbidity in childhood affected by craniopharyngioma, treated by surgery and radiotherapy; secondary endpoint was the assessment of overall survival (OS) and progression free survival (PFS).Materials/Methods: A retrospective analysis was conducted in patients with craniopharyngioma treated by surgery and radiotherapy (RT). The indications for RT were: repeated surgery with residual mass, inoperable symptomatic or recurrence lesions. A total dose of 5040 cGy in 180 cGy/fraction was administered to tumoral bed + residual mass. Acute toxicity was evaluated according to RTOG scale. A multidisciplinary follow-up was performed for all patients with radiation oncologist, neurosurgeon and neuropsychologist. A detailed and systematic cognitive (Griffith scale and Wechsler scale) and neuropsychological evaluation was performed in three precise moments: diagnosis (T0), one month after neurosurgical treatment (T1), and 2 years after radiotherapy (T2). A statement of Quality of Life was reported with PedQL0 questionnaire. Results: Analysis was performed in nine patients, with median age of 6 years (4 - 12) at time of diagnosis and 8 years (5-14 yrs) at beginning of RT. All patients presented residual mass and sixpatients underwent repeated surgery. Grade 1 skin, haematological and neurocognitive acute toxicity was observed in 3 patients, reversible in all cases. IQ was normal in all patients at T0, T1 and T2, without significant difference between different timing. The systematic review of specific neuropsychological disorders showed: visuoperceptual disorders in six patients (67%) both in T0and T2, an impairment of immediate recall and working memory at differenttimes; short term memory and working memory in five patients in the last follow-up. These results seemed correlating to decreased of attention systemprocessing, while language skills and praxia as executive function were preserved. Self perception scale was impaired at the last follow up. TheirPedQOL results was compatible with average range in 6 patients (67%) and low in three cases (33%). In summary, no significant disorders were reported. Allpatients are alive with disease, with a median follow-up of 73 months from diagnosis (53-117) and of 49 months from RT (27-81). One patients presented recurrence at 3 months from radiotherapy. 5 yrs PFS is 89%, while median PFS has not yet reached. Conclusions: Specific neuropsychological disorders seems acceptable in long time survivors. These data demonstrate the importance of multidisciplinary and expert approach to childhood craniopharyngioma. This type of approach also allows systematic and specific interventions in selected cases.
Vertebral Body Sparing in Wilm’s Tumor: Comparison between 3d-crt Vs Vmat

Hina Saeed MD (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Advances in multimodality treatment have significantly improved the survival rates of patients with Wilm’s tumor. Per Wright et al. the current 8-year survival rate for most patients who have favorable-histology tumors is 80-98%. Standard fields used for flank irradiation can detrimentally affect the bone marrow. Therefore, we must use novel methods to deliver craniospinal irradiation (CSI) to the Wilm’s tumor patients, thus allowing us to deliver higher doses to the tumor bed. In this paper, we report our experience with a novel and innovative technique of delivering CSI on young children, to minimize the side effects on the bone marrow and spinal cord.

Materials/Methods: From 9/2011 - 8/2013, 16 pediatric MB pts were treated with this CSI technique. Standard-risk (SR) received 23.4 Gy (RBE) CSI and a tumor bed boost to 54 Gy (RBE); high-risk (HR) 36 Gy (RBE) and 55.8 Gy (RBE), respectively (2 with spine boosts of 5.4 Gy (RBE) and 12.6 Gy (RBE)). Pts were immobilized in prone position by thermoplastic mask and vacuum bag. Due to field size limitations on proton machines, cranial RT was delivered with 2 opposed lateral 6MV photon fields. Spine RT was delivered with 2-4 double scattered or uniform scanning posterior-anterior proton fields matched at anterior part of the vertebral body and feathered every 5 fractions. Fields were configured in lateral directions using a multileaf collimator and distally by a compensator. Daily IGRT was performed. Toxicities were documented according to CTCAE v4. Results Median age was 11 years (range 4.9 - 17.4), 9 pts were female, 10 required anesthesia during RT, and 81% were SR; 7 tumors were classical, 2 desmoplastic/nodular, 7 NOS. Median time from surgery to start of RT was 31 days (range 28-72). Delay >31 days was often due to transfer of care between institutions; the only delay >40 days was for an international patient. Median time from simulation to RT start was 15.5 days (range 6-21). All pts received weekly concurrent vincristine and 1 received additional daily carboplatin. Chemo was initiated prior to RT for 1 pt and medical delays. Most common acute toxicities were nausea/vomiting and anorexia (table). Mean weight loss was 2.3 kg (range 0-5.8). Bone marrow toxicity was ≤ grade 2 for all pts receiving standard weekly vincristine; 1 pt receiving daily carboplatin developed grade 4 neutropenia and grade 3 thrombocytopenia; 1 pt receiving pre-RT chemo developed grade 3 neutropenia. At a median follow up of 13.6 months (range 3.8-24.5), 13 are alive with no evidence of disease, 1 is alive with vertebral recurrence, and 1 is lost to follow up.

Conclusions: This review suggests that this CSI technique is safe and well-tolerated; it may decrease GI and bone marrow toxicity depending on chemotherapy regimen. Planning is feasible in a 2 week period, allowing treatment to be initiated within 31 days of surgery, although referral to proton center from outside institutions must be initiated rapidly. Acute toxicities experienced during photon/proton CSI with concurrent weekly vincristine in MB Grade None 1 2 3 4 Fatigue (n=16) 4 (25%) 9 (56.25%) 3 (18.75%) 0 0 Nausea/vomiting (n=16) 1 (6.25%) 7 (43.75%) 6 (37.5%) 2 (12.5%) 0 Diarrhea (n=16) 14 (87.5%) 2 (12.5%) 0 0 Anorexia (n=16) 7 (43.75%) 6 (37.5%) 2 (12.5%) 0 0 Dermatitis (n=16) 3 (18.75%) 12 (75%) 1 (6.25%) 0 0 Decreased Hemoglobin (n=15) 2 (13.3%) 4 (26.7%) 7 (46.7%) 0 Decreased WBC (n=15) 0 3 (20%) 10 (66.7%) 1* (6.7%)* Patient given pre-RT chemotherapy 1** (6.7%)* Pat received daily carboplatin Decreased Platelets (n=15) 13 (86.7%) 1 (6.7%) 0 1** (6.7%)* Pat received daily carboplatin 0

Acute Toxicities and Treatment Outcomes of a Novel Combined Photon/Proton Craniospinal Irradiation (CSI) Technique for Medulloblastoma (MB) Patients

Andrew Holland (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objectives: We developed a technique for CSI involving treatment in the prone position with junctions between cranial photon and spinal proton fields. We report acute toxicities and early outcomes of this treatment. Materials/Methods: From 9/2011 - 8/2013, 16 pediatric MB pts were treated with this CSI technique. Standard-risk (SR) received 23.4 Gy (RBE) CSI and a tumor bed boost to 54 Gy (RBE); high-risk (HR) 36 Gy (RBE) and 55.8 Gy (RBE), respectively (2 with spine boosts of 5.4 Gy (RBE) and 12.6 Gy (RBE)). Pts were immobilized in prone position by thermoplastic mask and vacuum bag. Due to field size limitations on proton machines, cranial RT was delivered with 2 opposed lateral 6MV photon fields. Spine RT was delivered with 2-4 double scattered or uniform scanning posterior-anterior proton fields matched at anterior part of the vertebral body and feathered every 5 fractions. Fields were configured in lateral directions using a multileaf collimator and distally by a compensator. Daily IGRT was performed. Toxicities were documented according to CTCAE v4. Results Median age was 11 years (range 4.9 - 17.4), 9 pts were female, 10 required anesthesia during RT, and 81% were SR; 7 tumors were classical, 2 desmoplastic/nodular, 7 NOS. Median time from surgery to start of RT was 31 days (range 28-72). Delay >31 days was often due to transfer of care between institutions; the only delay >40 days was for an international patient. Median time from simulation to RT start was 15.5 days (range 6-21). All pts received weekly concurrent vincristine and 1 received additional daily carboplatin. Chemo was initiated prior to RT for 1 pt and medical delays. Most common acute toxicities were nausea/vomiting and anorexia (table). Mean weight loss was 2.3 kg (range 0-5.8). Bone marrow toxicity was ≤ grade 2 for all pts receiving standard weekly vincristine; 1 pt receiving daily carboplatin developed grade 4 neutropenia and grade 3 thrombocytopenia; 1 pt receiving pre-RT chemo developed grade 3 neutropenia. At a median follow up of 13.6 months (range 3.8-24.5), 13 are alive with no evidence of disease, 1 is alive with vertebral recurrence, and 1 is lost to follow up.

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Intracranial germ cell tumors are a heterogeneous group of neoplasms with high cure rates due to its sensitivity to radiation and chemotherapy (CT). However, recurrences are not uncommon after focal-field radiotherapy (RT) and the whole ventricle irradiation appears to be a more attractive approach in this scenario. The aim of this retrospective study is to report our experience in treating these tumors with CT followed by Intensity Modulated Radiation Therapy (IMRT) to whole ventricles and a tumor bed boost.

Methods and Materials: Between January 2011 and January 2014, 7 patients with pathologically or clinically diagnosed CNS Germ cell tumors were reviewed at our institution. The first treatment approach was based on CT combined to RT, and 7 patients underwent tumor resection as well. All of them had whole ventricle irradiation with doses ranging from 18 Gy to 36 Gy, and 22 patients received an additional tumor bed boost ranging from 30.6 Gy to 54 Gy. IMRT was the technique of choice in all cases and Volumetric Modulated Arc Therapy was used to treat 66% of them. The outcomes were recorded.

Results: The 24 patients are alive, although three recurred with time to relapse ranging from 4 to 26 months. All of them had cranial spinal fluid (CSF) recurrence and two presented with spinal nodules. They were all treated with CT followed by IMRT by a second course of radiation, consisting on a spinal nodules boost by a third course of radiation with an additional dose to spine residual masses. The 3 patients are alive, and only one of them has persistent disease.

Conclusions: Whole ventricle irradiation following CT seems to be an effective approach for intracranial germ cell tumors. Efforts should be made to better identify the risk factors for spinal spread and provide an adequate selection of the best candidates for whole ventricle irradiation.
Preoperative Radiotherapy of Soft Tissue Sarcoma: A Single Institute Experience

Ayca Iribas (Presenter): Nothing to Disclose

ABSTRACT

PURPOSE: Assessment of the outcomes of preoperative radiotherapy (RT) ± chemotherapy (ChT) administered to patients with soft tissue sarcoma (STS) in our Institute. MATERIAL: Preoperative RT was applied to 131 pts with STS between the years of 1996 and 2010 in Istanbul Univ. Institute of Oncology. 65 (50%) of the patients (pts) were male, 66 (50%) were female. 109 of the pts had a T2 tumour and 22 had a T1 tumour. The tumours were located in the extremities in 113 pts and 18 pts non-extremity. Their histopathological diagnosis were respectively: 30 pts-fusiform sarcoma; 26 pts-synovial sarcoma; 24 pts-liposarcoma; 15 pts-pleomorphic sarcoma, 11 pts-mesenchymal sarcoma, 10 pts-malign fibro histiocytoma, 15 pts-other kinds of sarcoma. Median tumour size was 9 cm (4-25 cm). Preoperatively, 28 Gy/8 fr RT was applied as external RT to 115 pts. 16 pts received 45-50 Gy /23-25 fr in the same manner. Preoperative response to post-RT were as follows: 96 pts (73%)-partial response; 19 (15%)-stable response; 11 (8%)-no response. The method of surgery was radical excision. Surgical margin was found negative in 79%, microscopically positive in 27%, and close 25% of pts. Prognostic variables were determined by univariate analysis (UVA). RESULTS: Median follow-up was 38 months (2-142), and median age was 43 (15-84) yrs. Local recurrence was seen in 16 pts (12 %), and distant metastasis was seen in 36 (27%) pts. The distant metastasis frequently occurred in the lungs and bones. The rate of 2-yr local control (LC) was 91%, 2-yr disease-free survival (DFS) was 74%, and 2-yr of general survival (OS) was 93%. The rate of 5-yr LC was 83%, 5-yr of DFS was 58%, and 5-yr of OS was 77%. UVA revealed that a tumour diameter of 10 cm was a significantly negative prognostic factor as far as 5-yr OS rate is concerned (86 % vs 64%, p=0.025). ChT was applied to pts with a high grade and high risk of metastasis. Accordingly, prognosis in pts who received ChT was determined to be better than in those who did not (87% vs. 65%, p: 0.04). In pts who developed metastasis the prognosis was poor (88% vs. 44%, p= 0.000). The rate of the occurrence of a wound healing problem due to preoperative RT was 4%. CONCLUSIONS: Extremity preservation approach is a modern way of treatment in pts with STS. It is difficult for surgeons to perform resection in some pts. Preoperative RT makes total resection possible in those pts, thus successful LC results are achieved.

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Neuroradiology Tuesday Poster Discussions

Scientific Posters

STG

AMA PRA Category 1 Credits ™ : 0.50

Tue, Dec 2 12:15 PM - 12:45 PM  Location: NR Community, Learning Center

Participants

Moderator
Pratik Mukherjee MD, PhD : Research Grant, General Electric Company Medical Advisory Board, General Electric Company

Sub-Events

NRS417

Demonstration of Salivary Flow from the Parotid Gland by MRI Using the Time-spatial Labeling Inversion Pulse (Time-SLIP) Technique: Feasibility Study in Normal Volunteers (Station #1)

Wataru Fukumoto (Presenter): Nothing to Disclose, Toru Higaki PhD : Nothing to Disclose, Yuko Nakamura MD : Nothing to Disclose, Yoshiko Iwakado : Nothing to Disclose, Tatsuya Ohkubo : Employee, Toshiba Corporation, Kazuo Awai MD : Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd , Yoko Kaichi : Nothing to Disclose, Kenji Kajiwara : Nothing to Disclose

PURPOSE

The time-spatial labeling inversion pulse (Time-SLIP) technique is a new MRI technique based on arterial spin labeling. It can visualize not only the blood flow but also intravital flows such as the cerebrospinal fluid flow and pancreatic secretion. The purpose of this study was to assess the feasibility of the Time-SLIP technique for demonstrating salivary flow in normal volunteers.

METHOD AND MATERIALS

Using a 3T-MRI scanner (Vantage Titan 3T; Toshiba), surface coils placed on the parotid gland, and the "flow-in" method of the Time-SLIP technique, we acquired images of salivary flow from the right parotid gland of 16 normal volunteers ranging in age from 24-53 years (median 40.5 years). We applied a spatially selective inversion recovery (IR) pulse to a parotid duct and then determined the black blood inversion time (time from the selective IR pulse to image acquisition) to null the background signal. We scanned the parotid duct 24 times at identical intervals. To stimulate saliva secretion we injected 1 mL of 2% citric acid into the mouth before scans 5, 9, 13, 17, and 21, and scored visualization of the parotid duct on the flow images (grade A= 100% visualization, grade B= 50-99% visualization, grade C= 1-49% visualization, grade D= incomplete visualization). We also measured the mean signal intensity ratio (SIR) of the parotid gland ([mean SI during each stimulation] / [mean unstimulated SI=1]) during each Stimulation (Stimulation1=1st scan, Stimulation2=2nd scan, Stimulation3=3rd scan, Stimulation24th scan after stimulation,).
RESULTS

With the Time-SLIP technique salivary flow from the parotid gland could be visualized in 15 of 16 volunteers. The scores were A in 1-, B in 8-, and C in 6 volunteers. Mean SIR during each Stimulation 1, 2, 3, 4 were 1.18 (standard deviation 0.28), 1.21 (0.23), 1.14 (0.17), and 1.11 (0.16), respectively. In 9 of 15 volunteers salivary flow could be most clearly visualized on the 2nd scan after each stimulation.

CONCLUSION

Salivary flow from the parotid gland could be visualized in 15 of 16 volunteers on images acquired with the Time-SLIP technique.

CLINICAL RELEVANCE/APPLICATION

The Time-SLIP MRI technique holds promise for the quantitative and qualitative evaluation of salivary flow. It may be useful in the evaluation of patients with reduced salivary secretion, e.g. patients with Sjogren syndrome and patients undergoing radiation therapy for head and neck tumors.

NRS418

Post-traumatic Cervical Spine Extra-Arachnoid Collections: Characteristics that May Allow for Conservative Management (Station #2)

David Lawrence MD : Nothing to Disclose , Michael Gregory Fox MD (Presenter) : Stockholder, Pfizer Inc , Brian Michael Trotta MD : Nothing to Disclose , Michelle S. Barr MD : Nothing to Disclose , Prashant Raghavan MD : Nothing to Disclose , Francis H. Shen MD : Consultant, Johnson & Johnson Consultant, Globus Medical, Inc Royalties, Globus Medical, Inc Royalties, Reed Elsevier

PURPOSE

Determine characteristics of post-traumatic cervical spinal extra-arachnoid collections that may allow for conservative management instead of surgical decompression.

METHOD AND MATERIALS

IRB approval obtained. Over a 17 month period, we retrospectively reviewed cervical spine MRIs on all patients >16-years-old with post-traumatic extra-arachnoid fluid collections. Patients were divided into 4 groups: 1) fusion for unstable spinal injuries (n=21); 2) small collections that required no treatment or follow-up (n=18); 3) surgical evacuation for neurologic deficits (n=1); and 4) moderate to large collections with follow-up MRI within 30 days (n=9). Group 4 collections were then evaluated for size, morphology and MR signal intensity.

RESULTS

No group 4 collection enlarged and no patient (mean age-40 years) developed worsening neurologic symptoms. 78% (7/9) of the collections demonstrated thin, tapered margins, extended >9.5 cm in length and had variable signal characteristics: hyper-T1/iso-T2 (n=1), iso-T1/T2 (n=3), hyper-T1/hypo-T2 (n=3), and mixed-T1/T2 (n=1). Follow-up MRI demonstrated complete resolution or significant decrease (n=4) between 1 to 12 days; stable or slight decrease (n=3) between 2 to 11 days. Two neurologically intact patients refused surgery for 2 mass-like collections that were then managed conservatively. These collections measured 2-3 levels in length, were confined to <90 degrees of the spinal canal diameter. One collection was slightly smaller after 1 day and 1 resolved after 31 days.

CONCLUSION

Post traumatic extraarachnoid spinal collections that have ventral and dorsal components with long, thin tapered margins will often resolve rapidly, irrespective of the signal characteristics.

CLINICAL RELEVANCE/APPLICATION

Conservative management of post-traumatic extra-arachnoid collections that have long thin tapered margins with serial neurologic checks and follow-up MRIs is safe in neurologically asymptomatic or stable patients.

NRS419

Improved Reliability of Diffusion Tensor Imaging Utilizing Reduced Field-of-View ZOOM-EPI in Normal Human Cervical Spinal Cord (Station #3)

Michael M. Poplawski MD, PhD (Presenter) : Nothing to Disclose , Richard Joseph Thomas Gorniak MD : Speaker, Koninklijke Philips NV , M. Alex Dresner PhD : Employee, Koninklijke Philips NV , Adam Eugene Flanders MD : Nothing to Disclose

PURPOSE

ZOOM-EPI technique has been shown to provide subjectively superior MR diffusion image quality compared to full-field ssEPI (fEPI) in the cervical cord. However, it has not been shown if the diffusion tensor imaging (DTI) metrics are comparable for the two techniques. The study aim was to determine consistency of DTI values in normal human cervical spinal cord using ZOOM DTI.

METHOD AND MATERIALS

Regions-of-interest were drawn at seven levels on axial DTI images from C1/2 to C7/T1 in 9 normal cervical cords acquired with fEPI and ZOOM on a Philips Achieva 1.5 T, with parameters (TR/TE/NSA/FOV/Matrix/slice/#/slice(mm)/in plane(mm)): fEPI 6176/82/8/220x130mm/144x84/36/4mm/1.53x1.53mm, ZOOM 6176/82/8/220x130mm/144x84/36/4mm/1.53x1.53mm.
RESULTS
Measured cord ROI volumes were equivalent at all levels, despite disparate voxel size. In a paired comparison within same cords, FA was higher ($p < 0.05$).

CONCLUSION
Within similar acquisition times, ZOOM provides more consistent estimates of FA and ADC in the cervical cord. This is attributed to a gain in resolution, less volume averaging from CSF, and diminished artifact. With superior image quality and more reliable DTI metrics, ZOOM is recommended over conventional ssEPI DTI for clinical applications in cervical spinal cord imaging.

CLINICAL RELEVANCE/APPLICATION
Introduction of spinal cord DTI into clinical practice will depend on availability of a reliable and practical DTI sequence. In that respect, ZOOM-EPI DTI provides a clear advantage over ssEPI DTI.

NRS420
Right Arcuate Fasciculus Disruption in Chronic Fatigue Syndrome (Station #4)

PURPOSE
(1) Detect microstructural abnormalities underlying chronic fatigue syndrome (CFS) using diffusion tensor imaging (DTI), (2) assess if gray and/or white matter volumes are abnormal utilizing T1-weighted volumetric analysis, and (3) detect suspected global alterations in brain perfusion using pseudo-continuous arterial spin labeling (ASL).

METHOD AND MATERIALS
15 CFS patients and 14 controls provided informed consent in accordance with Stanford’s Institutional Review Board and HIPAA. Subjects underwent 3.0T volumetric T1 and T2-weighted imaging, two DTI acquisitions, and ASL. Segmentations of supratentorial gray and white matter and cerebrospinal fluid were used to compare gray and white matter volume fractions and cortical thickness. DTI was processed with automated fiber quantification (AFQ), which compares piecewise fractional anisotropy (FA) along 20 tracks. The FreeSurfer segmentation was used to compare cerebral blood flow.

RESULTS
Bilateral white matter volume and right thalamic volumes were reduced in the CFS population. In CFS, FA was increased in the right arcuate fasciculus, and cortical thickness increased in both of its endpoints: the right middle temporal and right precentral gyri. In right-handers, FA was also increased in the right inferior longitudinal fasciculus, and thickness increased in one endpoint, the right occipital lobe. Within CFS patients, right anterior arcuate FA as well as basal ganglial volumes increased with disease severity. ASL showed no significant differences.

CONCLUSION
Bilateral white matter and right thalamic atrophy are present in CFS. Right hemispheric increased FA and cortical thickness are present, suggestive of a compensatory or pathological network. Right anterior arcuate FA may serve as a biomarker for CFS.

CLINICAL RELEVANCE/APPLICATION
Automated tractography can be useful for studying the microstructure underlying neurological disorders.

NRS421
A Diffusion Tensor Imaging Comparative Study of the Cervical Spinal Cord in Neuromyelitis Optica and Multiple Sclerosis (Station #5)

PURPOSE
To assess the diffusion changes in normal-appearing spinal cord (NASC) in patients with neuromyelitis optica (NMO) and multiple sclerosis (MS).

METHOD AND MATERIALS
Axial DTI of the cervical spinal cord was performed in 14 patients with NMO, 14 patients with MS and 14 sex- and age-matched normal controls. Fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD) and radial diffusivity (RD) were measured in regions of interest (ROIs) at the C2-C5 levels in four columns of the spinal cord. Student’s t-test were used for the comparison of DTI parameters.
RESULTS

Compared with normal controls, the values of MD were increased and FA were decreased for both MS and NMO groups, there were significant differences among them. Compared with MS groups, FA in patients with NMO was significantly decreased in the lateral, posterior columns, AD and MD in the lateral and posterior columns was significantly increased.

CONCLUSION

There are extensive NASC damage in both NMO and MS patients, including white matter areas of the cervical spinal cord, mainly caused by demyelination. This suggests the different spinal cord lesion pattern in NMO and MS.

CLINICAL RELEVANCE/APPLICATION

This study suggests the different spinal cord lesion pattern in NMO and MS, it helps the early diagnosis and differential diagnosis between NMO and MS.

NRS422

Changes in Brain Connectivity and Its Correlation with Idiopathic Complex Partial Seizures Epilepsy Patients: Evidence from Resting-State fMRI (Station #6)

Qiao Pengfei MD (Presenter): Nothing to Disclose, Yang Gao: Nothing to Disclose, Guangming Niu: Nothing to Disclose

PURPOSE

To investigate the modifications of resting state fMRI(rfMRI) in complex partial seizures (CPS) epilepsy patients employing regional homogeneity(ReHo),the amplitude of low frequency fluctuation (ALFF) and the functional connectivity(FC) techniques.

METHOD AND MATERIALS

Thirty-seven right-handed CPS patients were recruited and investigated in the comparison with 37 matched in age,gender and education background controls. All subjects underwent MR scanning on a 3.0 Tesla scanner (GE-Signa HDx, Milwaukee, US.). Functional MRI scanning was performed using GRE-EPI sequences (FOV 24 cm×24cm, 64×64 matrix, flip angle 90°, TR 2000 ms,TE 30 ms, whole brain coverage,30 oblique axial,4mm slices thickness and 0mm inter-slice space). Resting-state scanning lasted for 512s, producing 256 brain volume data sets. The first 10 images were excluded due to T1 equilibrium effects. T1-weighted 3DBRAVO-sequence images (FOV 24 cm×24 cm, 256×256 matrix, whole brain coverage, flip angle 13°, TR 7.8 ms, TE 3.0 ms) were achieved to assess the anatomical images for the co-registration of fMRI data with standard space coordinates. ReHo, ALFF and FC were processed using REST and SPM8 software to compare the resting state function in the whole brain between two groups.

RESULTS

Medial temporal lobe and surrounded brain regions were observed to participate the interictal epileptiform discharges(IEDs) and the default mode network(DMN). The cerebellum of CPS patients was the most commonly damaged region resulted from the abnormal neural electrical activities.

CONCLUSION

ReHo,ALFF and FC can detect interictal epileptiform abnormality, and can be possibly applied as an additional non-invasive tool for the detection of epileptogenic foci. Furthermore, the alterations in amplitude play a central role in epileptogenesis.

CLINICAL RELEVANCE/APPLICATION

ReHo,ALFF and FC can detect abnormal BOLD signals, localize the epileptic zones, and may be applied to evaluate the pathophysiological mechanisms of epilepsy.

NRS423

Long Term Height Maintenance of the Percutaneous Augmented Vertebral Body for the Treatment of Symptomatic Osteoporotic Compression Fractures (Station #7)

Ahmed Fadl MD (Presenter): Nothing to Disclose, Carla Alexis de Venecia MD: Nothing to Disclose, A. Orlando Ortiz MD, MBA: Nothing to Disclose

PURPOSE

To determine if percutaneous vertebral augmentation (PCA) provides long-term stability without significant changes in height over time in patients treated for osteoporotic compression fractures.

METHOD AND MATERIALS

A single institution PACS database query was conducted to determine the number of patients who underwent either vertebroplasty or kyphoplasty for back pain secondary to vertebral osteoporosis induced compression fracture. Augmented vertebral height measurements were analyzed from images during pre-intervention, immediate post-intervention, and at varying points during follow up examinations. Vertebral height measurements were measured and standardized against an internal control depending on the imaging modality. Controls were designated using a stable vertebral body and/or using an imaging device of a known
constant dimension. The ratio of heights between two values (injected vertebral body versus internal control) were recorded over time and compared to other ratio values at various time intervals.

RESULTS

45 patients met inclusion criteria (42 women / 3 men) with the distribution of kyphoplasty to vertebroplasty being 48 and 77 respectively. Of the 45 patients, 110 vertebral bodies were augmented. 41 of the 45 were on supplemental pharmacologic management for osteoporosis. Average imaging follow up was 4.7 years. All augmented vertebral bodies demonstrated adequate endplate-to-endplate filling. Follow-up imaging of the 110 injected vertebral bodies demonstrated no statistically significant change in vertebral height over time with a p-value of 0.46.

CONCLUSION

The findings of the study demonstrate that vertebral augmentation yields stable vertebral bodies with no change in overall vertebral body height over time. There was no statistically significant difference between the two techniques or pharmacologic treatment. Limitations of the project included comparison of relative vertebral heights versus absolute values. Further analysis utilizing a prospective cohort with absolute internal controls is needed to further add validity to the current findings.

CLINICAL RELEVANCE/APPLICATION

The findings of the study provide clinical evidence to support that percutaneous vertebral augmentation provides long term stability with respects to height for those patients with osteoporotic induced vertebral compression fractures.

NRE364

Spinal Canal Masses: Case Based Review of Various Mass Lesions and the Differential Diagnostic Considerations according to Compartmental Location (Station #8)

Nishith Patel MD (Presenter): Nothing to Disclose, Jay Patel MD: Nothing to Disclose, Amir Salomon MD: Nothing to Disclose

TEACHING POINTS

1. Review the anatomy of the spinal canal anatomy and its various compartments. 2. Review different imaging techniques available to evaluate spinal canal lesions. 3. Learn imaging features of a variety spinal canal masses based on compartmental location: intramedullary, extramedullary intradural, and extradural.

TABLE OF CONTENTS/OUTLINE

1. Approaches to image the spinal canal
2. Overview of the spinal canal anatomy and its contents and various spaces.
3. Extradural lesions
4. Intradural, Extramedullary lesions
5. Intramedullary lesions

After completing this educational exhibit, the reviewer will be familiar with the spinal canal anatomy and commonly used imaging techniques. The reviewer will also be confident about the different spaces within the spinal canal and use it to aid their formulation of a differential diagnosis.

NRE281

MR Imaging Characteristics of Typical and Atypical Intraorbital Neoplasms (Station #9)

Jeffrey Dorr MD (Presenter): Nothing to Disclose, Priya Krishnarao MD: Nothing to Disclose, Rajul Parimal Pandit MD: Nothing to Disclose, Mahesh Ramu Patel MD: Stockholder, Novartis AG

TEACHING POINTS

The purpose of this exhibit is:
1. To review pertinent anatomy and anatomic relationships of the orbit
2. To review MR imaging characteristics of neoplasms affecting the orbits, as well as differentiating features from lesions that mimic neoplasm
3. To describe common pathways of spread of orbital neoplasms

TABLE OF CONTENTS/OUTLINE

Basic Anatomy - Contents of the orbit - Osseous boundaries of orbit - Intracanal, Conal, and Extraconal spaces - Foramina relating spread of pathology (including superior orbital fissure, inferior orbital fissure) Sample cases with explanation of pertinent MR imaging characteristics: - Orbital MALT lymphoma - Meningioma - Metastatic disease - Orbital Pseudotumor - Orbital dermoid Conclusion - Key features of neoplasms involving the orbit and their differentiating MR imaging characteristics

NRE219

Abnormalities of the Basal Ganglia and Thalamus; MRI Findings in Common and Uncommon Entities (Station #10)

Jehan Al-Rayahi MD (Presenter): Nothing to Disclose, Walid Mabrouk Mubarak: Nothing to Disclose, Khaled Salem Doghem: Nothing to Disclose
**TEACHING POINTS**

To understand the anatomy & distinctive features of deep grey matter. The basalganglia & thalami (BG & T) constitute paired structures of the deep grey matter nuclei that are unique in their high metabolic activity, rich blood supply and mitochondrial content. This makes them susceptible to a wide spectrum of metabolic, toxic and vascular pathology. To present an overview of the different etiologies of BG&T abnormalities. These include: 1) Toxic, 2) Metabolic, 3) Vascular, 4) Infectious/Inflammation & 5) Hereditar/Degenerative. To learn the approach in the assessment of abnormalities of the BG&T which include the 3 steps: 1) Is it an isolated abnormality of the basal ganglia? If not, what other regions are involved? 2) What is the primary nuclei affected? 3) What MRI signal changes is noted? To understand that findings should always be interpreted with attention to patient age, clinical setting (including acuity/chronicity of the presentation) & correlation with laboratory findings.

**TABLE OF CONTENTS/OVERVIEW**


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**Brachial Plexus Imaging: Everything That a Radiologist Needs to Know for Reporting! (Station #11)**

Drushi Vatsal Patel MBBS, MD (Presenter): Nothing to Disclose, Hemant Tribhovandas Patel MD: Nothing to Disclose, Ankur Shah MD: Nothing to Disclose, Shikha Rahul Khandelwal MBBS, DMRD: Nothing to Disclose, Laxmi Vishnu Bhobe DMRD: Nothing to Disclose, Mrugesh Doctor: Nothing to Disclose

**TEACHING POINTS**


**TABLE OF CONTENTS/OVERVIEW**


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**Practical Approach to Sensorineural Hearing Loss in Pediatric Patients (Station #12)**

Jeffrey Sachs MD: Nothing to Disclose, Colin Michael Segovis MD, PhD (Presenter): Nothing to Disclose, Michael E. Zapadka DO: Nothing to Disclose

**TEACHING POINTS**

Sensorineural hearing loss (SNHL) is a major cause of childhood disability with significant implications on language development, school performance and social integration. Cross-sectional imaging plays an integral role in evaluating children with SNHL and otolaryngologists routinely request CT or MRI exams to assess anatomy of the temporal bone and evaluate potential causes for hearing loss. Because early diagnosis and intervention can improve language development in children, these studies are now ordered with increased frequency, even in the community setting. Knowledge of the anatomy and spectrum of congenital and acquired pathologies associated with SNHL in children is requisite for the radiologist to add value in clinical practice. Radiologists will increase their confidence in approaching the pediatric temporal bone and recognizing common pathologies by utilizing a practical, step-wise guide.

**TABLE OF CONTENTS/OVERVIEW**

- Anatomy of the temporal bone. - Differential considerations for SNHL in the pediatric population. - Image-rich examples of the most common causes of SNHL in children with emphasis on high-resolution CT of the temporal bone and MRI. Appropriate emphasis on unique anatomic, embryologic, and pathophysiologic concepts will be included. - To understand the anatomy & distinctive features of deep grey matter. The basalganglia & thalami (BG & T) constitute paired structures of the deep grey matter nuclei that are unique in their high metabolic activity, rich blood supply and mitochondrial content. This makes them susceptible to a wide spectrum of metabolic, toxic and vascular pathology. To present an overview of the different etiologies of BG&T abnormalities. These include: 1) Toxic, 2) Metabolic, 3) Vascular, 4) Infectious/Inflammation & 5) Hereditar/Degenerative. To learn the approach in the assessment of abnormalities of the BG&T which include the 3 steps: 1) Is it an isolated abnormality of the basal ganglia? If not, what other regions are involved? 2) What is the primary nuclei affected? 3) What MRI signal changes is noted? To understand that findings should always be interpreted with attention to patient age, clinical setting (including acuity/chronicity of the presentation) & correlation with laboratory findings.

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Beyond Flaps and Crescents: Pearls and Pitfalls in Diagnosing Craniocervical Dissection (hardcopy backboard)

Marcin Konrad Kolber MD : Nothing to Disclose, Mika Lidov MD : Nothing to Disclose, Jeremy Whang MD (Presenter): Nothing to Disclose

TEACHING POINTS

Classic signs of dissection of the carotid or vertebral arteries include crescent-shaped intramural hematoma, intimal flap, and narrowed lumen. However, these findings are not always reliable, and when present, may be difficult to identify or mimicked by artifact. We hope to expand the reader’s toolkit for identifying dissections by providing a pictorial review of:

- Common pitfalls with MRI, MRA, and CTA resulting in a missed diagnosis
- Imaging pearls to improve sensitivity
- Artifacts impacting diagnosis

TABLE OF CONTENTS/OUTLINE

Pitfalls:
- Clot shine-through on MRA simulating normal flow-related enhancement
- Normal-sized lumen despite presence of intramural hematoma
- Occult hematoma on 2DTOF visible as halo sign on 3DTOF
- Clot not hyperintense on T1 or T2FS
- Distal occlusion with proximal slow flow, simulating the appearance of proximal dissection
- Peri-vertebral plexus simulating V2 dissection

Pearls:
- Halo sign: T1 hyperintense thrombus surrounding the arterial lumen
- Susceptibility artifact on MRA source image, helping distinguish true lumen from clot
- Proper CT windowing to identify intimal flap and thrombus

Artifacts:
- Signal loss in ICA bulb caused by turbulent flow
- Entry flow phenomenon
- Skull base flow gap

NRS-TUB

Neuroradiology Tuesday Poster Discussions

Scientific Posters

NR

AMA PRA Category 1 Credits ™: .50
Tue, Dec 2 12:45 PM - 1:15 PM Location: NR Community, Learning Center

Sub-Events

NRS424

Evaluation of Metastatic Cervical Lymph Nodes Using Adaptive 4D Volume Perfusion CT in Patients with Head and Neck Squamous Cell Carcinoma (Station #1)

Hiroji Nagata RT (Presenter): Nothing to Disclose, Osamu Yamasita RT : Nothing to Disclose, Masahiro Kawasima RT : Nothing to Disclose, Hiroyuki Tuji MD : Nothing to Disclose, Munetaka Matoba MD : Nothing to Disclose, Hisao Tonami MD : Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the usefulness of adaptive 4D volume perfusion CT covering the whole-neck in patients with head and neck squamous cell carcinoma (HNSCC) for differentiation between metastatic and non-metastatic cervical lymph nodes.

METHOD AND MATERIALS

Perfusion CT was performed from the level of skull base to thoracic inlet in 25 patients with HNSCC before treatment. Each perfusion CT was performed in 75 seconds and included 15 repeated dynamic CT scan obtained using the adaptive 4D spiral mode. In each patient, perfusion parameters including blood flow (BF), blood volume (BV), mean transit time (MTT), and permeability surface product (PS) were calculated for all cervical lymph nodes larger than 8 mm in short axis using dedicated software. Patients underwent tumor resection along with neck dissection or chemoradiotherapy. After chemoradiotherapy, persistent lymphadenopathy were performed either neck dissection or fine needle aspiration. Then, perfusion parameters were correlated with histologic or imaging analysis of lymph nodes

RESULTS

The perfusion parameters and 58 nodes diagnosed as metastasis or non-metastasis by histologic or imaging assessment were correlated. Twenty-six of them were metastatic and the remains were non-metastatic. BF, MTT, and PS of metastatic nodes showed significantly higher than those of non-metastatic nodes (p=0.005, 0.04, and 0.01, respectively). In univariate analysis, BF and PS showed significant association with metastatic nodes (p=0.006, and 0.02, respectively). In multivariate analysis, only BF was identified as a significant
parameter associating with metastatic nodes (p=0.03). In receiver operating characteristic analysis, a feasible threshold value of BF for distinguishing metastatic nodes from non-metastatic nodes revealed a sensitivity of 76.2%, specificity of 72.5%, positive predictive value of 66.7%, and negative predictive value of 80.8%, respectively.

CONCLUSION

Adaptive 4D volume perfusion CT covering the whole-neck in patients with HNSCC may be useful for differentiation between metastatic and non-metastatic cervical lymph nodes.

CLINICAL RELEVANCE/APPLICATION

Adaptive 4D volume perfusion CT covering the whole-neck in head and neck squamous cell carcinoma patients may be useful for differentiation between metastatic and non-metastatic cervical lymph nodes.

NRS425 Thyroid Nodules Ultrasound Assessment with Semiquantitative, Quantitative and Qualitative Elastography: Comparison with Cytological Results (Station #2)

Athanasios N. Chalazonitis MD, MPH (Presenter): Nothing to Disclose, Zoi Antoniou BMedSc: Nothing to Disclose, Christina Gkali MD: Nothing to Disclose

PURPOSE

The purpose of our study is to evaluate the diagnostic accuracy of Semiquantitative, Quantitative and Qualitative Elastography, as an adjunctive technique to conventional ultrasonography comparing both imaging methods with cytological results.

METHOD AND MATERIALS

55 consenting patients with thyroid nodules meeting the ultrasonographic criteria for further testing with Fine Needle Aspiration (FNA), underwent both Strain Elastography (SE) and Acoustic Radiation Force Impulse (ARFI) imaging. SE provides qualitative assessment of the tissue hardness. Strain ratio consist a Semiquantitative type of Elastography. ARFI is divided into two types: a) Virtual Touch tissue Imaging (VTI) which provides the relative stiffness in qualitative way in the selected region of interest (ROI) on a gray scale image and b) Virtual Touch tissue Quantification (VTQ) which describes quantitatively the hardness of tissue. FNA was performed to all nodules and the results of the Elastography were compared to the cytological results.

RESULTS

Out of the 55 examined nodules, 51 with negative SE and ARFI elasticity proved to be benign. Out of the 4 remaining nodules, all had suspicious elastographic findings, 3 proved to be malignant (2 papillary carcinomas, 1 follicular carcinoma) and 1 proved to be benign.

CONCLUSION

Ultrasound Elastography is a relatively new and advanced clinical application, easily implemented, fast and reproducible. Combined Semiquantitative, Quantitative and Qualitative Elastography as an adjunctive tool to conventional ultrasonography can improve the diagnostic accuracy and the sensitivity to malignant thyroid nodules.

CLINICAL RELEVANCE/APPLICATION

To evaluate the diagnostic accuracy of Semiquantitative, Quantitative and Qualitative Ultrasound Elastography in differentiating benign and malignant thyroid nodules.

NRS426 MR Imaging of Syrinxes: Is Contrast Always Necessary? (Station #3)

Vincent Maurice Timpone MD (Presenter): Nothing to Disclose, Sohil H. Patel MD: Nothing to Disclose

PURPOSE

The imaging work up of a syrinx often includes contrast enhanced MR imaging to exclude the presence of an underlying mass lesion. The diagnostic yield of obtaining these additional contrast enhanced sequences is not well defined in the literature. We hypothesized that non-contrast T2WI sequences alone could reliably exclude the presence of an underlying syrinx associated lesion, without the need for additional contrast imaging.

METHOD AND MATERIALS

We analyzed contrast enhanced MR scans of 87 consecutive patients with syrinxes over a 12 month period. The presence or absence of an associated spinal lesion was determined independently by 2 neuroradiologists using only sagittal and axial T2WI. Imaging features considered positive for a possible syrinx associated lesion on T2WI included cord signal abnormality separate from the syrinx, cord expansion, or complex syrinx septations/nodularity. Using contrast enhanced sequences as the reference standard, statistical analysis was subsequently performed to determine the accuracy of T2WI in detecting an associated spinal lesion.
RESULTS
Of the 87 patients, 49 were female and 38 male, with age range 2 - 77 years (median 43 years). Pathologies associated with the syrinxes included: 23 mass lesions, 11 Chiari malformations, 3 spinal cord contusions, and 50 idiopathic. Based on evaluation of each syrinx with T2WI alone, reader sensitivity for underlying mass lesion was 100%, specificity 83%, PPV 66%, NPV 100% (p<0.0001). Readers detected no findings suspicious for syrinx-associated mass lesion in 55/87 cases, and findings suspicious for mass lesion in 33/87 cases. Inter-reader agreement was excellent (kappa = 0.88).

CONCLUSION
Non-contrast MRI with sagittal and axial T2WI is an effective screening tool for the workup of a syrinx, and can reliably exclude the presence of an associated mass lesion. Post-contrast imaging may not be required in the majority of cases of spinal cord syrinx.

CLINICAL RELEVANCE/APPLICATION
In cases of syrinx, T2WI alone reliably excludes the presence of an underlying mass lesion. More judicious use of follow up contrast imaging may help save time and lower healthcare costs.

NRS427
Genetic Frontotemporal Dementia with TDP-43 Inclusions: Distinct Radiological Phenotypes between Patients with PGRN and C9ORF72 Mutations (Station #4)

Anne Bertrand MD, PhD (Presenter): Nothing to Disclose, Fatima Ameur MD: Nothing to Disclose, Paola Caroppi MD: Nothing to Disclose, Didier Dormont MD: Nothing to Disclose, Alexis Brice: Nothing to Disclose, Isabelle Le Ber: Nothing to Disclose, Olivier Colliot: Nothing to Disclose

PURPOSE
To study the MR phenotypes of the 2 most frequent genetic forms of frontotemporal dementia: PGRN and C9ORF72 mutations.

METHOD AND MATERIALS
2 readers retrospectively reviewed axial FLAIR and 3DT1 images of 27 patients with a genetic form of frontotemporal dementia: 17 patients with C9ORF72 mutation and 10 patient with PGRN mutation. The severity of FLAIR hyperintensity was rated using the Fazekas & Schmidt score. The type of FLAIR hyperintensities was rated using a 3-level score: A- vascular type; B- vascular type predominating in the areas of atrophy; C- non vascular type. The presence of regional atrophy was scored as follow: presence or absence of an anteroposterior gradient of atrophy; presence or absence of a left-to-right or right-to-left gradient of atrophy.

RESULTS
 Interrater agreement was moderate for Fazekas & Schmidt score (0.50 {0.16-0.68}) and was high for the type of FLAIR hyperintensities 0.79 {0.56-0.91}), the presence of anteroposterior gradient of atrophy 0.76 {0.61-1}) and the presence of left-to-right or right-to-left gradient of atrophy 0.73 (0.52-0.94) (weighted kappa tests). Atypical FLAIR hyperintensities (type B-C) were present in 90% of patients with PGRN mutation, while only 12% with C9ORF72 mutation. Asymmetrical anterior atrophy, characteristic of frontotemporal dementia, was present in 70% of patients with PGRN mutation, while only 18% of patients with C9ORF72 mutation.

CONCLUSION
Major phenotypic differences distinguish on brain MRI C9ORF72 and PGRN mutations, which are both related to frontotemporal dementia with TDP-43 inclusions. This result demonstrates that gene-related effects can overpass lesion-related effects in the phenotypic expression of frontotemporal dementias.

CLINICAL RELEVANCE/APPLICATION
In patients presenting with frontotemporal dementia, neuroradiologists should raise the possibility of a genetic form linked to PGRN mutation when atrophy is particularly marked, and associated with atypical FLAIR hyperintensities, predominating in the areas of atrophy.

NRS428
Quantification of Multiple Sclerosis Normal-appearing White Matter on Quantitative Susceptibility Mapping (QSM) (Station #3)

Weiwei Chen (Presenter): Nothing to Disclose, Susan Gauthier: Nothing to Disclose, Chu Pan MD: Nothing to Disclose, Ketao Mu PhD: Nothing to Disclose, Tian Liu PhD: Nothing to Disclose, Yi Wang PhD: Nothing to Disclose, Wenzhen Zhu MD, PhD: Nothing to Disclose

PURPOSE
To quantify the susceptibility of normal appearing white matter (NAWM) by quantitative susceptibility mapping (QSM) to study its correlation with clinical features in MS patients.

METHOD AND MATERIALS
Seventy consecutive clinical confirmed RRMS patients (23M/47F, 40.6±10.6yrs, EDSS: 0-6; disease duration 0-43yrs) and 26 age and gender matched healthy controls (HCs) (9M/15F, aged:39.0±11.42yrs) were retrospectively selected. White matter regions without an abnormal signal on T2w, T1w, and T2FLAIR images were assumed to be NAWM for MS patients and normal white matter (NWM) for healthy controls. Region-of-interests (ROIs) of NAWM/NWM and CSF were drawn in bilateral frontal and parietal white matter, in the genu and splenium of the corpus callosum, and in the body of lateral ventricle manually by two neuroradiologists on T2-weighted images. The ROIs were overlaid onto QSM and NAWM/NWM susceptibility was calculated as its susceptibility difference from the corresponding patient/HC CSF susceptibility to eliminate possible constant offsets in susceptibility maps. The mean value of NAWM/NWM susceptibility was calculated for each patient. The significance of difference in NAWM/NWM susceptibility was assessed by t-test and One-Way
ANOVA with Bonferroni adjustment.

RESULTS
A total of 511 NAWM ROIs were drawn in 70 MS patients and 208 NWM ROIs in 26 HCs. Of 70 MS patients, 15 patients had one or more Gadolium-enhanced MS lesions, the remaining 55 had no Gadolium-enhanced MS lesion. The NAWM of MS patients showed significantly higher susceptibility than NWM of HCs (-19.96 ± 8.29ppb vs. -28.56 ± 5.44ppb, p<0.001). However, the NAWM of patients with Gd-enhanced lesions showed a similar susceptibility to healthy controls NWM (-25.97 ± 6.19ppb vs. -28.56 ± 5.44ppb, p=0.802), while the NAWM of MS patients without Gd-enhanced lesions showed significantly higher susceptibility than both healthy controls NWM (-25.97 ± 6.19ppb vs. -28.56 ± 5.44ppb, p<0.001) and the NAWM of patients with Gd-enhanced lesions (-18.29 ± 6.06ppb vs. -25.97 ± 6.19ppb, p=0.001) (figure 1).

CONCLUSION
The susceptibility of NAWM increased in MS patient compared to HCs. However, the susceptibility of NAWM increased only in patient without Gadolium-enhanced lesions, while closed to that of HCs in patient with Gadolium-enhanced lesions.

CLINICAL RELEVANCE/APPLICATION
QSM enable quantify the susceptibility of NAWM in MS patient, which might contribute to better understanding of MS pathogenesis.

NRS429
Double Inversion Recovery Imaging of the Brain in Seizures (Station #6)
Raja Sekaran  Kattumannarkudi Ramalingam  MBBS (Presenter):  Nothing to Disclose , Sravanthi Mantripragada  MBBS :  Nothing to Disclose , yvette kirubha  MBBS, MD :  Nothing to Disclose , Meera Krishnakumar :  Nothing to Disclose , Chidambaranathan Natesan  MD, PhD :  Nothing to Disclose

PURPOSE
To evaluate the utility of Double inversion recovery(DIR) imaging of brain in comparision to Fluid attenuated inversion recovery (FLAIR) in patients with seizures by analysing the lesion detection, lesion conspicuity and additional diagnostic informations

METHOD AND MATERIALS
This prospective study was conducted with institional review board approval and informed consent was obtained. The study protocol ( Routine epilepsy protocol+ DIR sequence) was performed with a 1.5 Tesla MRI in 123 consecutive seizure patients (mean age 18.2 years; range, 3 months-72 years) and 34 control population. Two radiologists independently assessed three criteria: lesion detection, conspicuity and additional diagnostic informations by using three point grading system, and compared FLAIR and DIR images. Interobserver agreement of each criteria were compared using kappa statistics.

RESULTS
On DIR images lesions were more conspicuous than FLAIR (p< 0.0001 & kappa 0.85 -Perfect agreement). Overall ability for the presence of lesions and detectability(p

CONCLUSION
DIR overcame the disadvantages of FLAIR in malformations of cortical development and hippocampal sclerosis.DIR images significantly improved the conspicuity of the lesions when compared to FLAIR especially lesions with low contrast on FLAIR images, lesions along the ependymal lining, cortical volume loss, abnormal cortical morphology,ectopic grey matter, pattern of abnormal gyri and sulci.DIR sequence can provide useful additional diagnostic information when evaluating cortical dysplasias, hippocampal sclerosis, lesions with perilesional edema, cortical atrophy.

CLINICAL RELEVANCE/APPLICATION
DIR sequence should be used as an adjunctive to FLAIR sequence in evaluation of epileptogenic lesions but need not replace it and it is recommended to implement DIR sequence in routine practice.

NRS430
Association of Hyperdense Middle Cerebral Artery Sign with Clinical Outcomes and Recanalization Rates in Patients with Acute Ischemic Stroke Treated with Intra-arterial Procedures (Station #7)
Irene Martin Lores  MRCS (Presenter):  Nothing to Disclose , Manuel M. Moreu  MD :  Nothing to Disclose , Carlos I Gomez-Escalonilla :  Nothing to Disclose , Juan Arrazola :  Nothing to Disclose , Luis Lopez Ibor :  Nothing to Disclose

PURPOSE
To study the relationship between the hyperdense middle cerebral artery sign with the clinical outcome at three months and the recanalization rate after an intra-arterial procedure in patients with acute ischemic stroke.

METHOD AND MATERIALS
A retrospective cohort study was conducted with all patients with an anterior ischemic stroke attended in our department during 2008-2013. All of them went through an endovascular procedure. They were divided in two groups using a non-contrast CT, based on the hyperdense vessel sign (defined as an hyperdense vessel diagnosed by two independent observers using a 35/35 window levels and comparing with contralateral vessel). Recanalisation rate was determined with the last image of the intra-arterial procedure by two independent observers and graded using TICI scale. A neurologist based on modified Rankin scale, 90 days
after the stroke, defined clinical outcome.

RESULTS

94 patients were evaluated with a mean age of 64.6 years old. 48 patients (51.1%) where women and 46 (48.9%) men. Median NIHSS was 19. Intra-arterial procedure was made with stent retrievers in almost all of the patients (93.6%). Hyperdense vessel sign was described in 55 patients. Good outcomes where identified in 37 patients and 3 month mortality was 17%. Statistic analysis was made using SPSS 20. Bad neurological outcome was more probable with an hyperdense vessel sign at 90 days (p=0.004) and at 7 days (p=0.002). Recanalization was harder in patients with hyperdense vessel sign (p=0.009).

CONCLUSION

In patients where mechanical thrombectomy is an option hyperdense vessel sign have worse clinical outcomes and implies lower recanalization rates.

CLINICAL RELEVANCE/APPLICATION

Although the results after the revascularization therapy are worse in patients with hyperdense vessel than in patients without this sign, it is still better than leaving the vessel closed. Therefore we recommend for these patients the use of intraarterial devices with better index results.
TEACHING POINTS

1. Viewers will learn a systematic imaging approach to cases of basal ganglia pathologies. 2. Specific key imaging features of common and uncommon basal ganglia lesions will be highlighted.

TABLE OF CONTENTS/OUTLINE

Introduction: Many systemic and focal diseases may present as basal ganglia abnormalities. We present a spectrum of MR imaging characteristics of various basal ganglia lesions, with emphasis on key imaging clues in a given clinical setting to narrow the differential diagnosis. Methods: A case based approach to basal ganglia pathologies will be presented. Common and uncommon MR imaging features of each pathology will be discussed. Clinical presentation will be taken into consideration to narrow the differentials. Various pathologies covered will be: 1. Congenital and Hereditary- NF1, Huntington's disease 2. Metabolic and Toxic- Wilsons / Organic aciduria / Mitochondrial cytopathy 3. Infections- Viral/ Tuberculosis/ HIV 4. Neoplastic- Gliomas/ Lymphoma/ Metastases 5. Vascular- Arterial and venous infarct

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NRE165

Ultrasound of the Neonatal Brain: Spectrum of Pathology (Station #11)

Lorene Elaine Romine MD (Presenter): Nothing to Disclose, Elise Housman: Nothing to Disclose, Julie Bykowski MD: Nothing to Disclose, Mary K. O'Boyle MD: Nothing to Disclose

TEACHING POINTS

1. Review the spectrum of abnormalities that may be encountered when performing transcranial ultrasound of the neonatal brain. Examples of postnatal MRI and prenatal imaging will be demonstrated for correlation. 2. Identify key imaging features that will aid in appropriate diagnosis.

TABLE OF CONTENTS/OUTLINE


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NRE159

Congenital and Developmental Brain Abnormalities (Station #12)

Hatsuho Mamata MD, PhD (Presenter): Nothing to Disclose, Valerie Lynn Jewells DO: Nothing to Disclose

TEACHING POINTS

The purposes of this exhibit are:

1. To understand types of congenital and developmental abnormalities and their etiologies.
2. To review image findings of various types of congenital and developmental abnormalities.
3. To discuss role of image diagnosis.

TABLE OF CONTENTS/OUTLINE


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NRE321

MR Findings of Head and Neck Cancers: Focused on Diffusion Weighted Images (DWI) (Station #13)

Eu Hyun Kim MD (Presenter): Nothing to Disclose, Woo Jin Lee MD: Nothing to Disclose, Bomi Gil: Nothing to Disclose, Jin Hee Jang MD: Nothing to Disclose, Hyun Seok Choi MD: Nothing to Disclose, So Lyung Jung: Nothing to Disclose, Kook Jin Ahn MD, PhD: Nothing to Disclose, Bum-Soo Kim MD, PhD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To share background knowledge about DWI of the head and neck 2. To review MR findings of variable head and neck cancers, including DWI

TABLE OF CONTENTS/OUTLINE

- Brief review on head and neck MR imaging
  : Anatomic considerations related to imaging in the head and neck region
  : Principle of DWI and its clinical value in head and neck cancers
- Review of image findings in head and neck of actual cases
Variable malignant lesions in head and neck:
- SCC (tonsil, hypopharynx, larynx)
- Lymphoma
- Metastatic LNs
- Uncommon malignancy
- Post-treatment changes - recurrence or post OP change

- Other malignant mimics and pitfalls, especially on DWI

- Summary and future directions

**MSRO33**

**BOOST: Head and Neck—Case-based Review (An Interactive Session)**

**Multisession Courses**

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AMA PRA Category 1 Credits™: 1.25
ARRT Category A+ Credits: 1.50

Tue, Dec 2 3:00 PM - 4:15 PM   Location: S103AB

**Participants**

- Suresh K. Mukherji MD (Presenter): Nothing to Disclose
- Sung Kim MD (Presenter): Nothing to Disclose
- Carol R. Bradford MD (Presenter): Nothing to Disclose
- Francis Paul Worden MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review common tumors of the head and neck.
2) Review imaging findings in head and neck malignancies that specifically change staging.
3) Review the value of imaging in directly affecting management and treatment.

**ABSTRACT**

This session will be tumor board that includes a head and neck radiologist, head and neck surgeon, medical oncologist and radiation oncologist. We will discuss a variety of head and neck cancer cases and illustrate the value-added benefits and highlight of imaging affects staging, treatment and management.

**SSJ17**

**Neuroradiology/Head and Neck (ENT Oncology)**

**Scientific Papers**

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AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 1.00

Tue, Dec 2 3:00 PM - 4:00 PM   Location: N227AB

**Participants**

- Moderator
  - Ashley Hawk Aiken MD : Nothing to Disclose
- Moderator
  - Barton F. Branstetter MD : Nothing to Disclose

**Sub-Events**

**SSJ17-01**

Proposal of a Sequential Clinico-Radiological Protocol for Aetiological Characterisation of Cervical Lymphadenopathy by Comparing the Accuracies of Ultrasonography (USG), Elastography and MDCT

Sravanthi Mantripragada MBBS (Presenter): Nothing to Disclose, Raja Sekaran Kattumannarkudi Ramalingam MBBS : Nothing to Disclose, Meera Krishnakumar DMRD, MD : Nothing to Disclose

**PURPOSE**

To determine the most accurate modality and propose a sequential protocol for cause identification of cervical lymphadenopathy.

**METHOD AND MATERIALS**

The study population consisted of 121 nodes and a control of 11 reactive nodes. USG and Strain elastography were performed with an Acuson S2000 unit. ImageJ software was used to analyse Elastographic images. MDCT was performed using a Toshiba 64 slice scanner. Based on characteristics like size, shape, reticulation, type of vascularity, hilar echogenicity, necrosis, matting, percentage of elastographic stiffness, nodes were diagnosed and compared with the final HPE diagnosis. Accuracy of each modality (USG, combination of USG and Elastography and MDCT) was estimated by calculating the sensitivity, specificity, PPV and NPV for each aetiology (Lymphoma, TB, Metastasis and Reactive). The modalities were compared in pairs to determine the most accurate modality for cause characterization. P-values, PPV, NPV and PLR for certain characteristics of
USG and MDCT which favoured some aetiologies were calculated. The data was analysed using Fisher’s exact test and Pearson’s Chi-squared test. A p value <0.05 was considered significant.

RESULTS

USG was the most accurate modality, followed by MDCT and combination of USG and Elastography, in that order. On USG: -Intranodal reticulation with posterior acoustic enhancement implies Lymphoma -Displaced vascularity or necrosis and matting implies TB -Hilar vascularity implies Reactive -Peripheral or mixed vascularity imply Metastasis On MDCT: -Heterogeneous enhancement and low attenuation centres (not necrosis) implies Metastasis -Thick nodular capsular enhancement with internal septae or matting or peripheral/multilocular enhancement or necrosis implies TB

CONCLUSION

USG is the preferred modality for cause characterization of cervical lymphadenopathy. Elastography significantly reduces the accuracy of USG, when used in tandem, especially in cases of TB. This implies that Elastography has very limited application in the cause characterization of cervical lymphadenopathy. TB significantly reduces the accuracy of ultrasound modalities in cause determination.

CLINICAL RELEVANCE/APPLICATION

This study proposes a low-cost, low-radiation standard clinico-radiological step-by-step protocol (in fig) for approach to cervical lymphadenopathy, which is of practical application.

SSJ17-02

Comparison of Accuracies between US-guided Fine Needle Aspiration and US-guided Core Needle Biopsy to Detect Malignancy and to Make Tissue-specific Diagnosis of Salivary Gland Tumors

Seung-Won Jang MD (Presenter): Nothing to Disclose, Hye Joung Eom MD: Nothing to Disclose, Myung-Su Ko MD: Nothing to Disclose, Jeong Hyun Lee MD, PhD: Nothing to Disclose, Young Jun Choi MD: Nothing to Disclose, Raguayong Yoon MD: Nothing to Disclose, Jung Hwan Baek: Nothing to Disclose

PURPOSE

To compare the diagnostic accuracies of ultrasonography-guided fine needle aspiration (USFNA) and core needle biopsy (USCNB) for detecting malignant tumors of the salivary gland and for tissue-specific diagnosis of benign and malignant tumors in a tertiary hospital

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and informed consents were waived. From 2003 to 2012, 354 consecutive patients underwent USFNA (n = 121) or USCNB (n = 233) for a salivary gland mass. Among them we included 320 patients confirmed either by surgery (n = 248) or clinical follow-up > 1-year (n = 72) after exclusion of non-diagnostic results (n = 13) or follow-up loss (n = 21). We compared the diagnostic accuracies between USFNA and USCNB for discriminating malignant salivary gland tumors and for correct tissue-specific diagnosis of benign and malignant tumors. We also tested any difference between the procedures according to the operator’s experience level.

RESULTS

Non-diagnostic rates were significantly higher in USFNA with 6.7 % (7/104) than USCNB with 2.6 % (6/229), respectively. The overall accuracy of USCNB for diagnosing malignant tumors was significantly higher than that of USFNA (p = 0.026). Correct tissue-specific diagnosis for benign and malignant tumors was in 97 % and 53 % with USFNA and 96 % and 82 % with USCNB. The accuracy for diagnosing malignant tumors was significantly higher with USCNB than USFNA among the results by trainees, but there was no difference among the results by faculty. There was no significant complication needed intervention or hospitalization in our cohort.

CONCLUSION

USCNB should be the choice for diagnosis of a salivary gland mass because it is better in discriminating malignant tumors from benign and in tissue-specific diagnosis of benign and malignant tumors.

CLINICAL RELEVANCE/APPLICATION

Ultrasonography-guided core needle biopsy is superior to fine needle aspiration in diagnosis of malignant tumors of the salivary gland

SSJ17-03

The Incremental Value of Diffusion Weighted Imaging over Conventional MRI for Detection of Metastatic Nodes in Squamous Carcinoma of the Oral Tongue: Do We See the Glass Half Full or Half Empty?

Supreeta Arya MD (Presenter): Nothing to Disclose, Sonal Mahalwar MBBS: Nothing to Disclose, Nilesh Sable: Nothing to Disclose

PURPOSE

To determine the incremental value of diffusion-weighted MR imaging over conventional MRI in the detection of metastatic lymph nodes in oral tongue squamous cell carcinoma (SCC).

METHOD AND MATERIALS
A prospective study was undertaken in 30 patients of stage T2 - T4 oral tongue SCC at a tertiary referral oncology centre. Cases receiving neoadjuvant therapy were excluded. All cases underwent MRI on a 1.5T magnet. Multiplanar spin echo sequences (T1W, T2W, STIR and postgadolinium T1W) were obtained for conventional MRI. DWI/MRI were performed using b0 and b1000 values. ADC maps were used for calculating ADC values for nodes at each nodal station (IA, IB, II-V). All cases underwent elective neck dissection, either unilateral (n=16) or bilateral (n=14). In all 44 necks were operated; modified radical neck dissection (MRND) in unilateral dissections and MRND supra-omohyoid neck dissection on the contralateral side. The imaging findings were correlated with histopathology, both on a per neck basis and per nodal station level basis. Institutional review board clearance was obtained before recruiting patients for the study.

RESULTS
Conventional MR imaging using all criteria revealed a sensitivity of 66.6%, specificity of 90%, PPV of 88.8%, NPV 69.2%, and accuracy of 77.2%, on a per neck basis. On a per nodal station basis, a sensitivity of 63.8%, specificity of 90.9%, positive predictive value (PPV) of 69.6%, negative predictive value (NPV) of 88.5% and accuracy of 84.2% were obtained. There was significant overlap in the range of ADC values of benign and metastatic nodes. The cut off ADC value obtained from the ROC curve was 0.95x10^-3mm2. Using this ADC value the incremental value of DWI/MRI over conventional MRI yielded a sensitivity of 77.5%, specificity of 77.2%, positive predictive value of 50.8%, negative predictive value of 92% and accuracy of 77.3%.

CONCLUSION
DWI MRI added to conventional MRI increased sensitivity and NPV, but due to overlap in ADC values of metastatic and reactive nodes, the PPV reduced significantly. DWI of lymph nodes may not be as accurate as initially reported in literature.

CLINICAL RELEVANCE/APPLICATION
The debate between elective neck dissection and watchful waiting for the clinically negative neck is not yet settled. DWI MRI cannot improve surgical staging; but if watchful waiting is the decided policy, adding DWI-MRI to conventional MRI could contribute by an increase in NPV.

Could Contrast-enhanced CT Examination Add Diagnostic Value over US-based Detection of Metastatic Neck Lymph Nodes in Patients with Thyroid Cancer?: A Prospective, Multicenter Study.
Korean Society of Thyroid Radiology (KSThR) Study Group

Younghen Lee MD (Presenter): Nothing to Disclose, Ji-hoon Kim MD: Nothing to Disclose, Dong Gyu Na MD: Nothing to Disclose, Jung Hwan Baek: Nothing to Disclose, Sun Won Park: Nothing to Disclose, So Lyung Jung: Nothing to Disclose, Eun Ju Ha: Nothing to Disclose, Jinna Kim MD: Nothing to Disclose, Tae Jin Yoon MD: Nothing to Disclose

PURPOSE
To determine an additional diagnostic role of combined US/CT over the US evaluation for detection of metastatic LN in patients with thyroid cancers.

METHOD AND MATERIALS
During the recent 1 year, 9 experienced head and neck radiologists in seven institutions prospectively evaluated the both I-VI neck LN levels of patients with thyroid cancers prior to operation using both ultrasound (US) and contrast-enhanced neck CT. Imaging criteria of probably metastatic LN were as followed [US: calcification, cystic change, hyperechoic, abnormal vascular pattern; [CT]: calcification, cystic change, strong enhancement without hilar vessel, heterogeneous enhancement. If at least one of above mentioned criteria to suggest probably metastatic were found, we considered the corresponding LN level as probably metastatic. Finally, we classified the both I-VI neck LN levels of patients with thyroid cancers prior to operation using both ultrasound (US) and contrast-enhanced neck CT.

RESULTS
Our level by level and patient-based analysis revealed that combined US/CT imaging criteria significantly improved the sensitivities (p<0.01), and decreased the specificities (p<0.01), while not affected the diagnostic accuracies (p>0.05) in the overall, central and lateral neck levels, compared to US-only, except the more higher diagnostic accuracies achieved only in lateral neck by combined US/CT criteria (p=0.011). Moreover, the sensitivities of CT criteria to detect additional metastatic LNs in lateral neck were 54.8% (23/42 levels) and 65.5% (19/29 persons) in cases of LNs which were not considered as probably metastatic by US criteria.

CONCLUSION
For preoperative neck LN evaluation, US/CT combined evaluation could play additional diagnostic roles in patients with thyroid cancers, especially in lateral neck, compared to US-based evaluation.

Head and Neck Neoplasms: Correlation of CT Perfusion Imaging with Microvessel Density and Cascular Endothelial Growth Factor

Zuohua Tang MS, MD (Presenter): Nothing to Disclose, Jie Wang: Nothing to Disclose, Lingjie Wu MD: Nothing to Disclose, So Lyung Jung: Nothing to Disclose, Eun Ju Ha: Nothing to Disclose, Jinna Kim MD: Nothing to Disclose, Tae Jin Yoon MD: Nothing to Disclose
PURPOSE
To evaluate the value of perfusion CT (CTP), microvessel density (MVD), and vascular endothelial growth factor (VEGF) in the differentiation of malignant from benign head and neck neoplasms (HNNs).

METHOD AND MATERIALS
Forty-one HNNs proven by pathology underwent CTP, MVD, and VEGF analysis. All lesions were divided into three groups: Group A, benign hypovascular lesions; Group B, benign hypervascular lesions; and Group C, malignant lesions. A time density curve (TDC) and CTP parameters (MIP, BV, BF, MTT, CP) were analysed. The relationship between the perfusion measurements and MVD/VEGF was assessed by Pearson correlation.

RESULTS
The TDCs could be classified into three types. TDC of type I was mainly found in Group A, and type II was found in Groups B and C. MIP, BF, and BV were all significantly higher in Groups B and C compared to Group A (all P < 0.01). Pearson correlation showed a positive correlation between the MVD and MIP, BV, and VEGF, respectively (all P<0.05). The VEGF expression in Group C was significantly higher than that in Groups A and B (all P<0.05).

CONCLUSION
The MIP and BV of CTP correlate positively with MVD and may reflect angiogenesis of HNNs. CTP combined with VEGF could be beneficial by allowing differentiation of malignant from benign HNNs.

CLINICAL RELEVANCE/APPLICATION
CTP may reflect angiogenesis of head and neck neoplasms (HNNs) and is helpful in the differentiation of malignant from benign HNNs and is recommended in the initial evaluation of HNNs.
Sub-Events

SSJ18-01

Evaluation of the Capability of Arterial Spin Labeling to Depict the Seizure Focus in Patients with Clinical Seizure Activity

Beom Su Kim MD (Presenter): Nothing to Disclose, Beom Su Kim MD: Nothing to Disclose, Tae Jin Yun MD: Nothing to Disclose, Jin Chul Paeng: Nothing to Disclose, Seung Hong Choi MD, PhD: Nothing to Disclose, Ji-hoon Kim MD: Nothing to Disclose, Chul-Ho Sohn MD: Nothing to Disclose, Roh-Eul Yoo MD: Nothing to Disclose, Jung Hyo Rhim MD, PhD: Nothing to Disclose

PURPOSE

The capability of arterial spin labeling (ASL) MR to depict the seizure focus in patients with clinical seizure activity has not yet been elucidated. We aimed to assess the relative capability of ASL to depict the seizure focus compared with electroencephalogram (EEG) in patients with clinical seizure activity.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board, and informed consent requirement was waived. Consecutive postictal ASL images from 36 patients with clinical seizure activity were analyzed. All patients underwent both EEG and MR imaging using ASL technique after clinical seizure activity. Eight of the patients also underwent 99mTc-HMPAO single-photon emission computed tomography after clinical seizure activity. The area under the receiver operating characteristic curve was used to evaluate diagnostic accuracy of ASL relative to that of EEG. Diagnostic performance of ASL images to depict the location of seizure focus was evaluated using EEG as the gold standard.

RESULTS

The area under the receiver operating characteristic curve of ASL to depict the seizure focus was 0.903 (95% confidence interval: 0.756 - 0.976, p < 0.0001). In terms of diagnostic performance of ASL to depict the seizure focus, there was a sensitivity of 87% (26/30), a specificity of 33% (2/6), a positive predictive value of 87% (26/30), and a negative predictive value of 33% (2/6). Of 8 patients who underwent single-photon emission computed tomography images after clinical seizure activity, all patients showed perfusion abnormality. Among the patients, concordance was revealed in all 7 patients in terms of seizure location.

CONCLUSION

ASL can depict the seizure focus with excellent performance in patients with clinical seizure activity and has the potential to serve as a non-invasive imaging tool for detection of seizure focus in the patients.

CLINICAL RELEVANCE/APPLICATION

ASL can depict the seizure focus with excellent performance in patients with clinical seizure activity.

ASL has the potential to serve as a non-invasive imaging tool for detection of seizure focus in the patients.

SSJ18-02

Diffusion Tensor Imaging Can Detect Epileptogenic Tissue in Pediatric Tuberous Sclerosis Patients

Akira Yogi MD (Presenter): Nothing to Disclose, Yoko Hirata: Nothing to Disclose, Elena Karavaeva MD: Nothing to Disclose, Joyce Wu MD: Nothing to Disclose, Sue Yudovin: Nothing to Disclose, Benjamin Michael Ellingson MS, PhD: Research Consultant, MedQIA Imaging Core Laboratory Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Tocagen Inc Research Consultant, Boston Scientific Corporation Research Consultant, Amgen Inc Research Grant, Siemens AG Research Grant, F. Hoffmann-La Roche Ltd, Noriko Salamon MD: Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate if diffusion tensor imaging (DTI) can detect epileptogenic tubers and perituberal tissues in pediatric tuberous sclerosis complex (TSC) patients, and to investigate if background white matter myelination, which usually completes by 3 years old, influences DTI parameters.

METHOD AND MATERIALS

Twenty-two patients (0.4-19.6 year old, mean age 5.3; 12 female, 10 male) who underwent tuber resection for treatment of epilepsy between 2004 and 2011 were retrospectively selected from TSC cohort of our institute. All patients had preoperative DTI. Total of 545 tubers were divided into as epileptogenic or non-epileptogenic.
Epileptogenicity was defined by preoperative evaluation of EEG, FDG-PET, Magnetoencephalogram, and intraoperative electrocorticography. Two observers manually outlined all tubers (ROI\textsubscript{tuber}) on ADC map as a reference of T2WI or FLAIR. 4 mm thick ring-shaped ROIs of perituberal tissue (ROI\textsubscript{perituber}) and ROIs including tuber and perituberal tissue (ROI\textsubscript{tuber+perituber}) were also generated. Maximum, minimum, mean, and median values of ADC, FA, and RD were calculated. Mann-Whitney test and unpaired t test were used to analyze DTI parameters between epileptogenic and non-epileptogenic tubers. To investigate the influence of white matter myelination, a group of patients younger than 3 years old was separately analyzed and results were compared with all patients.

**RESULTS**

Maximum ADC and RD were significantly higher in epileptogenic tubers. FA showed no significant difference between groups. The changes were more significant in patients younger than 3. Furthermore, ROI\textsubscript{tuber} and ROI\textsubscript{tuber+perituber} showed higher mean ADC and lower minimum FA in epileptogenic tubers. Maximum ADC value of ROI\textsubscript{tuber+perituber} showed most significant difference in all patients and patients younger than 3 (Fig. 1a, 1b). ROC curves showed higher value of area under curve in patients younger than 3 (Fig. 2a, 2b).

**CONCLUSION**

ADC and RD of tuber and tuber + perituberal tissue were higher in epileptogenic group. DTI can be a promising additional tool to predict epileptogenic tissue, especially in patients younger than 3 years old.

**CLINICAL RELEVANCE/APPLICATION**

DTI can be a promising tool to detect epileptogenic tubers in pediatric TSC patients, which may lead to seizure control and better cognitive outcome.

**SSJ18-03 Extratemporal Abnormalities of Brain Parenchyma in Young Adults with Temporal Lobe Epilepsy: A Diffusion Tensor Imaging Study**

**Xiang Yuan Yin : Nothing to Disclose, Shi Jun Qiu MD (Presenter): Nothing to Disclose, Zhen Yin Liu : Nothing to Disclose, Hong Zhao Wang : Nothing to Disclose, Wei Feng Xiong : Nothing to Disclose, Shan Shan Li : Nothing to Disclose, Jie An : Nothing to Disclose, Dong Lin Wu : Nothing to Disclose**

**PURPOSE**

Our study aimed to examine extratemporal abnormalities of cerebral parenchyma in young adult TLE patients, using DTI.

**METHOD AND MATERIALS**

The study comprised 20 adults with unilateral TLE and 20 controls. We calculated fractional anisotropy (FA), apparent diffusion coefficient (ADC), parallel eigenvalue (\(\lambda//\)) and perpendicular eigenvalue (\(\lambda?\)) in the ROIs using a 3-T MRI scanner. ROIs included: anterior/posterior limb of the internal capsule (AIC/PIC), external capsule (EC), head of caudate nucleus (HCN), lenticular nucleus (LN), thalamus (TL) and genu/ body / splenium of the corpus callosum (GCC/BCC/SCC).

**RESULTS**

Compared to controls, TLE patients showed: lower FA in all ROIs; higher ADC in bilateral ECs, HCNs, TLs and BCC; lower \(\lambda//\) in ipsilateral LN and bilateral AICs, TL and GCC; higher \(\lambda?\) in all ROIs except the bilateral PICs. In TLE patients, the ipsilateral TL had decreased FA compared with the contralateral TL. Pearson correlation analysis revealed a negative correlation between ADC of GCC and the epilepsy onset age, \(\lambda//\) of ipsilateral PIC and the epilepsy onset age, \(\lambda?\) of contralateral AIC and the duration of epilepsy, respectively; and a positive correlation between ADC of GCC and the duration of epilepsy, \(\lambda?\) of GCC and the duration of epilepsy, respectively.

**CONCLUSION**

The study revealed bilateral extratemporal abnormalities in young adult TLE patients compared with controls; and TLE patients with younger onset age or longer duration of epilepsy may have more serious extratemporal changes.

**CLINICAL RELEVANCE/APPLICATION**

fMRI

**SSJ18-04 Stereotactic Amygdalohippocampectomy and Anterior Temporal Resection for Mesial Temporal Lobe Epilepsy: Resection or Destruction Extent versus Seizure and Neuropsychological Outcomes**

**Hana Malikova MD (Presenter): Nothing to Disclose, Lenka Kramska : Nothing to Disclose, Zdenek Vojtech MD : Nothing to Disclose, Roman Liscak PhD : Nothing to Disclose**

**PURPOSE**

Surgical therapy of intractable mesial temporal lobe epilepsy (MTLE) is an effective and well-established treatment that brings seizure relief in 60-70% of patients. Anterior temporal resection (ATL) is commonly used surgical procedure. Stereotactic radiofrequency amygdalohippocampectomy (SAHE) is a minimally invasive selective approach. It is known that the surgical treatment of MTLE bears the risk of memory impairment especially in left-sided surgery. The aim of the study was to compare 2 different surgical approaches, standard ATL and alternative SAHE for MTLE, with respect to the extent of resection or destruction, and clinical outcomes.
METHOD AND MATERIALS

75 MTLE patients were included; 41 treated by SAHE (11 right-sided, 30 left-sided) and 34 treated by ATL (21 right-sided, 13 left-sided). All patients underwent MRI volumetry of hippocampus and amygdala and neuropsychological evaluation preoperatively and 1 year after operation. Clinical seizure outcome was assessed 2 years after therapy.

RESULTS

Hippocampal (60.6±18.7%) and amygdalar (50.3±21.9%) volume reduction by SAHE was significantly lower than by ATL (86.0±12.7%, 80.2±20.9%, respectively). Seizure control by SAHE was comparable with ATL (Engel I in 75.6% and 76.5%) 2 years after surgery. Neuropsychological results of SAHE patients were better than in ATL patients. In SAHE patients no memory impairment was found, they improved in Global MQ and Verbal MQ. In ATL group, memory performance was significantly deteriorated only in Delayed Recall.

CONCLUSION

In this study we have proven that destruction of hippocampal and amygdalar tissue by SAHE was significantly lower than hippocampal and amygdalar resection after ATL. Seizure control by SAHE was comparable to ATL. However, SAHE offers better neuropsychological results.

CLINICAL RELEVANCE/APPLICATION

SAHE is minimally invasive selective treatment for MTLE that partially spares mesial structures of temporal lobe and offers comparable seizure control as ATL, with better neuropsychological results.

SSJ18-05

Intraoperative MRI in Anterior Temporal Lobectomy for Mesial Temporal Lobe Epilepsy: Does Intraoperative MRI Improve the Resection Extent?

Hana Malikova MD (Presenter): Nothing to Disclose, Zdenek Vojtech MD: Nothing to Disclose, Jan Sroubek: Nothing to Disclose

PURPOSE

Mesial temporal lobe epilepsy (MTLE) is the most common epilepsy diagnosis in adults. Surgery brings seizure relief in 60-70% of patients. Anterior temporal resection (ATL) is commonly used for surgical therapy. The resection extent of mesial structures is often discussed in literature and it is known that the amount of resected tissues often varies considerably. The aim of the study was to compare the resection extent and complication rate in patients with and without intraoperative MRI evaluation during ATL procedure.

METHOD AND MATERIALS

We included 34 MTLE patients treated by ATL for MTLE: 13 of them underwent intraoperative MRI evaluation of the resection extent and 21 patients did not. MRI volumetry of mesial temporal structures was done preoperatively and 1 year after ATL.

RESULTS

In patients without intraoperative MRI, the volume resection of the hippocampus was 89.1±10.7% and of the amygdala was 77.4±23.6%. In patients with intraoperative MRI, the volume resection of the hippocampus was 83.2±14.3% and of the amygdala was 84.8±13.4%. The following complications were observed in patients without intraoperative MRI: 4.8% of purulent meningitis; 4.8% of clinically silent infarction; 4.8% manifest infarction (1 case with transient dysphasia). In patients with intraoperative MRI the following complications developed: 15.4% of clinically non-silent infarctions (one case with transient dysphasia, one case with transient hemiparesis); 15.4% of silent infarctions. We did not find any death cases or persistent neurological deficit more than 1 year after ATL. Two years after ATL both groups had comparable seizure control, 84.6% patients were seizure free in group with intraoperative MRI and 71.4% without intraoperative MRI.

CONCLUSION

Intraoperative MRI evaluation brought more ischemic complications without effect on the resection extent. We speculate that intraoperative MRI brings more infarctions due to the prolonged time of operation (approximately 1 hour more) probably vasospasm may play a role.

CLINICAL RELEVANCE/APPLICATION

Intraoperative MRI evaluation of the resection extent in case of ATL should be carefully considered due to the risk more ischemic complications.

SSJ18-06

CT Perfusion (CTP) Changes in Seizure Patients Presenting with Stroke-like Symptoms: Correlation with Clinical and Electroencephalography (EEG) Findings


PURPOSE
To determine the CTP changes in seizure patients presenting with stroke-like symptoms and its correlation with clinical presentation and EEG results.

METHOD AND MATERIALS

The clinical and imaging records of all patients who presented to our emergency department with stroke-like symptoms and underwent CTP, from 1/2006 to 7/2011, were reviewed. Those patients without stroke (as per follow up imaging) who were clinically diagnosed with seizure were included. In those patients with unilateral hyperemia on CTP scan, relative CBV, CBF, and MTT of the hyperperfused regions were calculated compared to contralateral side.

RESULTS

From 1085 CTP examinations over 5.5 years, 21 patients were included. The average age at the time of presentation was 40 ± 12.2 years; and average time gap between the symptom onset and CTP scan was 2.3 ± 1.4 hours. Of note, 11 (52%) patients had history of prior seizure, and 9 (43%) were on antiepileptic medications at presentation. Unilateral hyperemia was found in 16 (76%) patients (10 in the left cerebral hemisphere); and the remaining 5 patients had symmetric perfusion on CTP. Temporal lobe was involved in 14/16 patients with unilateral hyperemia. Compared to patients with symmetric perfusion, those with unilateral hyperemia had higher rate of contralateral motor deficit and/or aphasia at presentation (12/16 vs 1/5, P=0.047); whereas the common presentation of those patients with symmetric perfusion scan was altered mental status (3/5 vs 1/16, p=0.028). Among those patients with unilateral hyperemia and abnormal EEG (n=13), 4/13 had unilateral fast/spike epileptiform discharge, which was associated with higher relative CBF (2 ± 0.3 vs 1.5 ± 3.7, p=0.034) and lower relative MTT (0.47 ± 0.05 vs 0.93 ± 0.34, p=0.030) compared to patients with diffuse or unilateral slowed EEG waves.

CONCLUSION

Seizure patients presenting with unilateral motor deficit or aphasia commonly have contralateral hyperemia on CTP scan; whereas, those presenting with altered mental status in the absence of lateralized motor deficit commonly have symmetric perfusion study. Moreover, lateralized fast epileptiform discharge on EEG is associated with ipsilateral high relative CBF and low MTT.

CLINICAL RELEVANCE/APPLICATION

The correlation between CTP changes and clinical/EEG findings in seizure patients can potentially be used for diagnosis, prognostication, treatment follow up and therapy guidance in these patients.

SSJ19

Neuroradiology (Neurointerventional Radiology)

Scientific Papers

<table>
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<td>AMA PRA Category 1 Credits ™: 1.00</td>
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Tue, Dec 2 3:00 PM - 4:00 PM   Location: N228

Participants

Moderator
Colin P. Derdeyn MD : Consultant, MicroVention Inc Consultant, Penumbra, Inc Consultant, Silk Road Medical Stock options, Pulse Therapeutics, Inc

Kristine Blackham MD : Nothing to Disclose

Sub-Events

SSJ19-01 Carotid Angioplasty and Stenting: Long-term Outcomes in Radiation Associated Stenosis

Chun Kit Shiu MBBS, FRCR (Presenter): Nothing to Disclose, Joyce Pui Kwan Chan : Nothing to Disclose, Sherman Sheung Ming Lo MBBS, MPH : Nothing to Disclose, Wai Lun Poon MBBS, FRCR : Nothing to Disclose

PURPOSE

This retrospective study aims at comparing the short-term and long-term outcomes of carotid angioplasty and stenting (CAS) between patients suffering from radiation-associated carotid stenosis and those with atherosclerosis-associated stenosis.

METHOD AND MATERIALS

All consecutive patients who underwent CAS in our institution for carotid stenosis between Jan 2008 and Dec 2013 were identified. According to any history of head and neck irradiation, patients were stratified into radiation treatment (XRT) or non-XRT group. All CAS were performed by a dedicated team of neurointerventionists. Standardized post-operative clinical and Doppler ultrasound follow-up were undertaken...
for all patients. Diagnostic angiograms were performed to confirm the restenosis (>70%) detected by Doppler studies. Procedural and clinical records were reviewed and any periprocedural events and long-term recurrent stroke were documented. Univariate and Kaplan-Meier analyses were performed for both groups.

RESULTS

114 CAS procedures were identified. There were 41 patients with 46 CAS in XRT group and 68 patients with 78 CAS in non-XRT group. 15 patients received bilateral CAS. Median follow-up for XRT and non-XRT were 25.6 and 24.8 months. XRT patients were younger (63.5 vs. 73.1 years; p<0.001) and with significantly less vascular risk factors. 37 (90%) XRT patients had irradiation for nasopharyngeal carcinoma. More XRT patients had CCA stenosis (52.1% vs. 6.4%; p<0.001) and significantly longer segment of stenosis. The periprocedural events including stroke, myocardial infarction and mortality did not differ significantly between the two groups but only 1 (2.2%) patient in XRT had stroke compared with 8 (10.3%) in non-XRT. Although there was no statistically significant difference in long-term mortality and ipsilateral stroke between XRT and non-XRT group, likely due to a small sample size, a trend towards better outcomes in XRT group can be observed. Restenosis was significantly more common in XRT compared with non-XRT (p=0.043). Majority of the restenosis were asymptomatic.

CONCLUSION

This study shows the perioperative and long-term outcomes of CAS in radiation-associated stenosis are comparable to that in atherosclerotic stenosis, except for a higher restenosis rate.

CLINICAL RELEVANCE/APPLICATION

CAS in radiation-associated stenosis is probably safe and efficacious and we recommend a more frequent follow-up in these patients due to a higher restenosis rate.
To analyze the incidence and risk factors of microembolic lesions on diffusion-weighted imaging (DWI) after endovascular coiling of unruptured intracranial aneurysms.

METHOD AND MATERIALS

From Jul. 2011 to Jun. 2013, we had 271 consecutive cases (70 men and 201 women, median age of 57 with a range of 23-79) of unruptured aneurysm embolization. Aneurysm location was in the anterior circulation in 226 and posterior circulation in 45. Multiple aneurysms were seen in 37. Maximum diameter of the index aneurysm was 5 mm in median (range: 2.2-21). Procedures were done by simple coiling (n=91), stent assisted (n=105), balloon assisted (n=16), or multiple microcatheters (n=59) using various types of detachment coils. Total number of coils was 5 in median (range, 2-23). Procedure duration ranged from 20 to 235 (median, 61) minutes. Any coil loop herniation was seen in 37. Overt thromboembolic phenomenon which required use of thrombolytics was noted in 5. Intra-procedural rupture occurred in 4. DWI was obtained the following day to see occurrence of any microembolic lesion. 2 independent reviewers were analyzed the presence of any microembolic lesion and counted the lesion number. Multivariate analysis was done to find independent risk factors of microembolism.

RESULTS

Microembolic lesions were noted in 101 (37.3%). The number was less than 5 in 70.3%. Multivariate analysis showed various statistically significant factors which included age (OR: 1.04, p=0.01), diabetes (OR: 3.21, p=0.002), previous history of ischemic stroke (OR: 3.58, p=0.044), white matter FLAIR HSI (OR: 5.48, p=0.001), multiple aneurysms (OR:3.08, p=0.018), and stent-assisted technique with Enterprise stent (OR: 10.7, p<0.001) Previously known risk factors such as prolonged procedure duration, aneurysm size, or decreased antiplatelet function did not show any significant influence.

CONCLUSION

The incidence of DWI high signal lesions after coiling of unruptured aneurysms was not low even though most of them were asymptomatic. It occurred more frequently in patients with vulnerable vascular status. Multiplicity of aneurysm and stent type also influenced its occurrence.

CLINICAL RELEVANCE/APPLICATION

Care should be taken to reduce the incidence of post-procedural microembolic lesions after coiling of unruptured cerebral aneurysms in patients with vulnerable vascular status.

Delayed Complications after Flow-diverter Stenting: Reactive In-stent Stenosis and Creeping Stents

John Moshe Gomori MD (Presenter): Consultant, Medymatch Technology Ltd , Jose Enrique Cohen MD :
Nothing to Disclose

PURPOSE

Assess the frequency and severity of changes in stent configuration and location, and patterns of in-stent stenosis of flow diverter stents.

METHOD AND MATERIALS

: Retrospective review of consecutive data from October 2011 to July 2012 of Silk flow diverter [Balt Extrusion, Montmorency, France] and Pipeline embolization device [ev3/Covidien, Minneapolis, MN, USA]. Routine 2, 6, 9-12, and 16-20 month follow-up angiograms were compared, with a focus on changes between stent configuration and location immediately after deployment and on angiographic follow-up, and the incidence and development of in-stent stenosis.

RESULTS

Thirty-four patients with 42 aneurysms met inclusion criteria. The Silk device was implanted in 16 patients (47%, single device in 15), the Pipeline device in 18 (53%, single device in 16). On first follow-up angiography, in-stent stenosis was observed in 38% of Silk devices and 39% of Pipeline devices. In-stent stenosis was asymptomatic 12/13 patients. One woman presented with transient ischemic attacks and required stent angioplasty due to end tapering and mild, diffuse in-stent stenosis. Configuration and location changes such as stent creeping and end tapering were seen in 2/16 patients (13%) with Silk devices, and 0/18 patients with Pipeline devices. We describe stent creeping and end tapering among the unusual findings with potential for delayed clinical complications.

CONCLUSION

In-stent stenosis, with a unique behavior, is a frequent angiographic finding observed after flow-diverter stent implant. The stenosis is usually asymptomatic; however, close clinical and angiographic monitoring is mandatory for individualized management. Stent creeping and end tapering is more common with Silk devices.

CLINICAL RELEVANCE/APPLICATION

Silk diverter stents are less stable than Pipeline devices. Both devices show instent stenosis and need careful monitoring.
Large and Giant Intracranial Aneurysms Treated with Pipeline Embolization Device — MR-MRA Imaging Primary Findings: A Single Center Experience

SSJ19-05

Carolina Parada MD (Presenter): Nothing to Disclose, Jorge Pablo Chudyk MD: Nothing to Disclose, Hector Eduardo Lambre MD: Nothing to Disclose, Pedro Lylyk MD: Consultant, Medtronic, Inc Consultant, Surpass Medical Ltd Consultant, Cardiatis SA

PURPOSE

Data including long-term follow up imaging using MR-MRA in the evolution of large and giant intracranial aneurysms treated with PED is still missing. We report our experience in the review and analysis of the primary MR-MRA findings on the evolution of these challenging aneurysms after treatment.

METHOD AND MATERIALS

From a total of 570 intracranial aneurysms treated with PED in a period between 2006 and 2013 a total of 92 were included with the following criteria: 1) large and giant intracranial aneurysms treated with PED and 2) MR-MRA follow up. All imaging studies were performed every 6 months the first year, and annually after that, with a 3T magnet (Philips Healthcare, Best, the Netherlands) and included FLAIR, T1, T2, MRA and postgadolinium T1.

RESULTS

76% aneurysms were located in the anterior circulation being 58% supraclinoid and the remaining 24% originated at the posterior circulation with 64% at the basilar trunk. The MRA showed complete occlusion in 66% with most of them occluded in a six month period after treatment, 79% of these from the anterior circulation and 21% from the posterior circulation. The MRA also revealed shrinkage and total regression of the aneurysms in 60% with a dominance of the supraclinoid segment (56%) while 32% remain without changes in size and 8% showed an increase of size with predominance of the anterior circulation (80%). The aneurysms parenchymal environment was examined reporting 79% with no surroundings alterations and 21% with perilesional edema that showed resolution after treatment.

CONCLUSION

MRA absence of signal intensity of the occluded aneurysms after treatment that show postgadolinium T1 enhancement of the sac does not mean permeability of the lumen although could suggest complete endothelialization. The results also support the reliability of the use of PED in the treatment of this challenging aneurysms.

CLINICAL RELEVANCE/APPLICATION

Our data provide good correlation to DSA follow up supporting MR-MRA as an effective non-invasive method which should be considered for initial follow up.

Comparison of Recent Volume of Percutaneous Endovascular Neurointerventions among Radiologists, Neurosurgeons, Neurologists, and Other Physicians: Who is Doing Them?

SSJ19-06

Mougnyan Cox MD (Presenter): Nothing to Disclose, David C. Levin MD: Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC, Laurence Parker PhD: Nothing to Disclose, Vijay Madan Rao MD: Nothing to Disclose

PURPOSE

Historically, cerebral catheter angiography and endovascular neurointerventions (ENI) were developed, refined and practiced by early pioneers in the field of neuroradiology. Recently, rapid developments in the safety and efficacy of ENI have resulted in other physician specialties expressing a strong interest in performing these procedures. Our purpose was to compare trends in performance ENI among the various specialties, as well the overall utilization trends from the years 2000 to 2012.

METHOD AND MATERIALS

Data from the Center for Medicare and Medicaid Services Physician/Supplier Procedure Summary Master Files for 2000 to 2012 were used. The Current Procedural Terminology, 4th edition (CPT) codes for percutaneous neurointerventions were used to obtain the volume of procedures performed in the Medicare fee-for-service population. Using the provider specialty codes, we classified the physicians performing ENI into 6 groups; radiologists, neurosurgeons, neurologists, vascular surgeons, other surgeons, cardiologists and other physicians. The utilization trends for 2000 to 2012 were studied.

RESULTS

Overall, the volume of percutaneous neurointerventions increased from 2439 in 2000 to 7181 in 2012. Radiologists’ volume increased from 1956 in 2000 to 3939 in 2012. Neurosurgery ENI volumes increased from 237 in 2000 to 2377 in 2012. Neurology volumes increased from 1 in 2000 to 664 in 2012. Cardiologists’ volumes went from no ENI procedures performed in 2000 to 31 in 2012. ENI volumes for vascular surgeons increased from 1 in 2000 to 44 in 2012, and the ENI volumes for all other physicians went from 244 in 2000 to 144 in 2012.

CONCLUSION
Radiologists continue to maintain a strong presence in the field of Neurointerventional radiology, performing 55% of the total number of procedures in 2012, down from 80%. However, neurosurgery has made significant inroads into ENI procedures, with their volume increasing from 10% in 2000 to 33% in 2012. The overall volume of ENI continues to rise at a steady pace from 2000 to 2012.

**CLINICAL RELEVANCE/APPLICATION**

Radiologists continue to maintain a strong presence in the field of neurointerventional radiology, performing the majority (55%) of percutaneous neurointerventions.

## RC405

**Traumatic Brain Injury**

*Refresher/Informatics*

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AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

**Participants**

**Moderator**

**Sub-Events**

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<tr>
<th><strong>RC405A</strong></th>
<th><strong>CT and MR Imaging in Head Trauma</strong></th>
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<tr>
<td><strong>Presenter</strong></td>
<td>Joshua S. Shimony MD, PhD</td>
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**LEARNING OBJECTIVES**

1) To assess patients with acute head trauma through the use of a standardized imaging pattern analysis approach. 2) To become familiar with the different types of traumatic brain injury and their imaging patterns. 3) To learn about the imaging characteristics of various types of intracranial haemorrhage by CT and MR. 4) To identify quantitative imaging parameters that can serve as (surrogate) biomarkers for predicting patient prognosis and outcome.

**ABSTRACT**

CT and MRI examinations constitute an essential part of the diagnostic work-up of patients with head trauma. In the acute setting, imaging findings determine patient management and greatly influence the clinical course. CT remains the first choice technique to determine the presence and extent of injuries, and to guide surgical planning. Multi-detector CT allows simultaneous assessment of head and cervical spine, obviating the need for plain X-rays. A standardized pattern analysis approach will be presented, to obtain a complete inventory of the traumatic brain lesions. From a clinical point of view, it is important to understand the difference between primary and secondary lesions. Primary injuries occur as a direct result of the impact with damage to brain tissue. Examples include fractures, different types of traumatic haemorrhage (epidural, subdural, intracerebral, subarachnoid), cerebral contusion, diffuse axonal injury (DAI). CT-angiography is useful to document traumatic blood vessel injury. Secondary injuries are caused by systemic factors such as increased intracranial pressure, edema, brain herniation, decreased cerebral blood flow, excitotoxic damage. These lesions can be documented with multiparametric MRI including diffusion, perfusion, and susceptibility-weighted imaging. Whenever there is a discrepancy between the patient's clinical status and imaging findings, MRI is indicated. Diffusion tensor imaging with fractional anisotropy mapping may show microstructural abnormalities in patients with mild TBI, even when traditional MRI sequences appear normal. Neuroimaging also plays a role in the chronic stage, identifying sequelae, determining prognosis, and guiding rehabilitation. In conclusion, recent technological advances in CT and MRI have greatly improved our understanding of the pathophysiology of cranio-cerebral trauma and allow us to detect abnormalities, even in patients with mild head trauma, when routine imaging studies appear normal.

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<tr>
<th><strong>RC405B</strong></th>
<th><strong>The Changing Context of Imaging After Head Injury</strong></th>
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<tr>
<td><strong>Presenter</strong></td>
<td>Michael N. Brant-Zawadzki MD</td>
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**LEARNING OBJECTIVES**

1) The audience will understand the challenges in understanding the concept of minimally traumatic brain injury.

<table>
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<tr>
<th><strong>RC405C</strong></th>
<th><strong>Advanced Imaging Techniques in Traumatic Brain Injury</strong></th>
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<tr>
<td><strong>Presenter</strong></td>
<td>Pratik Mukherjee MD, PhD</td>
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<td><strong>Research Grant, General Electric Company Medical Advisory Board, General Electric Company</strong></td>
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LEARNING OBJECTIVES

1) To understand the potential of advanced MRI techniques such as diffusion tensor imaging (DTI) and resting state functional MRI (rs-fMRI) and of magnetoencephalography (MEG) for better diagnosis in mild traumatic brain injury (TBI). 2) To review the current best practices for imaging of concussions and the findings of recent imaging research studies. 3) To provide an overview of ongoing multicenter research studies for validation of advanced MRI and MEG for TBI.

RC406

Temporal Bone Imaging

Refresher/Informatics

AMAPRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Tue, Dec 2 4:30 PM - 6:00 PM Location: S406B

ABSTRACT

The temporal bone is a small but anatomically complex region for which the acquisition of a basic knowledge of anatomy represents a significant achievement. Review of temporal bone imaging studies requires a highly structured and systematic approach, in order to prevent missing important but often subtle imaging findings. Additionally, good imaging technique is critical, and time spent optimizing protocols will yield substantial dividends. Currently, one should interpret studies with submillimeter acquisition and reconstruction thicknesses, with the right and left sides reconstructed separately at small field of views. A minimum of axial and coronal planes should be reviewed; many additionally interpret sagittal images, with oblique planes available to aid in specific diagnostic issues, such as superior semicircular canal dehiscence. Inflammatory disease of the temporal bone can be broadly divided into acute and chronic processes; these differ not only in duration of disease, but most importantly, in etiology. Acute otitis media represents an infection that typically ascends from the upper respiratory tract and is most common in children. Chronic otomastoiditis is a result of Eustachian tube dysfunction and is typically not associated with infection. Both are imaged primarily to look for complications, as the primary diagnosis is made clinically. A wide variety of tumors affect the temporal bone, including those found elsewhere intracranially and at the skull base, including meningioma, schwannoma and paraganglioma. The skin of the external auditory canal is susceptible to those lesions that may affect skin anywhere, including squamous and basal cell carcinomas, as well as melanoma. Other tumors, such as metastases, myeloma and lymphoma, are primary to the osseous components of the temporal bone and are most commonly found at the petrous apex.

Sub-Events

RC406A  Temporal Bone Imaging: Anatomy

Tabassum A. Kennedy MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Analyze the temporal bone using a systematic approach. 2) Identify the main structures of the temporal bone based on anatomic location within the external ear, middle ear and inner ear.

RC406B  Temporal Bone Imaging: Inflammation

Deborah Rachelle Shatzkes MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize CT and MRI imaging anatomy of the temporal bone most salient to temporal bone disease. 2) To apply an understanding of the etiologic differences between acute and chronic inflammatory disease of the temporal bone to the interpretation of relevant imaging studies. 3) To analyze CT and MRI imaging features and construct a limited and clinically relevant differential diagnosis for temporal bone masses.

Active Handout


RC406C  Temporal Bone Imaging: Tumor

Karen Lisa Salzman MD (Presenter): Consultant, Amirsys, Inc Stockholder, Amirsys, Inc

LEARNING OBJECTIVES

1) Review the benign and malignant tumors of the temporal bone. 2) Understand the key imaging features of each tumor in order to differentiate the lesions in clinical practice.
Blood on the Brain: Intracranial Hemorrhage in the Emergency Setting (An Interactive Session)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 4:30 PM - 6:00 PM Location: E353C

Sub-Events

RC408A  Traumatic Intracranial Hemorrhage
Wayne Scott Kubal MD (Presenter):  Stockholder, Stryker Corporation Research Grant, Guerbet SA

LEARNING OBJECTIVES

1) Understand how pathophysiology and anatomy determine the imaging appearance of traumatic intracranial hemorrhage. 2) Critically assess which imaging options offer the greatest sensitivity for diagnosing traumatic intracranial hemorrhage. 3) Be conversant with some of the new techniques for studying traumatic intracranial hemorrhage.

RC408B  Non-traumatic Subarachnoid Hemorrhage
Diego B. Nunez MD, MPH (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Analyze the various causes, patterns of distribution and imaging features of non-traumatic subarachnoid hemorrhage. 2) Identify common and not so common diagnostic pitfalls encountered in the initial CT assessment of the patient with suspected subarachnoid hemorrhage. 3) Recognize the contribution of additional imaging (CT angiography, MR, DSA) as integral part of the admitting evaluation of patients with subarachnoid hemorrhage.

RC408C  Non-traumatic Intraparenchymal Hemorrhage
Peter George Kranz MD (Presenter):  Research Consultant, Cephalogics, LLC Research Consultant, Biogen Idec Inc

LEARNING OBJECTIVES

1) Identify the major causes for non-traumatic (spontaneous) brain parenchymal hemorrhage. 2) Understand the role of the primary survey in indentifying the most important imaging features needed for the acute management of hemorrhages. 3) Understand the contribution on non-contrast CT, CTA, and MRI in the management of spontaneous hemorrhage, including the contribution these modalities make to defining the etiology of hemorrhages.

RC452  Nerve Ultrasound Based on a Regional Approach: Shoulder and Neck (Hands-on Workshop)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 4:30 PM - 6:00 PM Location: E264

Participants

Carlo Martinoli MD (Presenter):  Nothing to Disclose
J. Antonio Bouffard MD (Presenter):  Nothing to Disclose
Catherine J. Brandon MD (Presenter):  Stock options, VuCOMP, Inc
Etienne Cardinal MD (Presenter):  Nothing to Disclose
Mary Margaret Chiavaras MD, PhD (Presenter):  Nothing to Disclose
Joseph Gerard Craig MD (Presenter):  Nothing to Disclose
Michael A. Dipietro MD (Presenter):  Nothing to Disclose
David Paul Fessell MD (Presenter):  Nothing to Disclose
Ghiyath Habra MD (Presenter):  Nothing to Disclose
Andrea Klauser MD (Presenter):  Nothing to Disclose
Rachel Beth Hulen MD (Presenter):  Nothing to Disclose
Marina Kislyakova MD (Presenter):  Nothing to Disclose
LEARNING OBJECTIVES

1) Describe the ultrasound anatomy and scanning technique for examination of neck (i.e. brachial plexus, spinal accessory, long thoracic, phrenic, vagus) and shoulder (i.e. suprascapular, axillary, musculocutaneous) nerves. 2) Illustrate the main anatomic landmarks to identify these nerves. 3) Master technical approaches to nerve ultrasound including the recognition of pitfalls.

ABSTRACT

In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound with a special focus on the examination of small (<1mm thick) and difficult-to-study nerves. The standardized techniques of performing an adequate ultrasound study of the axillary nerve in the shoulder, the musculocutaneous nerve in the arm and the anterior interosseous nerve in the proximal forearm will be illustrated. Similarly, the examination technique to image the lateral femoral cutaneous nerve in the inguinal area and the saphenous nerve throughout the lower extremity will be described. The hands-on workshops will provide the opportunity to interactively discuss the role of ultrasound in this field with expert instructors. Participants will be encouraged to directly scan model patients. A careful ultrasound approach with thorough understanding of soft-tissue planes and extensive familiarity with anatomy are prerequisites for obtaining reliable information regarding the affected structure and the site and nature of the disease process affecting it.

SPDL41

RSNA Diagnosis Live™: Body, Cardiac, MSK, Neuro, ENT Potpourri

Special Courses

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 0

Wed, Dec 3 7:15 AM - 8:15 AM   Location: E451B

Participants

Adam Eugene  Flanders  MD (Presenter):  Nothing to Disclose
Sandeep Prakash  Deshmukh  MD (Presenter):  Nothing to Disclose
Christopher Geordie  Roth  MD (Presenter):  Author, Reed Elsevier

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

SPSC41

Controversy Session: DTI in Head Injury: Crossing Borders, Clinical Applications, and Legal Ramifications

Special Courses

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 1.00

Wed, Dec 3 7:15 AM - 8:15 AM   Location: N228

Participants

Moderator
Gordon K.  Sze  MD :  Investigator, Remedy Pharmaceuticals, Inc

Sub-Events

SPSC41A  DTI in the Courtroom: Pro
Michael L.  Lipton  MD, PhD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

This presentation will discuss dMRI assessment the legal context, to illustrate the potential and limitations of dMRI, as well as other imaging approaches. The basis and limitation of dMRI will be discussed in the context of the legal standard of evidence.

SPSC41B  DTI in the Courtroom: Con
LEARNING OBJECTIVES

1) Identify the diffusion tensor imaging (DTI) correlates of traumatic brain injury (TBI). 2) Explain the challenges of applying DTI to the diagnosis of TBI. 3) Summarize the current state of clinical research in DTI of TBI, including the advent of large multi-center trials.

SPSC44
Controversy Session: Vertebroplasty: Science or Séance?

Special Courses

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Wed, Dec 3 7:15 AM - 8:15 AM   Location: S405AB

Participants

Moderator
Peter George Kranz MD : Research Consultant, Cephalogics, LLC Research Consultant, Biogen Idec Inc

David F. Kallmes MD (Presenter): Research support, Terumo Corporation Research support, Covidien AG Research support, Sequent Medical, Inc Research support, Benvenue Medical, Inc Consultant, General Electric Company Consultant, Covidien AG Consultant, Johnson & Johnson

A. Orlando Ortiz MD, MBA (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the effectiveness of vertebral augmentation in patients with painful osteoporotic vertebral compression fractures. 2) To review the literature and update attendees with an analysis thereof. 3) To discuss the impact of published clinical trials on the practice of vertebral augmentation. 3) To discuss whether patient selection may impact success vertebral augmentation procedures.

MSRO41
BOOST: CNS—Oncology Anatomy—MR and PET Imaging Brain Tumors: Practical Primer for the Radiologist and Radiation Oncologist (An Interactive Session)

Multisession Courses

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Wed, Dec 3 8:30 AM - 10:00 AM   Location: S103CD

Participants

Whitney B. Pope MD, PhD (Presenter): Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Amgen Inc Research Consultant, Tocagen Inc Consultant, Celldex Therapeutics, Inc Consultant, Guerbet SA

Christina I. Tsien MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the limitations of conventional MRI in assessing intracranial masses. 2) Define the importance of non-enhancing tumor, edema, and necrosis, in interpreting neuro-oncologic imaging. 3) Discuss the role of advanced MR and PET imaging in the diagnosis, treatment planning and response assessment of CNS tumors.

ABSTRACT

Abstract Advanced MR imaging and PET imaging in brain tumors provide important information regarding individual tumor biology and pathophysiology beyond anatomical information. This session provides an important practical primer on neuro-imaging in the diagnosis and response assessment of brain tumors that will be of value to both radiologists and radiation oncologists. This session will highlight the role of conventional and advanced MRI/PET imaging in the diagnosis, treatment planning and response assessment in CNS tumors.

MSSR41
RSNA/ESR Emergency Symposium: General Principles, Pediatric and ENT Emergencies (An Interactive Session)

Multisession Courses

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Wed, Dec 3 8:30 AM - 10:00 AM   Location: S402AB
Sub-Events

MSSR41A General Principles
Ulrich Linsenmaler MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate general principles of diagnostic imaging in Emergency Radiology in traumatic and non-traumatic emergencies. 2) Analyze etiology, background and management of common radiological emergencies. 3) Identify the role, indications and protocols for US, CR, MDCT in modern emergency radiology.

MSSR41B Challenges of Imaging Pediatric Abdominal Emergencies
Susan D. John MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the variations of pathology that cause abdominal pain and vomiting in infants and children. 2) Plan safe and effective imaging protocols using US, CT, and MRI. 3) Recognize pitfalls in the diagnosis of pediatric abdominal emergencies with imaging.

MSSR41C Imaging in ENT Emergencies
Diego B. Nunez MD, MPH (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Analyze imaging findings in patients presenting with acute head and neck conditions using a systematic spatial approach. 2) Demonstrate understanding of the role and indications of CT and MR in acute non-traumatic ENT case management. 3) Identify the extent of disease and recognize specific complications of cervicofacial infections.

RC506 SCC of the Upper ADT: A Primer

LEARNING OBJECTIVES

1) Review the anatomy and imaging findings of the various subsites of the upper aerodigestive tract. 2) Describe the spread patterns of squamous cell carcinoma of the upper aerodigestive tract. 3) Review the important information that should be included in the radiology reports that affect treatment and staging.

ABSTRACT

The presentation will be focused on squamous cell carcinoma of the upper aerodigestive tract. The lecture will review the anatomy and imaging findings of the various subsites of the upper aerodigestive tract and describe the spread patterns of squamous cell carcinoma and how this affects staging. The lectures will also review the important information that should be included in the radiology reports that affect treatment and management.

RC506A The ADT Primaries
Suresh K. Mukherji MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the anatomy and imaging findings of the various subsites of the upper aerodigestive tract. 2) Describe the spread patterns of squamous cell carcinoma of the upper aerodigestive tract. 3) Review the important information that should be included in the radiology reports that affect treatment and staging.

RC506B The Cervical Lymph Nodes
Peter M. Som MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) The difference between nodal staging and nodal classification in the neck. 2) The criteria for assessing a pathologic neck lymph node. 3) The impact on survival of metastatic nodes and what they mean to treatment plans. 4) The varied appearances of metastatic papillary thyroid cancer nodes.
ABSTRACT

This course will discuss why cervical metastatic nodes are so important in determining treatments for head and neck cancer patients. The course will also discuss the anatomic locations of the cervical lymph nodes and the differences between nodal staging and nodal classification and when each of these systems should be used. Criteria for assessing when a node is metastatic will also be presented. The use of PET/CT will be discussed as it pertains to metastatic cervical adenopathy.

RC506C  
Post-treatment Imaging  
Lawrence E. Ginsberg MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the techniques, timing and strategies for imaging the patient who has been treated for upper aerodigestive tract malignancy. 2) To explore the imaging findings that would be expected after successful therapy, and to differentiate these from tumor recurrence. 3) To review the typical complications of radiation therapy in the head and neck, and their imaging findings.

VSNR41

Neuroradiology Series: Stroke

LEARNING OBJECTIVES

1) Provide a brief review of CNS vasculopathies highlighting the key diagnostic features. 2) Review pertinent differential diagnoses of neuroimaging cases. 3) Provide important imaging pearls for differentiating CNS vasculopathies.

ABSTRACT

A review of CNS vasculopathies highlighting the key diagnostic features will be provided. The pertinent differential diagnoses of neuroimaging cases will be reviewed. Important imaging pearls for differentiating CNS vasculopathies will be provided.

VSNR41-02  
The Value of High-Resolution T2-Weighted Vessel Wall MR Imaging for the Differentiation of Intracranial Vasculopathies

Mahmud Mossa-Basha MD (Presenter): Nothing to Disclose, William D. Hwang MD: Nothing to Disclose, Tom Hatsukami: Research Grant, Koninklijke Philips NV, Adam de Havenon MD: Nothing to Disclose, David Tirschwell MD, MSc: Nothing to Disclose, Yoshimi Anzai MD: Nothing to Disclose, Niranjan Balu PhD: Nothing to Disclose, Daniel S. Hippe MS: Research Grant, Koninklijke Philips NV Research Grant, General Electric Company, Chun Yuan PhD: Research Grant, Koninklijke Philips NV Consultant, Bristol-Myers Squibb Company Consultant, Koninklijke Philips NV

PURPOSE

To assess the contribution of high-resolution T2-weighted vessel wall MR (VWI) sequences for differential diagnosis of intracranial vasculopathies.

METHOD AND MATERIALS

Consecutive patients with intracranial arterial stenosis who had undergone 3T high-resolution MR VWI were retrospectively selected. 2D T2-weighted sequences (.4 x .4 mm in-plane resolution, 1 mm thick slices) were scanned and assessed in both axial plane and a plane perpendicular to the artery lumen. Relative vessel wall thickness, eccentricity of disease and signal characteristics were assessed in areas of arterial stenosis or irregularity as seen on luminal imaging by a double blinded rater. Classification of patients was based on the
following clinical and imaging criteria: atherosclerosis (>2 atherosclerosis risk factors without evidence of systemic or CSF inflammation or clinical evidence of vasospastic process/reversibility), vasculitis (clinical evidence of CSF infection/inflammation and/or systemic inflammatory disease without atherosclerosis risk factors or clinical evidence of vasospastic process) and reversible cerebral vasoconstriction syndrome (RCVS) (classic clinical presentation, with reversibility of the imaging findings and no evidence of systemic or CNS inflammatory disease).

RESULTS

There were 21 atherosclerosis cases with 45 plaques, 4 vasculitis cases (VZV, PACNS, TB and Behcet vasculitis) with 14 stenoses and 4 RCVS cases with 19 stenoses that could adequately be assessed on T2-weighted VWI. A linear T2 hyperintense band along the intimal surface (presumed to represent fibrous cap) was seen in 36/45 atherosclerotic, 0/14 vasculitic and 0/19 RCVS lesions. All of the atherosclerotic lesions showed appreciable wall thickening, as compared to 11/14 vasculitis and 4/19 RCVS lesions. 42/45 atherosclerotic plaques, 2/14 vasculitis and 2/19 RCVS lesions showed eccentric wall thickening.

CONCLUSION

High resolution T2-weighted VWI can complement T1 and PD pre and post-contrast VWI for the differentiation of intracranial stenosing vasculopathy, based on disease eccentricity, presence of a T2 hyperintense intimal band and appreciable wall thickening.

CLINICAL RELEVANCE/APPLICATION

High-resolution T2 VWI should be incorporated into intracranial VWI protocols, as this technique can provide complementary information to T1 and PD-weighted techniques.

VSNR41-03 Whole Brain 3D-T1w-Black-Blood 3T-MRI for the Diagnosis of Intracranial CNS Vasculitis and Horton’s Disease: A Pilot Study

Nora Navina Kammer MD (Presenter): Nothing to Disclose, Eva Maria Coppenrath MD: Nothing to Disclose, Karla Maria Treitl MD: Nothing to Disclose, Hendrik Kooijman: Employee, Koninklijke Philips NV, Maximilian F. Reiser MD: Nothing to Disclose, Tobias Saam MD: Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG

PURPOSE

2D-T1w black-blood sequences are used in atherosclerotic plaque imaging and for the assessment of inflammatory changes of intracranial vessels. However, sequences are limited due to long acquisition times which limits the number of acquired slices and thus the coverage (coverage often 3 cm or less). Aim of the study was to evaluate a commercially not available gadolinium-enhanced isotropic 3D-whole-brain-black-blood T1w-VISTA sequence with variable flip angles (T1w-VISTA) for the diagnosis of intra- and extracranial vasculitis.

METHOD AND MATERIALS

We prospectively included 26 patients with suspected vasculitis, 3 patients with Sickle-cell disease and 15 tumor patients without any evidence of vascular disease. All patients received a standardized protocol (T1w pre- and post contrast, TOF, DIF, T2, FLAIR) and a T1w 3D-BB-VISTA sequence pre- and post contrast (resolution=0.8 mm3 isotropic, scan time 4:43 minutes). Left and right arteries of the anterior and posterior circulation (176 segments) and right/left temporal artery (88 segments) were evaluated for the presence of stenosis, wall thickening (eccentric/concentric) and contrast enhancement of the vessel wall (3-point Likert scale).

RESULTS

6 out of 104 arterial segments in patients with suspected intracranial vasculitis (3x right/1x left middle cerebral artery, 1x right and left vertebral artery) and 6 out of 88 temporal arteries showed focal circumferential, concentric wall thickening, luminal narrowing and strong contrast enhancement. These findings were found in 8 distinct patients in which vasculitis was clinically confirmed. One patient with sickle-cell disease presented with a stenosis and concentric wall thickening without contrast enhancement. None of the 60 arterial segments of the tumor patients showed vasculitis like lesions but 6 segments (distal vertebral artery) showed an eccentric wall thickening and none to moderate contrast enhancement due to atherosclerotic plaques.

CONCLUSION

Whole-brain-black-blood MRI is feasible in less than 5 minutes scan time and allows to accurately diagnosing CNS vasculitis and Horton’s disease. Future studies will be necessary to evaluate the utility of this sequence for other vascular pathologies, such as arterial dissection and atherosclerosis.

CLINICAL RELEVANCE/APPLICATION

Whole-brain-black-blood MRI is a relevant additional tool for diagnosing and monitoring cranial vasculitis.

VSNR41-04 Identification of an Impaired Cerebrovascular Reactivity by Use of Arterial Spin Labeling in Patients with Moyamoya Disease

Tae Jin Yun MD (Presenter): Nothing to Disclose, Jin Chul Paeng: Nothing to Disclose, Chul-Ho Sohn MD: Nothing to Disclose, Beom Su Kim MD: Nothing to Disclose, Seung Hong Choi MD, PhD: Nothing to Disclose, Ji-hoon Kim MD: Nothing to Disclose

PURPOSE

We aimed to assess the ability of arterial spin labeling (ASL) to identify an impaired cerebrovascular reactivity (CVR) relative to single photon emission computed tomography (SPECT) in patients with moyamoya disease (MMD).
METHOD AND MATERIALS
The institutional review board of our hospital approved this prospective study and written informed consent was obtained from all patients. We conducted a prospective study to determine the ability of ASL to identify CVR relative to SPECT in 78 subjects with MMD. Among these patients, 31 patients performed unilateral direct arterial anastomosis, and in these patients, follow up ASL perfusion MR and SPECT were performed additionally (for ASL, 1 weeks, 3 months, and 6 months after operation; for SPECT, 6 months after operation). Volumes of interests based on internal carotid artery territories were applied to the cerebral blood flow maps from the basal stress ASL and SPECT. And, the concordance between the CVR indexes (CVRIs) from ASL and SPECT was assessed using Bland-Altman analysis, and the area under the receiver-operating characteristic curve (AUC) was used to evaluate diagnostic accuracy of ASL relative to that of SPECT using various CVRI cutoff points.

RESULTS
The CVRI from ASL had a negative bias as compared to the CVRI from SPECT (systemic bias, -3.5%). In addition, the differences between the CVRI from ASL and SPECT tended to be larger when the CVRI is more impaired. The analysis of the diagnostic accuracy of ASL for detecting the impaired CVR revealed an AUC of 0.81 with a sensitivity of 81%, a specificity of 100%, a positive predictive value of 100%, and a negative predictive value of 12%. ASL performed in 6 months after anastomosis showed significant increase in CVRI than that performed preoperatively as well as SPECT (for ASL, -2.7 ± 7.3 and -11.2 ± 9.3, P < 0.001; for SPECT, -3.7 ± 2.9 and -6.2 ± 5.2, P = 0.013, respectively).

CONCLUSION
ASL can identify impaired CVR with excellent performance in patients with MMD and has the potential to serve as a non-invasive imaging tool for determining CVR in patients with cerebrovascular disease.

CLINICAL RELEVANCE/APPLICATION
1. ASL can identify impaired CVR with excellent performance in patients with MMD
2. ASL has the potential to serve as a non-invasive imaging tool for determining CVR in patients with cerebrovascular disease.

Assessing the Hemodynamic Insufficiency Model of Stroke Risk in Children with Sickle Cell Disease Using MR-based Measures of Cerebrovascular Reactivity
Przemyslaw Kosinski BS (Presenter): Nothing to Disclose, Jackie Leung: Nothing to Disclose, Manohar Meghraj Shroff MD: Nothing to Disclose, Suzan Williams: Nothing to Disclose, Gabrielle deVeber: Nothing to Disclose, Andrea Kassner PhD: Nothing to Disclose

PURPOSE
The most devastating complication of sickle cell disease (SCD) is overt stroke, which occurs in more than 10% of children. Patients with cerebral blood flow velocities (CBFv) >200cm/s on Transcranial Doppler (TCD) are at highest risk of stroke. There are two models that explain how increased CBFv in SCD increases risk of stroke: the vasculopathy-stenosis and the hemodynamic insufficiency (HI) models. The stenosis model was originally used to attribute stroke onset to high CBFv. However, in the STOP trial, 79% of children with SCD had minor/no stenosis. This favours the HI model, which postulates that cerebral vessels have only a finite capacity to dilate, which is compromised in SCD due to chronic anemia. As a result it poises the cerebral vasculature for ischemia and subsequent stroke. The aim of the study was to investigate the HI model in children with SCD by quantifying the capacity of vasodilation using an MR- based cerebrovascular reactivity (CVR) defined as a change in cerebral blood flow (CBF) in response to a vasoactive stimulus. We hypothesize that CVR is reduced and correlates with the degree of anemia.

METHOD AND MATERIALS
30 SCD patients (10-18 years) were imaged on a clinical MRI system. A hypercapnic challenge (CO2) was administered in synchrony with a blood-oxygen-level dependent (BOLD) MRI to measure relative CBF changes. Anatomical images were also acquired and reviewed by a radiologist to exclude with significant stenosis, large white matter lesions or vascular abnormalities. CVR maps were generated by correlating the BOLD MRI signal change with the corresponding CO2 values. Mean CVR values were then calculated based on gray and white matter segmentation. Hct values were obtained from hematology records. Pearson correlation coefficients were calculated for CVR and hct as well as CVR and CBF.

RESULTS
CVR demonstrated a moderately strong correlation with hct, r=0.68 (p=0.01). The correlation between CVR and gray matter CBF was moderately strong, r=-0.63 (p=0.021).

CONCLUSION
Our results show that CVR is associated with the degree of anemia in children with SCD who do not have a stenosis. This seems to support the HI model of stroke risk in this population.

CLINICAL RELEVANCE/APPLICATION
The degree of anemia needs to be considered when assessing stroke risk in SCD. CVR seems to be superior to TCD measures of high CBFv, as CVR can fully describe the status of the cerebral vasculature.
LEARNING OBJECTIVES

1) Understand how to protocol imaging studies for a child with new onset of localized neurologic impairment and, in particular, when ultrasound or CT may be useful as opposed to performing MRI as the initial procedure. 2) Recognize which studies and, in particular, what sequences should be performed on MRI and in what order. 3) Understand the causes of pediatric stroke, which are different from those in adult stroke. 4) The stroke is easy to identify; to find the cause of the stroke is not easy in children, but will be easier after attending this session.

ABSTRACT

Localized stroke is an important cause of morbidity and mortality in childhood and one of the top ten causes of childhood death. Approximately 25% of all pediatric strokes occur in neonates and approximately 50% occur in children less than 1 year of age. Despite these numbers, the misconception remains that stroke is a rare and relatively unimportant illness in childhood. Fortunately, the medical community has recently become more aware of this entity and its importance in pediatric health. Presenting signs and symptoms depend upon the region of brain affected and the age of the patient at the time of the infarct. Perinatal/prenatal stroke is much more common than generally recognized, with a prevalence of 1 in 2300-5000 live births. Patients may present with neonatal encephalopathy or seizures or may remain undetected until early stage preference is manifested. In older children, presentation is one of abrupt onset of seizure or neurological deficit. Once a stroke is suspected, clinically or by imaging, it is imperative to determine whether hemorrhage is present in order to determine whether anticoagulation is in order. Vascular imaging is essential and in either case should be obtained with high resolution, as dissections and post-infectious vasculopathy can be extremely subtle and both require anticoagulation. If the stroke is hemorrhagic and if there are regions of increased diffusivity, venography should be obtained. If vasculopathy is suspected because of location of the infarct or history of recent illness, we obtain vascular wall imaging with 1mm partition size after administration of contrast to look for irregularity or enhancement of the arterial wall; the latter seems to be associated with inflammation. If dissection is identified in the vertebral artery at the upper cervical level, careful attention should be paid to anomalies of the upper cervical vertebrae that may stretch or damage the vessel with abrupt head motion, usually secondary to trauma.

LEARNING OBJECTIVES

1) Understand the concept of the diffusion-perfusion (DWI-PWI) mismatch concept in acute stroke. 2) Review the recent results of stroke trials using the DWI-PWI concept. 3) Appreciate the potential role of other markers, such as collateral flow, oxygenation, pH, and resting-state fMRI for assessing the ischemic brain.

METHOD AND MATERIALS

IMS-III protocol is published. Two readers assessed clot characteristics on NCCT [hyperdense(HD) sign location, length, ratio of maximal Hounsfield Unit (HU) HDS/contralateral MCA (rHU)] and CTA [Clot burden score, length, residual flow through clot, ratio of contrast HU at proximal/distal clot interface (c(rHU))] by consensus. Very early arterial weighted CTAs were excluded; appropriate imputation techniques used whenever distal clot interface was not measured. Early recanalization with IV-tPA was assessed on first angio (only in the endovascular arm) while 24-hour recanalization with IV-tPA was assessed on follow-up CTA (only in the IV-tPA alone arm).

RESULTS

Of 263 patients with anterior circulation clots on baseline CTA, after excluding patients with missing data, 64 in the IV-tPA and 175 in the endovascular arm were analyzed. CART models for early and 24-hr recanalization with IV-tPA are shown in Figures 1 and 2 respectively.

CONCLUSION

Clot Characteristics on Baseline Imaging Predicts Recanalization with IV tPA in the IMS III Trial

Clot characteristics on NCCT and CTA can help physicians estimate a range of early and late recanalization rates with IV-tPA.

**CLINICAL RELEVANCE/APPLICATION**

Clot characteristics on both NCCT and CTA can help determine the efficacy of tPA and should be considered when deciding to treat patients with tPA over endovascular.

### VSNR41-09 Predictors of Reperfusion in Acute Ischemic Stroke Patients

**Purpose**

Acute ischemic stroke studies emphasize a difference between reperfusion and recanalization but predictors of reperfusion have not been elucidated. This study aims to identify predictors of reperfusion and to investigate the relation between recanalization and reperfusion.

**Method and Materials**

From the XXX trial 178 patients were selected with a middle cerebral artery territory perfusion deficit on admission CT perfusion (CTP) and complete day 3 follow-up CTP and CT-angiography (CTA). Reperfusion and recanalization were evaluated on the follow-up imaging. The association between reperfusion and recanalization was calculated using absolute and relative risks. Patient admission and treatment characteristics as well as admission CT imaging parameters regarding occlusion site and stroke severity were collected. Their association with complete reperfusion was analyzed using logistic regression.

**Results**

Absolute risk for complete reperfusion was 0.60 in the complete recanalization group and 0.23 in the incomplete recanalization group, with a relative risk of 2.60 (CI 1.63-4.13), but around 40% showed a discrepancy between recanalization and reperfusion status. Lower clot burden (OR 1.35, CI 1.14-1.58), more distal thrombus location (OR 2.28, CI 1.18-4.39) and good collateral score (OR 2.84, CI 1.34-6.02) increased the odds of complete reperfusion whilst higher NIHSS score (OR 0.95, CI 0.90-1.00), larger infarct core size (OR 0.32, CI 0.15-0.69) and larger total ischemic area (OR 0.31, CI 0.15-0.67 for 2001-5000 mm2 and OR 0.16, CI 0.07-0.37 for >5000 mm2) decreased the odds of complete reperfusion. None of the patients with ipsilateral intracranial ICA occlusion showed complete reperfusion.

**Conclusion**

Recanalization and reperfusion are strongly related but not always equivalent in acute ischemic stroke. Lower clot burden, distal thrombus location, collateral score, NIHSS score, infarct core size and total ischemic area are predictors of reperfusion.

**Clinical Relevance/Application**

Lower clot burden, distal thrombus location, collateral score, NIHSS score, infarct core size and total ischemic area are predictors of reperfusion and can be used to aid treatment decisions in acute ischemic stroke patients.

### VSNR41-10 How Can We Make Stroke Imaging Better around the World? Global Survey of Radiologists in 18 Countries

**Purpose**

Stroke poses a major health challenge in today's world. "Time is Brain" in stroke and every minute counts in stroke management. To what extent are we able to provide timely imaging to these patients globally and if not what can be done? Our aim was to survey radiologists across developing countries in Asia, Europe and South America to assess the stroke care and find out what in their opinion are the most effective ways to improvise imaging and management.

**Method and Materials**

A standardized questionnaire containing 18 questions was sent to radiologists in 20 developing countries across the world. Radiologists from 18 countries responded (response rate=90%). These include Kenya, Algeria, Rwanda, Sri Lanka, Malaysia, Costa Rica, Macedonia, Bulgaria, Mexico, China, India, Uruguay, Burma and Venezuela among others.

**Results**

Survey results indicated that most of the countries (72%), lack access to CT scanners. Intravenous tissue plasminogen activator (tPA) is the standard of care of ischemic stroke and cannot be given unless hemorrhage is excluded on CT. Also, this can only be administered for a specific time window after symptom onset. To maximize patients who can benefit from thrombolysis, the key is to have a short Emergency Room Door to CT scan time. Unfortunately, Door to CT scanner time is more than 30 minutes in 83% (95% CI being...
80.5-85.4%). Moreover, 77% of the countries had shortage of the drug tPA. Overall, radiologists rated their knowledge as "average" in reading stroke imaging and 77% (95% CI being 74.5-79%) believed that further training would be helpful. Minority had access to Neurointerventionalists (33%) and Telestroke services (27%). When questioned about the three most powerful ways to improve stroke imaging in their respective countries, the highest rated choices were: training programs on stroke imaging to improve knowledge among radiologists, campaigns to increase awareness in the community and improving access to CT.

CONCLUSION
This survey helps radiologists around the world communicate the imaging needs in stroke in their respective countries and how can they be met. This can help radiologists who want to reach out in their humanitarian efforts to improve imaging around the world.

CLINICAL RELEVANCE/APPLICATION
Global outreach programs can use this survey to determine more effective ways of improving stroke imaging and care in developing countries.

VSNR41-11 The Prediction of Prognosis Using ADC Volume in Endovascular Revascularization Therapy for Acute Ischemic Stroke

Miran Han MD (Presenter): Nothing to Disclose, Jin Wook Choi MD: Nothing to Disclose, Sun Yong Kim MD: Nothing to Disclose, Jin Soo Lee: Nothing to Disclose, Young Keun Sur MD: Nothing to Disclose, Seon Young Park MD: Nothing to Disclose

PURPOSE
The recent shift of endovascular treatment (ET) methods for acute ischemic stroke towards better outcome. We hypothesized that bigger core volume may be tolerable to further ET. This study was retrospectively designed to predict the prognosis using ADC volume in endovascular revascularization therapy for acute ischemic stroke.

METHOD AND MATERIALS
Patients with acute ischemic stroke in anterior circulation territory and intra-arterial (IA) revascularization therapy were retrieved. ADC volume taken before the IA therapy was calculated quantitatively with the margin thresholds of ADC value as $700 \times 10^{-3} \text{mm}^2/\text{s}$. Futile prognosis was defined as modified Rankin Scale 5-6 at 3 months. We divided patients into 3 groups. Group 1 represented with ADC volume less than 50 cm$^3$, group 2 with 50 to 100 cm$^3$ and group 3 with more than 100 cm$^3$. Baseline characteristics (age, initial NIHSS score), imaging data (successful revascularization, TICI 2a-3) and clinical outcomes (good outcome, mRS 0-2 at 3 months; poor outcome, mRS 5-6) were compared among groups. Logistic regression and Receiver Operating Characteristic (ROC) curve analyses were done.

RESULTS
Finally, 76 patients were enrolled in this study. There is no difference of age and successful revascularization among the groups. Larger volume group show significantly high initial NIHSS score ($p=0.027$) and poor outcome ($p<0.001$). ADC volume more than 100 cm$^3$ was significantly associated with futile prognosis ($p=0.001$, Odds ratio, 25.4 [95%CI, 3.874-166.673]). The area under the ROC curve for ADC volumes was 0.675 ($p=0.009$). For predicting futile prognosis, sensitivity and specificity were 57.6% and 69.8% at ADC volume 50 cm$^3$, 48.5% and 95.3% at 100 cm$^3$ and 33.3% and 97.7% at 150 cm$^3$, respectively.

CONCLUSION
A huge DWI volume was associated with the futile prognosis. This imaging marker, however, could not be a single sign for stopping further aggressive IA treatment for acute ischemic stroke because the area under the ROC curve was relatively small. When IA therapy is considered, well known harmful factors including old age, high NIHSS score and huge ADC volume should be combined altogether for ‘no more to go’.

CLINICAL RELEVANCE/APPLICATION
Recent progress of ET methods might be attributed to a tolerance of bigger ADC volume than previously recommended.

VSNR41-12 Endovascular Treatment for Stroke: What do we do Now?

M. Imran Chaudry MD (Presenter): Stockholder, Medina Medical Stockholder, Blockade Medical, Inc Proctor, Covidien AG Consultant, Penumbra, Inc Consultant, Johnson & Johnson Fellowship Funding, MicroVention Inc Fellowship Funding, Stryker Corporation

LEARNING OBJECTIVES
1) Assess the impact of recent stroke clinical trials. 2) Compare the outcomes with various thrombectomy devices. 3) Develop a simple systematic approach to thrombectomy.
**Sub-Events**

**MSRO42-01**

**Invited Speaker:**
Stephanie E. Weiss MD (Presenter): Nothing to Disclose

**Risk of Fatal Secondary Malignancies from the Bladder using 3 different CSI Techniques**

Jongmyung Kim MD, PhD (Presenter): Nothing to Disclose, Stephen Sozio: Nothing to Disclose, Venkat R. Narra PhD: Nothing to Disclose, Rihan Davis DMD: Nothing to Disclose, Madeera Kathpal DO, MA: Nothing to Disclose, Atif Jalees Khan MD: Nothing to Disclose, Ning Jeff Yue PhD: Nothing to Disclose, Sung Kim MD: Nothing to Disclose

**ABSTRACT**

**Purpose/Objectives:** Craniospinal Irradiation (CSI) typically involves 2 matches: upper lateral fields matched to an upper PA spine field, and upper spine field matched to a lower spine field. Historically, the spine fields are matched at the skin (conventional). Another method uses a couch kick and appropriate gantry rotation in the lower spine field to develop a perfect match with the upper spine field divergence (couch kick). IMRT may also be used. Our hypothesis was that the downward angulation of the inferior spine field associated with the couch kick technique might increase the equivalent dose (and theoretical risk of secondary malignancy) to pelvic structures, and that the opposite was true for IMRT. This study compares the risk of secondary malignancy from a pelvic organ (bladder) associated with the couch kick and IMRT techniques compared to conventional.

**Methods:** Four patients had three CSI plans (conventional, couch kick, IMRT) made with a prescription of 54 Gy to the posterior fossa and 36 Gy to the spine. Mean dose to bladder was recorded for each technique, as well as the minimum dose absorbed by the most highly irradiated 2 cc of bladder (for a more conservative estimate). The equivalent dose to the bladder was determined by multiplying the mean dose by 1 Sv/Gy (radiation weighting factor for photons). Lifetime risk of fatal secondary malignancy from bladder was calculated by multiplying equivalent dose by 0.3 %/Sv (NCRP report 116 coefficient for probability of experiencing fatal cancer from the bladder for a whole population). To compare the risk of secondary malignancy from bladder using couch kick and IMRT compared to conventional techniques, the ratio of excess relative risk 

**Results:** The risk of secondary malignancy from bladder was increased by couch kick (RRRs were 3.98, 2.32, 0.95, 1.17) and decreased by IMRT (RRRs were 0.92, 0.84, 2.70, 0.50) compared to conventional CSI techniques. The results using minimum dose to most highly radiated 2cc of bladder was consistent with the results using mean dose.

**Conclusions:** This study demonstrates that the couch kick technique increases dose (and theoretical risk of fatal secondary malignancy) to the bladder, compared with conventional CSI. Though it has the advantage of a perfect match at the lower junction, the downward angulation may increase dose to pelvic structures. Conversely, IMRT lowers the dose at the bladder in most cases. It should be noted that the absolute difference was in some cases minimal. The potential advantages/disadvantages of these CSI techniques should of course be tempered by factors such as total MU output and overall safety/reproducibility.

**MSRO42-03**

**Factors Influencing Treatment Plan Quality in Stereotactic Radiosurgery of Brain Metastasis**

Maya Mathew MD (Presenter): Nothing to Disclose, Sebastien Gros: Nothing to Disclose, Haoming Qiu MD: Nothing to Disclose, Iris Rusu: Nothing to Disclose, Edward Melian MD: Nothing to Disclose, Anil Sethi PhD: Nothing to Disclose

**PURPOSE**

Stereotactic Radiosurgery (SRS) is often delivered with 5-6 cone based circular arcs. Although circular arc technique is ideal for spherical targets, it gives suboptimal results for large, irregularly shaped volumes. In SRS, treatment plan quality is evaluated based on several dosimetric indices: conformity index (CI), homogeneity index, OAR doses etc. We investigate improvement in SRS plan quality with MLC based dynamic conformal arcs.

**METHOD AND MATERIALS**

Thirty patients treated for brain metastasis with SRS were included in this study. All patients received a single fraction dose to the planning target volume (PTV). Cones were planned with dynamic conformal arcs using micro-MLC (3mm) without changing dose constraints and arc parameters. Treatment plans were evaluated based on dosimetric indices: Dmin, Dmax, Dmean, D90, D95, CI, CI50, and homogeneity index, HI = Dmax/Dmin. For each target, a shape index (SI) was computed as the ratio of the smallest sphere volume enclosing the given target to PTV. Dependence of dose parameters on PTV and SI was investigated.
RESULTS
Target size ranged from 0.05 to 3.16 cc (average 0.538 ±0.645 cc) with an average shape index of 1.52 ±0.49. Transitioning from cone based plans to MLC plans improved CI from 2.16 ±0.55 to 1.59±0.29 (p<0.001). With increasing PTV, both MLC and cone based CI and CI50 showed improvement. For larger PTVs, the degree to which the CI and CI50 could be improved by MLC planning also increased. Both CI and CI50 were found to significantly improve (p<0.001) with MLC based dynamic conformal arcs especially for irregularly shaped larger (>1cm diameter) targets.

CONCLUSION
For large irregular targets SRS plan quality can be significantly improved using MLC based dynamic arc technique.

CLINICAL RELEVANCE/APPLICATION
We present a guide for designing and evaluating optimal and consistent SRS treatment plans for brain metastasis as a function of target and shape.

MSRO42-04 Secondary Tumors in Long-term Follow-up of Patients Treated for Intracranial Germ Cell Tumors
Maikel Botros MD (Presenter): Nothing to Disclose

ABSTRACT
Purpose/Objective(s): To report secondary tumor development in patients treated with radiation therapy for intracranial germ cell tumors within our institution. Materials/Methods: A retrospective review was carried out on pediatric patients treated for intracranial germ cell tumors with radiation therapy at our institution from 1983 to 2006 (n=13). Six patients had germinomas (G); and 7 patients had non-germinomatous germ cell tumors (NG).

Results: Median follow-up for the 13 patients reviewed was 9.7 years (range 8.32 months -16.1 years). A gross total resection was utilized in 3 G and 2 NG patients, whereas 2 G and 4 NG patients underwent subtotal resection. One G patient underwent a biopsy only. One NG patient did not have biopsy or surgery. Of the 6 G patients 3 received CSI while 3 received local field irradiation. All NG patients received CSI. One G patient received chemotherapy per COG studies. Five- and 10-year disease free survival (DFS) for all patients was 92% and 85%. 5 G and 6 NG patients were free of disease at 10 years. Two patients developed a recurrence: A G patient who had received CSI, and a NG patient treated with CSI and chemotherapy. Three of 13 patients (23%) developed a secondary tumor: one intracranial low grade glioma diagnosed 20 years after CSI for a G, one intracranial meningioma diagnosed 16 years after CSI in a NG patient, and one osteochondroma of the right posterior 2nd rib diagnosed 6 years in a G patient who had received CSI. Of the three patients with a secondary tumor, only one patient (who developed a meningioma) had received chemotherapy. Long-term complications of the whole group included endocrinopathy (n=10), neurocognitive delay (n=6), sensorineural hearing loss (n=4), visual deficits (n=8), and orthopedic complications (n=3).

Conclusions: Patients with intracranial germ cell tumors are at risk for secondary tumors due to high survival rates achieved with treatment. In this small series of intracranial germ cell tumors, secondary tumors were observed in 23%. Interestingly, the time interval to development of osteochondromas has been previously reported in larger case-series in patients treated with total body irradiation.

MSRO42-06 Patterns of Failure Following Stereotactic Radiosurgery (SRS) for Recurrent Glioblastoma Multiforme (GBM)
Wendy Gao MD (Presenter): Nothing to Disclose

ABSTRACT
Purpose/Objective(s): Despite surgical resection, temozolomide, and radiation therapy, most patients with GBM recur. Effective strategies against recurrence have yet to be elucidated, and may involve systemic treatment, surgery, and/or re-irradiation. Re-irradiation with SRS targets smaller volumes and may have decreased side effects compared to fractionated involved field radiation therapy. However, it is unclear how it affects the overall disease progression. Here, we present our experience of re-irradiation for GBM to report the patterns of failure and overall survival following SRS.

Materials/Methods: We reviewed 36 consecutive patients treated with Gamma Knife SRS for recurrent GBM between June 2006 and July 2013. The median age was 59 years (range, 31-79) and median interval from initial radiation therapy course was 11 months (range, 1-56). The target was enhancing tumor with median volume of 4.6 cc (range, 0.6-24.9) and median prescription dose of 18 Gy to the 50% isodose surface (range, 12-22). Six (17%) patients were treated to 2 or more recurrent volumes. In addition, 28 (78%) received bevacizumab and 2 (6%) received temozolomide. MRIs at time of enhancing tumor progression were fused with treatment planning MRIs for analysis. Recurrences were classified as infield, marginal or distant based on percent volume receiving the prescription dose and maximum dose in the recurrence volume. Statistical analysis was performed with the Mann Whitney U test.

Results: With a median follow up of 11 months, 13 (36%) patients were alive at last follow up, 1 (2%) was lost to follow up, and 22 (61%) were deceased. Median overall survival was 8 months. Twenty-five (69%) patients had treatment failure after SRS, with a median time to progression of 6 months (range, 1-31). At time of recurrence, 64% had a detriment in KPS. There were 12 (48%) in field failures, 8 (32%) marginal, and 5 (16%) distant. Median time to progression was 4 months for in field failures, 6 months for marginal and 6 months for distant. There was no significant difference in time to progression in patients with infield failure vs distant failure (p=0.18). Eighteen failures (75%) were also associated with FLAIR progression. The median maximal dose received by recurrent tumors was 25 Gy (range, 0.4 - 37.7) with 76% of recurrences in areas receiving more than 20 Gy.

Conclusions: Our study of patterns of failure following SRS for recurrent GBM found that the majority of failures were infield, followed by marginal, with distant failures the least likely. In field failures also had the shortest median time to disease progression. Further investigation comparing these data with patterns of failure after fractionated re-irradiation may inform the best strategy for re-irradiation.
A Dosimetric Criterion for Patient Selection: Intensity Modulated Radiation Therapy or Three Dimensional Conformal Radiation Therapy—In High Grade Gliomas

Meenu Gupta MD, MBBS (Presenter): Nothing to Disclose

ABSTRACT

AIM: Modern radiotherapy attempts to improve the dose distribution to conform the high dose region to the planning target volume (PTV). The present work aimed to assess which clinicodosimeteric scenario could benefit the more from IMRT as compared to three dimensional conformal radiation therapy (3DCRT).

MATERIAL AND METHODS: The number of organs at risk (OARs) overlapping the planning target volume (PTV) was the parameter describing the clinical dosimeteric pattern. Twenty four previously irradiated patients of high grade gliomas were retrieved and replanned with both 3DCRT and IMRT. The cases were divided into 4 groups (6 patients in each group). Each group represents a scenario where 0, 1, 2 or 3 OARs overlapped the target volume respectively. A total dose of 60 GY was delivered with a dose/fraction of 2 GY, five fractions weekly. The dose was normalized to the isocentre.

RESULTS: We compared the average values of the dosimeteric parameters for the four groups. We observed that the group where OARs overlapping were 0, the TV$_{95\%}$ and HI were roughly equal for the 3DCRT and IMRT plans. For group 2 where 1 OARs overlapped, the TV$_{95\%}$ for the IMRT plan was 96.50 % versus 96.03 % for 3DCRT. For group 3, where 2 OARs overlapped the dosimeteric plans were competitive. The IMRT plan had better TV$_{95\%}$ (96.53 %) as compared to 3DCRT(94.82%). For group 4, where number of OARs overlap was 3, the IMRT dosimeteric plan were better with TV$_{95\%}$ (96.78 %) and HI values (1.072) and the TV$_{95\%}$ values(92.89 %) and HI values(1.14) were inferior in case of 3DCRT plans. IMRT provided better target coverage (V$_{95\%}$) than 3DCRT, the difference ranged from 0.05% for group 1 to 3.84 % for group 4, passing through 0.47% and 1.71 % for group 2 and 3, respectively.

Conclusion: Results suggest that the overlap of these OARs can be used as a criteria to select which patient should receive IMRT treatment. IMRT seems a superior technique compared to 3DCRT where there are multiple overlaps between OARs and PTV.

Stereotactic Radiosurgery Boost to the Surgical Cavity after Surgical Resection of Renal Cell Carcinoma (RCC) or Melanoma Brain Metastases: Radiographic Review of Tumor Loco-regional Control

Miriam Knoll MD (Presenter): Nothing to Disclose, Seth Blacksburg MD, MBA: Speakers Bureau, Bayer AG, Isabelle Germano MD: Nothing to Disclose, Blagoja Todorov: Nothing to Disclose, Kathleen Maloney-Lutz RN: Nothing to Disclose, Yeh-Chi Lo PhD: Nothing to Disclose, Sheryl Green MD: Advisory Board, Toshiba Corporation

PURPOSE

Tumor histology plays an important role in the local control of lesions treated with surgery or radiation. The aim of this retrospective study was to evaluate local control of brain metastases arising from tumors of relatively radioresistant histologies, treated with surgical resection followed by a SRS boost.

METHOD AND MATERIALS

We reviewed all patients (pts) with brain metastases arising from primary tumors considered to be relatively radioresistant, i.e. RCC and melanoma, who were treated with surgical resection followed by SRS boost to the surgical cavity. We recorded the radiographic local tumor control of the treated lesion and regional progression in the brain outside the treated lesion. IRB approval was obtained.

RESULTS

Thirteen lesions in 11 pts received SRS boost after surgical resection at a median lapsed time between surgery and SRS of 1.4 months (mos). Eight lesions received one fraction with a median dose of 17 Gy. 5 lesions received 25 Gy in 5 fractions. Median radiographic follow up was 18.5 mos after SRS. Two lesions demonstrated local failure occurring at 14.0 and 18.2 mos after SRS; both recurrent lesions were melanoma metastases treated with 25 Gy in 5 fractions. Seven pts experienced progression elsewhere in the brain and were treated with SRS (3 pts) and 3 additional pts (27%) were treated with whole brain radiation therapy. In patients with a minimum follow up of 12 mos (64%) or 18 mos (55%), local control was 100% at 12 mos and 85% at 18 mos. Two pts (15%) with melanoma developed hemorrhage in the treated surgical bed at 6 and 28 days after SRS; 1 of these patients required surgical intervention.

CONCLUSION

Our results demonstrate that local control can be achieved in the treatment of brain metastases arising from RCC or melanoma utilizing SRS boost following surgical resection. A randomized clinical trial is needed to confirm these findings and to establish a standard of care.

CLINICAL RELEVANCE/APPLICATION

SRS boost after surgical resection can achieve local control of radioresistant tumor metastases, i.e. RCC and melanoma.

Clinical Outcomes and Prognostic Factors for Central Neurocytoma

MSRO42-08

Stereotactic Radiosurgery Boost to the Surgical Cavity after Surgical Resection of Renal Cell Carcinoma (RCC) or Melanoma Brain Metastases: Radiographic Review of Tumor Loco-regional Control

MSRO42-09

Clinical Outcomes and Prognostic Factors for Central Neurocytoma
Central neurocytomas are intraventricular central nervous system neoplasms that comprise 0.25-0.5% of brain tumors. Optimal management remains controversial due to their rarity. We assessed clinical outcomes for a historical cohort of neurocytoma patients and evaluated effects of tumor pathologic grade and atypia, tumor size, extent of resection (EOR), and adjuvant radiation (RT).

**RESULTS**

A total of 22 patients (14 males, 8 females) were treated between 1995 and 2009, with median age at diagnosis of 24 years (range 11-62 years). One patient died perioperatively and 4 patients were lost to follow-up prior to 6 months and excluded from analysis. A total of 7 patients experienced recurrent/progressive disease. Median PFS and OS were 52 months (range 6-210) and 86 months (range 24-210), respectively. Two patients died of disease, both of whom had atypical tumors. There was near 100% concordance between tumor atypia and MIB-1 labeling. Three-year PFS was 57% for MIB labeling >2% and 100% for MIB labeling ≤ 2% (HR 8.1, CI 1.1-58.2, p = 0.04). Median tumor diameter at diagnosis was 4.1 cm (range 0.8-8.6 cm). Three-year PFS was 44% for tumors >4.3 cm and 89% for tumors ≤4.3 cm (HR 3.0, CI 0.76-12.2, p = 0.12). We examined influence of EOR and adjuvant RT. Four patients had gross total resection (GTR) and 13 had subtotal resection (STR). Six patients progressed after STR. None of the GTR patients received adjuvant RT and four of the STR patients received adjuvant RT. Three-year PFS was 100% with RT and 67% without RT (HR 0.44, CI 0.08-2.41 p=0.34).

**CONCLUSION**

For patients with central neurocytoma, MIB-1 labeling index >2% is predictive of worse outcome. Although patient numbers were limited, our data indicate that lesser extent of resection and larger tumor size may confer poorer prognosis and adjuvant RT after STR may improve PFS.

**CLINICAL RELEVANCE/APPLICATION**

Greater tumor atypia, as quantified by MIB-1 labeling index >2%, is predictive of poorer outcomes in patients with central neurocytoma.

**SUB-EVENTS**

**MSSR42A**

**CNS Trauma and Neurovascular Injury**


**LEARNING OBJECTIVES**

1) To be familiar with traumatic brain injury demographics and classification schemes. 2) Be able to apply appropriateness criteria for head trauma imaging in children and adults. 3) Identify key imaging patterns and pitfalls in the evaluation of brain and neurovascular trauma.

**ABSTRACT**

This lecture on *Acute Head Trauma* is divided into 4 parts: Part 1 will briefly review TBI demographics. Part 2 will discuss the current imaging approach to acute TBI in today’s clinical practice. Part 3 will briefly describe the most common TBI classification schemes. Part 4 will illustrate the imaging manifestations of the different injuries located in the extra-axial space (e.g., scalp and skull injury; epidural, subdural, subarachnoid and intraventricular collections), and the intra-axial space (e.g., dysautoregulation, contusion, hematoma, penetrating TBI, axonal injury, fat emboli). Note that a common theme throughout the lecture will be “Lessons I’ve Learned Since Neuroradiology Fellowship” ;-)
LEARNING OBJECTIVES

1) To know the modalities (CT/MRI) and protocols for non-traumatic neurological emergencies. 2) To know and diagnose the main non-traumatic neurological vascular and non-vascular emergencies. 3) To be aware of the pitfalls and limitations of clinical presentation and imaging findings in non-traumatic neurological emergencies.

ABSTRACT

Neurological emergencies are often associated with high morbidity and mortality, and thus require prompt diagnostic and therapeutic action. Non-traumatic emergencies may however have a subacute onset, and radiological signs may be subtle, which can lead to delay in diagnosis and treatment. Since clinical features are often nonspecific, the radiologist may be the first to point the clinician in the direction of the correct diagnosis. It is therefore of great importance that the radiologist is aware of and familiar with the various imaging findings, on both computed tomography (CT) and magnetic resonance imaging (MRI), of non-traumatic neurological emergencies. These include vascular, infectious and inflammatory diseases. Commonly encountered emergencies are ischaemic and haemorrhage stroke, venous thrombosis, arterial dissection, abscess, acute disseminated encephalomyelitis (ADEM), and encephalitis. Radiological findings in rarer diseases may mimic those in the more commonly occurring diseases, but need to be correctly interpreted as therapeutic strategies and prognosis may be entirely different. Such entities include for instance posterior reversible encephalopathy syndrome (PRES), reversible cerebral vasoconstriction syndrome, Susac’s syndrome, and status epilepticus. Furthermore, initial findings of (impending) complications of brain disease, such as hydrocephalus and herniation of brain structures, may be subtle, while early recognition allows for prompt and adequate intervention. Finally, diagnostic and therapeutic interventions performed in an emergency setting may interfere with the diagnosis and interpretation of clinical and imaging findings. Associated limitations and pitfalls therefore need to be recognised to avoid false negative or false positive diagnosis respectively.

Interactive Case Discussion

LEARNING OBJECTIVES

1) To review traumatic brain injury (TBI) and non-traumatic neurological emergencies. 2) To describe imaging manifestations of TBI and non-traumatic neurological emergencies. 3) To understand the clinical implications of radiological imaging findings in TBI and non-traumatic neurological emergencies. 4) To know the state-of-the-art radiological imaging options for the assessment of acute TBI and non-traumatic neurological emergencies.

ABSTRACT

This interactive case discussion builds on the two previous lectures in this session, on traumatic and non-traumatic neurological emergencies respectively. Both lecturers will take the audience through several clinical cases, highlighting and emphasizing important issues from their lectures, such that the previously presented theory is placed in a clinical context. Preferably, the participants will have attended the two prior lectures, to optimally benefit from and participate in this interactive case discussion.
SSK13-02  
**ME-MRI Demonstrating Improved Axonal Transport after Microtubule Stabilization in Alzheimer Transgenic Mice**

**Donna Jean Cross PhD (Presenter):** Research Grant, Hitachi, Ltd Research Grant, Astellas Group, Christopher Allen Potter MD: Nothing to Disclose, Nathalie M. Martin BA: Nothing to Disclose, Greg Garvin: Nothing to Disclose, Rodney Ho PhD: Nothing to Disclose, Satoshi Minoshima MD, PhD: License agreement, General Electric Company Research Grant, Koninklijke Philips Electronics NV Research Grant, Hitachi, Ltd Research Consultant, Hamamatsu Photonics KK Grant, Nihon Medi-Physics Co, Ltd Research Grant, Astellas Group Research Grant, Seattle Genetics, Inc

**PURPOSE**

Using MR imaging with manganese (ME-MRI) to assess bulk axonal transport rates in vivo, we reported previously decreased axonal transport in young mice transgenic (Tg) for Alzheimer's disease (AD). Microtubule stabilizing therapeutics have been shown to improve cognition and decrease pathology in AD Tg mice. For this current study, we hypothesized that intranasal administration of paclitaxel, a microtubule-stabilizing drug would improve transport rates in the olfactory tract of triple transgenic AD mice (3xTg-AD).

**METHOD AND MATERIALS**

Mice, (3xTg-AD, n=15, age=75±10 days) were treated by intranasal lavage with either Paclitaxel (0.6 mg/kg; Hospira, Inc., Lake Forest, IL) or 0.9% saline vehicle in a volume of 5 ul per nostril. Mice received a total of 6 treatments at intervals of 14±0.2 days with post treatment imaging occurring at age=172±16 days. Scanning (14T Bruker MR: T1-weighted MDEFT, TR/TE: 5000ms/1.9ms, resolution 0.140 x 0.140 x 0.25mm3) pre and post treatment occurred at 100 min. and again from 280-350 min after administration of 5 µL of 1M MnCl2 intranasally. After imaging, mice were perfused and brains removed for histopathology. Images were co-registered, normalized and stereotactically aligned to a mouse brain atlas. Volumes of interest in the olfactory nucleus (ON) and lateral olfactory tract (OT) were used to measure average signal intensity change indicating Mn2+ transport. Uptake and rate of transport were estimated.

**RESULTS**

Lateral olfactory tract axonal transport was decreased 63% between pretreatment time (75 days of age) and post (approximately 6 mo. of age) in 3xTg-AD mice receiving saline treatment. This time period usually includes the onset and development of amyloid-related pathology and initial appearance of fibrillary tau in this Tg model. In comparison, mice receiving intranasal treatment with paclitaxel over the same period of time showed a 65% relative increase in OT transport rates. There were no significant differences in total Mn2+ uptake in the ON between groups, indicating delivery thru activity-dependent Ca2+ channels was not affected by treatment.

**CONCLUSION**

The ME-MRI results indicate that microtubule-stabilizing drugs may intervene the AD neuropathological cascade via normalization of axonal transport processes, which are critical to maintain homeostatic neuronal functions.

**CLINICAL RELEVANCE/APPLICATION**

Microtubule-stabilizing drugs present an exciting new therapeutic option for Alzheimer's disease.

SSK13-03  
**Molecular MRI Detects Synergistic Combination of Glatiramer Acetate and Myeloperoxidase Inhibition in a Mouse Model of Multiple Sclerosis**

**Anning Li MD (Presenter):** Nothing to Disclose, Yue Wu: Nothing to Disclose, Cuihua Wang PhD: Nothing to Disclose, Benjamin Pulli MD: Nothing to Disclose, Gregory R. Wojtkiewicz MSc: Nothing to Disclose, Yoshiko Iwamoto: Nothing to Disclose, Muhammad Ali MBBS: Nothing to Disclose, JINGHUI LI PHD: Nothing to Disclose, Zhenwei Yao: Nothing to Disclose, John Chen MD, PhD: Research Grant, Pfizer Inc

**PURPOSE**

Purpose: Glatiramer acetate (GA), a first-line drug for multiple sclerosis (MS), is thought to primarily increase Th2 anti-inflammatory lymphocytes while 4-aminobenzoic acid hydrazide (ABAH) is an irreversible inhibitor for myeloperoxidase (MPO), a major product of pro-inflammatory myeloid cells. The aim of this study was to investigate whether the combination of these two agents could be more beneficial, and whether this benefit could be evaluated and tracked by molecular imaging targeting MPO.

**METHOD AND MATERIALS**

Materials and Methods: 3 groups of experimental autoimmune encephalomyelitis (EAE) mice were given sub-optimal doses: ABAH 20mg/kg bid, GA 75µg qd, combination (ABAH 20mg/kg bid and GA 75µg qd) and saline as control. Mice were imaged when they first became symptomatic with bis-5HT-DTPA-Gd (MPO-Gd) MRI to assess MPO activity in vivo. Analysis of lesion number, lesion size and contrast-to-noise ratios (CNRs) was conducted. Histopathology was used to analyze the disease activity. Statistical analysis was performed using Student’s t-test with P<0.05 as significant.

**RESULTS**

Results: The combination group showed delayed disease onset, reduced disease severity (Fig. A) and significantly less disease burden (Fig. B) compared to the ABAH group (P<0.005) and GA group (P<0.05). The combined treatment also tended to improve survival (Fig. A). On imaging, the combination group showed fewer lesions (51.0±11.2 for combination vs. 100.8±11.9 for ABAH, P<0.01; vs. 87.3±14.6 for GA, P<0.05), smaller lesion size (23.9±4.5 for combination vs. 73.0±26.5 for ABAH, P<0.05; vs. 90.1±36.5 for GA, P<0.05) and...
lower image intensity (2.7±0.6 for combination vs. 6.8±1.3 for ABAH, P<0.01; vs. 4.6±0.7 for GA, P<0.05). Reduced disease severity was confirmed on histopathology, where inflammatory cells infiltration, MPO expression, and demyelination were attenuated (Fig. C).

CONCLUSION

Conclusion: Molecular MR imaging targeting MPO can track the beneficial effect of synergistic treatment effects of targeting lymphoid and myeloid inflammation, establishing MPO imaging as a potential imaging biomarker for MS.

CLINICAL RELEVANCE/APPLICATION

Clinical Relevance: Upon translation, MPO targeted MR imaging could be used to track MS treatment efficiency and guide treatment decisions.

SSK13-04

Targeted Gd Nanoparticle for T1-MR Molecular Imaging of Amyloid Plaques

Eric Tanifum PhD (Presenter): Stockholder, Alzeca Biosciences LLC, Ketan B. Ghaghada PhD: Research Grant, Marval Biosciences Inc Consultant, Marval Biosciences Inc Shareholder, Marval Biosciences Inc

Zbigniew Starosolski PhD: Stockholder, Alzeca Biosciences, LLC, Ananth Annapragada PhD: Stockholder, Marval Pharma Ltd Stockholder, Alzeca Biosciences LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson

PURPOSE

A hyper-relaxive Gd containing liposome targeted to amyloid plaques by a novel targeting ligand was fabricated. We tested (a) the ability of this particle to label amyloid plaques, and (b) detection of the labeling by T1-weighted MRI. If sufficiently sensitive and specific, such particles could be alternatives to PET based molecular imaging agents.

METHOD AND MATERIALS

Liposomes targeted to amyloid plaques by a novel amyloid binding ligand, surface-coated with Gd-DOTA and containing ICG (10µM) for near-infrared detection, were fabricated. They were injected into 9-month old Tg2576 mice via the tail vein at a dose of 8µL/gram body weight. Imaging pre-contrast and at daily intervals up to 5 days post-contrast was conducted using a 1T permanent magnet based system, and a T1 weighted spin-echo sequence with TE=30ms, TR=700ms, FA=90°, NEX=4. The animals were sacrificed, brains perfused with saline, fixed with formaldehyde, and immersed in 10% sucrose. 20µ frozen alternating sections were stained with 4G8 antibody and visualized with a Cy3 labeled secondary antibody to confirm amyloid burden. The other alternate sections were visualized unstained in both bright field, and for ICG.

RESULTS

Amyloid positive animals (n=6) treated with the targeted liposomes showed clear T1 signal in the hippocampus and cerebral cortex, while both amyloid positive animals treated with a control untargeted formulation (n=6), and amyloid negative animals treated with the targeted formulation (n=6) showed no such signal. Histologically, the presence of amyloid plaques only in the brains of the positive animals was confirmed, as was the presence of the fluorescent ligand and the ICG only in the positive animals treated with the targeted formulation.

CONCLUSION

The MRI data are clearly consistent with avid labeling of amyloid plaques in this animal model by the targeted liposomes, with sufficient sensitivity for T1 weighted imaging using 1T field strength. The histological data confirmed the presence of amyloid plaques in the positive animals as well as the presence of targeted particles in the brains of the amyloid positive animals treated with them.

CLINICAL RELEVANCE/APPLICATION

The high sensitivity and specificity suggest this agent could be highly successful in imaging amyloid plaques, and could be worthy of development as an alternative to currently available PET ligands.

SSK13-05

Molecular MRI Detection of Traumatic Brain Injury (TBI) with Amide Proton Transfer (APT) Imaging

Hong Zhang MD (Presenter): Nothing to Disclose, Wen Zhu Wang: Nothing to Disclose, Bo Ma: Nothing to Disclose, Yun Peng MD: Nothing to Disclose, Jian Wang: Nothing to Disclose, Jinyuan Zhou PhD: Nothing to Disclose

PURPOSE

In the TBI, the initial impact includes the primary injury and secondary injury cascades, such as ischemia, progressive neurodegeneration, persistent inflammation, glial hypertrophy and proliferation, and cerebrovascular dysfunctions. APT imaging is a novel molecular MRI method that can non-invasively detect endogenous mobile protein and tissue pH changes. We explored the capabilities of APT imaging for detecting the TBI in rat models.

METHOD AND MATERIALS

Six adult male SD rats had craniotomy plus controlled cortical impact (CCI) surgery (3-mm impactor tip,
velocity of 5m/sec, deformation depth of 5 mm, and impact duration of 65 msec) under isoflurane anesthesia. MRI data was acquired at 4.7T, using T2w, T2*w, T1w, T2, T1, isotropic ADC, CBF, and APT-weighted (APTw; RF saturation power/time 1.3 μT/4 sec) MRI. APTw images were quantified using the magnetization transfer-ratio asymmetry at 3.5 ppm from water. MRI was performed 1 and 6 hours, as well as 1, 2 and 3 days after TBI.

RESULTS

All APTw images show an 'ischemia-like' pattern of hypointensity, unique from all other used MRI sequence, in some areas of the lesion. Average APTw signal intensities decreased significantly and globally at 1 hr (compared to contralateral normal brain tissue), with 84%, 63% and 62% reductions in a contused cortical region, ipsilateral hippocampus and thalamus. There were some areas of intermediate to slightly hyperintense APT signals in the lesion, consistent with the hemorrhage (with abundant mobile proteins), as shown by T2*w and pathology. The low APT-pH MRI signal was gradually recovered after the initial drop. At day 3 after injury, the TBI lesion became heterogeneous with areas of high and low APTw signal intensities. Notably, the APTw signal intensity of the perilesion cortex dramatically increased (3.3% ± 1.5% at 3d vs. -3.2% ± 1.6% at 1 h), due to the secondary inflammatory response, as confirmed by pathology.

CONCLUSION

This study for the first time demonstrates that APT-MRI can reveal many key TBI features in vivo, such as ischemia, hemorrhage, and inflammatory response.

CLINICAL RELEVANCE/APPLICATION

The APT-MRI signal is a unique, sensitive biomarker for identifying and assessing the TBI in the clinic, which should have considerable influence on the patient care.

Metabolic Coherence Mapping of the Brain to Elucidate Regional Neuronal Activity and Functional Integration: Multivariate Correlational Analysis Using Dynamic FDG PET


PURPOSE

The functional integrity of neural activity via circuitries/pathways is thought to be reflected on regional intercorrelation of neuronal activity ("functional connectivity"). This study investigates the feasibility of such parametric mapping using individual FDG-PET imaging and compared to standard static images.

METHOD AND MATERIALS

Ten non-human primates underwent dynamic brain PET imaging under sevoflurane anesthesia. Following a slow-bolus injection of 3 mCi [F-18]FDG, 120 30-second dynamic frames were obtained over 60 min. Following frame-to-frame image coregistration, stereotactic transformation, and global normalization, voxel-wise principal component analysis (PCA) with matrix transposition was applied to the individual data sets, followed by Varimax rotation of initial components. Individual quantitative Metabolic Coherence (MC) maps were created by averaging absolute component loadings and compared to conventional static FDG maps.

RESULTS

In all subjects, the first 2 components represented large variances (76% +/-11 SD to total variance) resulting from general blood flow and tissue FDG uptake that were eliminated by exclusion of the initial vascular phase in the dynamic data. Individual MC maps elucidated cerebral structures involved in the default mode network with high composite correlation coefficients: posterior cingulate cortex (0.070+/-.006); frontal (0.070+/-.005); parietal (0.069+/-.006), and temporal (0.069+/-.005) association cortices. MC values were modest in the striatum (0.059+/-.007) and low in the visual cortex (0.039+/-.005, presumably due to anesthesia) and cerebellum (0.035+/-.007). In contrast, conventional static FDG maps from the same subjects showed high metabolic values (normalized to global activity 100) in the striatum (148+/-.94); posterior cingulate cortex (136+/-.65); parietal (134+/-.69) and frontal (124+/-.77) association cortices.

CONCLUSION

While static FDG maps represent regional neuronal activity, MC maps potentially provide unique supplementary information concerning regional functional integration via intercorrelation across regions within the brain. Further validation and optimization are underway.

CLINICAL RELEVANCE/APPLICATION

New parametric analysis of dynamic FDG-PET depicts regional neuronal activity and functional integrity that can supplement conventional static image interpretation and shed light on disease processes.
Amyotrophic Lateral Sclerosis: Impact of Disease Progression on Intraspinal Stem Cell Survival

Amit Srivastava: Nothing to Disclose, Sarah Gross: Nothing to Disclose, Camille Bulte: Nothing to Disclose, Akshata Almad: Nothing to Disclose, Nicholas Maragakis: Nothing to Disclose, Jeff W.M. Bulte PhD (Presenter): Research Grant, Koninklijke Philips NV Founder and co-owner, SenCEST, LLC

PURPOSE

The first Phase I clinical trials have shown that neural stem cell (NSC) therapy represents a possible new treatment for Lou Gehrig’s disease (ALS), a motor neuron disease for which there is no cure. Monitoring the survival of transplanted cells is imperative for determining the therapeutic success. The purpose here was to monitor graft survival as related to the progression of motor deficits.

METHOD AND MATERIALS

Allogeneic luciferase-transfected NSCs were transplanted bilaterally (100,000 cells) into the cervical spinal cord (C5) of presymptomatic SOD1(G93A) transgenic ALS mice (n=9) and wild type littermates (n=5) via laminectomy. Mice were immunosuppressed by using FK506/rapamycin (1 mg/kg, i.p.) daily. Bioluminescence imaging (BLI) and computed tomography (CT) were performed for several weeks post-transplantation using a dual-mode Perkin Elmer Spectrum/CT. Rota rod test was performed to determine motor deficits. Disease onset was defined by decline in motor skills and weight loss.

RESULTS

BLI showed no excessive proliferation of transplanted cells (Fig. 1A). The first sign of disease onset was observed in 84 days old ALS mice. Motor skills continued to decline further, Compared to day 1, a 60% decline in BLI signal was observed in ALS mice after four weeks of transplantation (at the time of disease Anchoronset) (p<0.05) (Fig. 1B). The decrease of cell survival preceded the decline in motor skills and, interestingly, showed the same overall time course pattern. There was a complete loss of BLI signal at the end point. In contrast, only 10% decline in the BLI signal was observed in wild type littermates after four weeks of transplantation. Anti-Iba1 (red) and anti-luciferase (green) staining showed the presence of activated microglia around engrafted cells in the spinal cord of symptomatic ALS mice (Fig. 1C).

CONCLUSION

The disease onset and progression adversely affect the survival of engrafted NSCs in ALS. This poor survival is likely a result of the pathological microenvironment in the spinal cord of ALS mice.

CLINICAL RELEVANCE/APPLICATION

The hostile microenvironment of the spinal cord in ALS represents a significant barrier for successful clinical therapy.

Increased Uptake of 2-[18F]fluoroacetate at Early Phase of Cerebral Ischemia

Ryuichi Nishii MD, PhD (Presenter): Nothing to Disclose, Hiroshi Mizuma PhD: Nothing to Disclose, Shinya Kagawa : Nothing to Disclose, Tatsuya Higashi MD : Nothing to Disclose, Hiroshi Yamauchi MD, PhD : Nothing to Disclose, Youichi Mizutani : Nothing to Disclose, Shigeki Nagamachi MD, PhD : Nothing to Disclose, Hirotaka Onee PhD : Nothing to Disclose

PURPOSE

2-[18F]Fluoroacetate (FACE) has been considered as a PET probe for evaluating glial metabolism (Marik et al., JNM, 2009), though little is known about its detailed functions in cerebral ischemia. We here examined changes in brain uptake of [18F]FACE by PET during cerebral ischemia, in combination with immunohistochemistry study for confirming glial cell activation associated with neuroinflammation.

METHOD AND MATERIALS

Rats were occluded in the right middle cerebral artery for 60 min, and were reperfused, subsequently (tMCAO). [18F]FACE-PET scan for 60 min under isoflurane anesthesia was conducted at 2 hr (early phase) and 7th day (later phase) after reperfusion. Glial activation was assessed by both [11C]PK11195-PET imaging for translocator protein (TSPO) and immunohistochemical staining with anti-CD11b and anti-GFAP antibodies for activated microglia and reactive astrocyte, respectively. Cerebral infarction was measured by 2,3,5-triphenyltetrazolium chloride (TTC) staining after PET imaging.

RESULTS

[18F]FACE uptake in the lesion side at 2 hr after reperfusion was significantly high compared with that in the contralateral side (p

CONCLUSION

These finding indicate that [18F]FACE-PET imaging could visualize the preinfarct area without any glial activation associated with neuroinflammation.

CLINICAL RELEVANCE/APPLICATION

[18F]FACE uptake at early stage of cerebral ischemia might be tightly associated with emergent metabolic shift coupled with neural dysfunction.

18F-FDG-PET, Pulsed Arterial Spin Labeling MRI and Structural MRI in Mild Cognitive Impairment and Alzheimer’s Disease: A Simultaneous PET/MRI Study
PURPOSE

Previous studies showed specific abnormality patterns as well as high pattern accordance between cortical PET hypometabolism-, ASL MRI hypoperfusion- and T1w MRI atrophy in Alzheimer’s disease (AD) and mild cognitive impairment (MCI). Whereas former studies were conducted on separate scanners at different time points we aimed to compare these three methods directly utilizing simultaneous PET/MRI in patients with MCI, patients with AD and healthy control subjects.

METHOD AND MATERIALS

19 AD- and 14 MCI patients and 11 matched healthy elderly controls (HC) were included in this prospective study. Patients and subjects were examined on a Siemens mMR Biograph integrated PET/MRI scanner, using a simultaneous acquisition protocol (pulsed arterial spin labeling (PASL) MRI, T1w MPRAGE MRI and 18F-FDG-PET). Matlab, SPM8/VBM8 based preprocessing was executed and voxelwise statistical comparisons between AD, MCI and HC were carried out (t-tests; p>0.001; kE=20).

RESULTS

Relative to HC distinct hypometabolism and hypoperfusion occurred in bilateral posterior cingulate- and bilateral superior parietal cortex for AD and left superior parietal cortex for MCI, while mild atrophy in the latter regions occurred only for AD. In MCI and AD most distinct atrophy without co-localization of hypometabolism and hypoperfusion occurred in bilateral medial- and inferior temporal cortical regions.

CONCLUSION

Applying simultaneous PET/MRI in MCI and AD, patterns of cortical hypoperfusion and hypometabolism showed high correspondence and did mainly not result from effects of regional cortical atrophy, which occurred most distinctively in medial- and inferior temporal regions. We suggest that in a group-based evaluation PASL MRI delivers comparable results to 18F-FDG-PET in the diagnosis of neurodegenerative MCI/AD, having the advantages of non-invasiveness and non-radiation exposure. PASL MRI might be a future alternative to 18F-FDG-PET in the PET/MRI diagnostic work-up of patients with neurodegenerative dementia, i.e. in combination with amyloid-PET. However, PASL MRI needs further evaluation on a patient basis and regarding its quantitative features.

CLINICAL RELEVANCE/APPLICATION

Our abstract has high clinical relevance, as non-invasive and radiation exposure free neuroimaging methods such as arterial spin labeling MRI have high potential to be translated in the diagnostic work-up of patients with neurodegenerative dementia and other diseases.

SSK16

Neuroradiology (Advanced Neuroradiology of Alzheimer's Disease)

Scientific Papers

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Wed, Dec 3 10:30 AM - 12:00 PM   Location: N226

Participants

Moderator
Carolyn C. Meltzer MD : Board of Directors, ACR Image Metrix
Moderator
Gloria Chia-Yi Chiang MD : Nothing to Disclose

Sub-Events

SSK16-01

FedFocused Ultrasound-mediated Blood-brain Barrier Opening for Treatment in a Mouse Model of Alzheimer’s Disease

Alison Burgess PhD : Nothing to Disclose, Sonam Dubey : Nothing to Disclose, Tam Nhan : Nothing to Disclose, Isabelle Aubert PhD : Nothing to Disclose, Kullervo H. Hynynen PhD (Presenter): Nothing to Disclose

PURPOSE

Focused ultrasound (FUS)-mediated opening of the blood-brain barrier (BBB) can reduce amyloid pathology in a mouse model of Alzheimer’s disease even in the absence of exogenous drug delivery. In this study, we determine whether the reductions in pathology by FUS-mediated BBB opening with and without antibody delivery, are correlated to changes in cognitive function. In addition, we assess how vasculature compromised by amyloid pathology responds to FUS-mediated BBB opening using real time using two-photon microscopy.

METHOD AND MATERIALS

7-month-old transgenic (Tg) mice that exhibit behavioral deficits and amyloid pathology as well as
aged-matched non-transgenic littermates were treated weekly with MRI-guided FUS treatments to temporarily open the BBB in the hippocampus (n=28). Treated mice received FUS+amyloid antibodies or FUS alone and were compared to untreated Tg and non-Tg controls. After 3 treatments, mice were evaluated in the Y-maze. Post-mortem histology was performed. Acute BBB opening in age-matched Tg and non-Tg mice was evaluated in real time using two-photon microscopy (n=48).

RESULTS

In the Y-maze, Tg mice spent 61% less time exploring the novel arm than non-Tg mice due to spatial memory impairments. After FUS, Tg mice spent 99% more time in the novel arm and performed as well as the non-Tg mice suggesting that FUS improves cognition. No difference was observed between Tg mice treated with FUS+antibodies or FUS alone. Using two-photon microscopy, we observed that after FUS, the BBB was not as permeable in Tg mice (0.006 ± 0.004 min⁻¹) compared to non-Tg mice (0.014 ± 0.008 min⁻¹) which was attributed to less opening in plaque-coated vessels. This suggests that drug delivery may be less effective in Tg mice but that these slower leakage kinetics may improve the safety of the treatment.

CONCLUSION

This data suggests that FUS-mediated BBB opening can improve cognition without drug delivery and in the presence of compromised vasculature suggesting that FUS should be further studied as a potential treatment for Alzheimer’s disease.

CLINICAL RELEVANCE/APPLICATION

Pre-clinical experiments suggest that MRIgFUS has the potential to positively affect symptoms and pathology associated with Alzheimer’s disease in addition to its proven ability to improve drug delivery to the brain. Clinical ultrasound transducers are currently used in clinical trials making translation of this technology feasible.

SSK16-02

Cerebrovascular Reactivity Can Distinguish Alzheimer’s Disease from Patients with Mild Cognitive Impairment, and Age Matched Controls

Paul Dufort PhD (Presenter): Nothing to Disclose, Adrian P. Crawley PhD : Nothing to Disclose, David John Mikulis MD : Stockholder, Thornhill Research Inc Research Grant, General Electric Company

PURPOSE

To determine if cerebrovascular reactivity (CVR) is a potential metric for distinguishing Alzheimer's Disease (AD) from Mild Cognitive Impairment (MCI) patients and age-matched controls (NC).

METHOD AND MATERIALS

Anatomical and CVR BOLD MRI scans were performed in 5 NC, 5 AD, and 6 MCI subjects. The subjects underwent two 10 mmHg prospective iso-oxic square wave increases in end-tidal CO2 lasting 45 sec. and 130 sec. with an intervening 90 sec. normocapnic period. The regression coefficient of the % change in BOLD MRI signal vs. mmHg change in end-tidal CO2 is the CVR metric. CVR maps and anatomical scans were normalized to MNI152 space using SPM 8. A sparse logistic binomial regression classifier (GLMnet) was then trained to differentiate between NC and AD subjects only, using as input: (i) the set of CVR values at each spatially standardized grey matter (GM) voxel; or (ii) the statistical quantiles of texture features representing spatial heterogeneity in the CVR maps over all GM voxels. As an additional quantification of differences in spatial heterogeneity, the distribution of power in each spatial frequency band was calculated and displayed.

RESULTS

The classifier based on CVR at each GM voxel performed with 80%/100% sensitivity and specificity under leave-one-out cross-validation, and was not significant (p = 0.34) under random label permutation. The classifier based on CVR GM texture features had 100% sensitivity and specificity (when trained on any 9 of the subjects and tested on the tenth, all test cases were classified correctly), and a significance of p = 0.007 under random label permutation. Figure 1a shows the probability of AD as a function of group for the texture-based classifier, while Figure 1b shows the differences in spatial power distribution.

CONCLUSION

Despite the small sample size and the exclusion of the MCI patients in training, the classifier found a classification axis placing the MCIs between the NCs and AD subjects based only on CVR texture features. The classifier may identify progression toward AD based on changes in CVR before either cognitive decline or gray matter loss, warranting a prospective assessment of efficacy.

CLINICAL RELEVANCE/APPLICATION

The MRI CVR texture metric that has been developed could become an efficient and effective alternative means for screening patients with AD.

SSK16-03

Utility of Automated MRI Brain Volumetrics in Predicting Conversion of Mild Cognitive Impairment to Alzheimer’s Disease: A Retrospective Study in the De-identified National ADNI Database

John Tuje Ikhena MPH (Presenter): Nothing to Disclose, Bharath Gopal Rathakrishnan BS : Nothing to Disclose, P. Murali Doraiswamy MD : Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neuronetrix, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neuronetrix, Inc Research Grant, Medivation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder,
Effective Connectivity of Amnestic Mild Cognitive Impairment Based on Granger Causality Analysis

PURPOSE
To retrospectively use NeuroQuant to assess how well age-adjusted volumetric measures perform in predicting conversion to Alzheimer's disease in patients with mild cognitive impairment (MCI).

METHOD AND MATERIALS
We selected data for subjects from the Alzheimer's disease Neuroimaging Initiative (ADNI) database. Participating study sites were approved by their respective institutional review boards and all subjects provided full written informed consents prior to data collection. All protected health information from the patient data was de-identified. We analyzed data from 281 subjects with mild cognitive impairment (260 with late MCI; 34% female) in the ADNI database and assessed the predictive values of MMSE, hippocampal volumes and lateral ventricles volume in converting to Alzheimer’s disease over a 3-year follow-up period. MRI volumetrics were derived from T1-weighted magnetic resonance (MR) imaging data from NeuroQuant. Data obtained were analyzed using Chi-Square test, Receiver operating characteristic (ROC) analysis and regression models.

RESULTS
46% of patients with late MCI converted to Alzheimer’s (110 subjects total) at 3 years follow up. We found that hippocampal volume has a 69.5% likelihood of predicting conversion to Alzheimer's (AUC - 0.695, p

CONCLUSION
Among the various age-adjusted NeuroQuant measures we analyzed, hippocampal volume was found to be the most sensitive in predicting conversion to Alzheimer’s in MCI subjects. Sensitivity increased when MMSE was added to these estimates. Therefore we conclude that in developing a predictive model, it would be vital to include MMSE and hippocampal volume of subjects.

CLINICAL RELEVANCE/APPLICATION
Our study quantitatively examines the utility of a currently available clinical implementation of automated volumetric assessment software (NeuroQuant) in the evaluation of MRI scans for predicting the conversion of MCI patients to Alzheimer’s disease. We will use this information to create an individualized risk-of-conversion profile for individual MCI patient’s based on volumetrics and other readily available clinical formation.
To evaluate the effective resting-state functional connectivity between PCC and other brain region and to understand the neuropathological mechanisms of amnestic mild cognitive impairment (aMCI), using Granger causality analysis method.

**RESULTS**

Significant lower connectivity (P<0.01) was observed in aMCI patients compared to controls, with decreased effective connectivity from PCC to the left cerebellar hemisphere, the left medial temporal lobe and bilateral prefrontal. Nevertheless, while considering the whole brain region connected to the PCC, connectivity enhanced in right thalamus, the left cerebellar hemisphere, the left superior temporal gyrus; where decreased in left frontal lobe, the left orbital gyrus.

**CONCLUSION**

The cognitive control functions reduced in aMCI, especially in the left frontal lob; The compensatory mechanisms of brain were active when the nerve transduction pathway was damaged. The loop of left cerebellar hemisphere and PCC may participate in the integration and management of episodic memory.

**CLINICAL RELEVANCE/APPLICATION**

Cognitive function disorders are observed in aMCI patients, which may provide information on the neuropathological mechanisms of aMCI.

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**Ex-vivo Quantitative Susceptibility Mapping Shows a Correlation between Magnetic Susceptibility and Alzheimer’s Pathology**

**PURPOSE**

Iron accumulation in the brain has been associated with aging, and Alzheimer’s disease (AD). MRI techniques that allow detection of iron accumulation may lead to development of biomarkers of AD pathology. Quantitative susceptibility mapping (QSM) was introduced recently, and is shown to be sensitive to changes in iron levels. Therefore, the purpose of this study was to investigate the neuropathologic correlates of magnetic susceptibility in subcortical gray matter, by conducting an ex-vivo QSM-pathology investigation of AD in a community cohort.

**METHOD AND MATERIALS**

Cerebral hemispheres were obtained from 94 participants (aged 65.5 ± 9.7) and 14 healthy group-matched on age, sex and education controls (aged 65.9 ± 9.1); The recruited patients demonstrated CDR scores of 0.5 and matched Petersen’s criteria with the neuropsychological examination. Imaging data were collected on a 3 T MR (GE Signa HDx). Functional data were acquired using a single shot GRE EPI sequence (TR/TE =2000/35 ms, flip angle=90°,FOV=256mm2, matrix= 64×64, 36 slices, slice thickness=3 mm, and 1 mm interslice). Structural data was acquired via a 3D fast field echo T1-weighted sequence (sagittal, TR/TE =8.2/3.2ms , flip angle=12°, FOV=256mm2, matrix= 256 × 256, slice thickness 1 mm, no gap, in-plane voxel size 1 mm × 1 mm). Resting-state fMRI data analysis was performed using the DPARSF and REST-GCA software. The results of posterior cingulated cortex (PCC) in the Meta analysis of aMCI were applied as the coordinates of the seed point for GCA analysis based on coefficient. Effective connectivity from PCC to brain region and vice versa were achieved. Two-sample T test was applied for the analysis of the differences of effective connectivity between the two groups.

**RESULTS**

Statistically significant positive correlations were detected between magnetic susceptibility values and the composite measure of global AD pathology in the putamen (p=0.035) and caudate (p=0.021).

**CONCLUSION**

These findings suggest that magnetic susceptibility values in subcortical gray matter measured with QSM are sensitive to AD pathology. This study provides a strong indication that QSM may play an important role in the development of biomarkers of AD pathology.
Unlike longitudinal FS, the MRP method calculates final atrophy estimates after each visit. Adding the CLINICAL RELEVANCE/APPLICATION FreeSurfer, especially in a setting with many time points. The combination of MRP and HHP is a robust and fast alternative to deviation of the atrophy rate was comparable to that of longitudinal FS, emphasizing longitudinal robustness of as longitudinal FS, which exploits information from both time points simultaneously. Moreover, the standard diagnostic performances were as follows (AUC; MRP / static FS / longitudinal FS): NC vs. MCI 0.65 / 0.67 / 0.69 / 0.76, MCI vs. AD 0.66 / 0.53 / 0.62. The MRP AUC was significantly larger (DeLong) than the static FS AUC for NC vs. AD and MCI vs. AD. In the remaining pairwise group comparisons, -1.63 (2.54), MCI -2.38 (3.28) / -3.69 (5.48) / -4.29 (5.32) / -4.83 (3.74). Diagnostic performances were as follows (AUC; MRP / static FS / longitudinal FS): NC vs. MCI 0.65 / 0.67 / 0.64, NC vs. AD 0.80 / 0.69 / 0.76, MCI vs. AD 0.66 / 0.53 / 0.62. The MRP AUC was significantly larger (DeLong) than the static FS AUC for NC vs. AD and MCI vs. AD. In the remaining pairwise group comparisons, MRP AUCs did not differ significantly from static FS AUCs. CONCLUSION The MRP method discriminated AD from either NC or MCI significantly better than static FS, and it was as good as longitudinal FS, which exploits information from both time points simultaneously. Moreover, the standard deviation of the atrophy rate was comparable to that of longitudinal FS, emphasizing longitudinal robustness of segmentations of the proposed method. The combination of MRP and HHP is a robust and fast alternative to FreeSurfer, especially in a setting with many time points.

CLINICAL RELEVANCE/APPLICATION These results suggest that QSM may be sensitive to iron accumulation due to AD pathology.
Unlike longitudinal FS, the MRP method calculates final atrophy estimates after each visit. Adding the comparable performance, the proposed method is a robust alternative for clinical trials.

**SSK16-09**

**Is Diffusion Kurtosis a New Biomarker to Assess the Vulnerable Brain Structure in Alzheimer’s Disease?**

Yanwei Miao (Presenter): Nothing to Disclose, Rui Hu MS: Nothing to Disclose, Wei-Wei Wang MD, PhD: Nothing to Disclose, Bingbing Gao: Nothing to Disclose, Shiyun Tian: Nothing to Disclose, Minting Zheng: Nothing to Disclose, He Qing Wang MSc: Nothing to Disclose

**PURPOSE**

As a kind of degeneration diseases, Alzheimer’s disease (AD) progressively involves into the different brain regions in turn. The measurement of brain region volume is up to date a structure biomarker for AD, but it is not used widely based on inconvenient process. This study is to exploit the ability of diffusion kurtosis imaging (DKI) on the detection of brain structure vulnerability in AD.

**METHOD AND MATERIALS**

Twenty three cases of clinically confirmed AD and Twenty four age- and sex-matched healthy volunteers underwent conventional MRI scan and DKI scanning on a 3.0T MR imaging scanner. The bilateral MK values, Ka values, Kr values, MD values, Da values, Dr values and FA values of the frontal WM, parietal WM, occipital WM, temporal WM, hippocampus, thalamus, splenium of the corpus callosum, genu of the corpus callosum, trunk of the corpus callosum, anterior limb of the internal capsule, posterior limb of the internal capsule, external capsule, and hemispherium cerebelli were measured manually by two neuroradiologist respectively. Two independent samples t-test was used to compare the mean values of parameters in all brain regions between the AD and healthy groups. Receiver operating characteristic (ROC) test were used to assess the ability of regional diffusion measures to discriminate differences between groups.

**RESULTS**

There is the high consistency of all DKI data between the two measurers (ICC=0.96). The significant different mean value of MK, Ka, Kr, MD, Da, Dr and FA value were present between AD group and healthy group in all regions, especially in the parietal WM, temporal WM and hippocampus.

**CONCLUSION**

The temporal WM, hippocampus and parietal WM are the vulnerable brain structures assessed by using DKI parameters.

**CLINICAL RELEVANCE/APPLICATION**

DKI can quantitatively evaluate microstructure damage in AD patients.

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**SSK17**

**Neuroradiology/Head and Neck (Head & Neck Tumors)**

**Science Papers**

**PURPOSE**

To evaluate the utility of arterial spin labeling perfusion weighted MR imaging in differentiating malignant from benign tumors of head and neck.

**METHOD AND MATERIALS**

Prospective study was done upon 37 patients (23M, 14F aged 28-72 ys: mean 49ys) with head and neck solid.
masses at 1.5 Tesla scanner (Ingenia Philips Nederland). Routine pre and post contrast and diffusion weighted MR imaging of head and neck region were done for all patients. Multi-phases arterial spin labeling with FEEPI sequence was applied. The applied scanning parameters: TR = 2500 ms, TE = 20 ms, flip angle = 35 degrees, slice thickness = 6 mm, interslice gap = 1 mm, NEX = 1, FOV = 25 cm X 20 cm, SENSE factor = 2.5 and scanning time = 4 minutes. There was reconstruction of 1200 source images. The tumor blood volume (rTBV) parametric perfusion maps were reconstructed from source images. The regional tumor blood volume (rTBV) were correlated and calculated with pathological findings.

RESULTS

There was a statistically significant difference in (rTBV) between malignant tumors and benign lesions of head and neck (P=0.001). Also, there was significant difference (P=0.001) in rTBV between well and moderately differentiated malignancy versus poorly and undifferentiated head and neck malignancy. The rTBV was correlated with ADC value (r=0.879). Selection a threshold of rTBV for differentiating malignant from benign tumors results in area under the curve of 0.863, accuracy of 87%, sensitivity of 82%, specificity of 78%, positive predictive value of 83% and negative predictive value of 86%.

CONCLUSION

We concluded that arterial spin labeling perfusion weighted MR imaging is a non-invasive imaging technique that can play a role in differentiation malignant from benign tumors of head and neck.

CLINICAL RELEVANCE/APPLICATION

Arterial spin labeling MR imaging is a non-invasive imaging technique may differentiate malignant tumors of head and neck from benign lesions. So, it can be added into routine MR imaging of head and neck.

SSK17-02

Virtual Monoenergetic Reconstructions of Dual-Energy CT Improve Image Quality and Delineation of Head and Neck Squamous Cell Carcinoma

Julian Lukas Wichmann MD (Presenter): Nothing to Disclose, Eva-Maria Noske: Nothing to Disclose, Johannes Kraft: Nothing to Disclose, Iris Burck MD: Nothing to Disclose, Claudia Freilisen: Nothing to Disclose, Josef Matthias Kerl MD: Research Consultant, Siemens AG, Ralf W. Bauer MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Boris Bodelle MD: Nothing to Disclose, Thomas Lehndt MD: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose, Boris Schulz MD: Nothing to Disclose

PURPOSE

To evaluate virtual monoenergetic reconstructions of dual-energy computed tomography (DECT) regarding their impact on objective and subjective image quality in patients with head and neck squamous cell carcinoma (HNSCC).

METHOD AND MATERIALS

71 Patients (53 male, 18 female; 59.3 years ± 12.0) with biopsy-confirmed untreated primary (n = 55) or recurrent (n = 16) head and neck SCC underwent DECT. Standard linear blending (30% of 80 kVp, 70% of 140 kVp) and four virtual monoenergetic image series at 40, 60, 80, 100 keV were reconstructed. Attenuation of tumor and other anatomic landmarks and image noise were measured, lesion contrast-to-noise ratio (CNR) was calculated. Two observers subjectively rated each image series using a 5-point scale regarding overall image quality, tumor delineation, image sharpness and noise.

RESULTS

Tumor attenuation peaked in the 40 keV reconstructions (140.2 HU ± 42.6) followed by the 60 keV (121.7 HU ± 25.5) and M_0.3 series (102.7 ± 22.3; all P < 0.001). Calculated lesion CNR was superior in the 60 keV reconstructions (6.76 ± 3.43; all P < 0.001) and all other monoenergetic series (all P < 0.001). Subjective image quality (4.22; κ = 0.411) and tumor delineation was highest for the 60 keV reconstructions (4.35; κ = 0.451) compared to the M_0.3 (3.81; κ = 0.394; 3.77; κ = 0.451; all P < 0.001). Differences between both series regarding image sharpness were non-significant (3.81 vs. 3.79; P = 0.78). Subjective rating regarding absence of image noise was rated highest for the 80 and 100 keV series (4.31 vs. 4.34; P = 0.522).

CONCLUSION

Virtual monoenergetic reconstructions at 60 keV of DECT data significantly improve objective tumor enhancement and CNR while subjective overall image quality and tumor delineation are also superior compared to the standard linear blending setting in patients with head and neck SCC.

CLINICAL RELEVANCE/APPLICATION

Objective and subjective image quality can be significantly improved using monoenergetic reconstructions of DECT data in patients with head and neck squamous cell carcinoma.

SSK17-03

The Association of the BRAFV600E Mutation with Sonographic Features and Clinicopathologic Parameters in a Large-scale Study Population with Conventional Papillary Thyroid Carcinoma

Ah Young Park MD (Presenter): Nothing to Disclose, Eun Ju Son MD, PhD: Nothing to Disclose, Jeong-Ah Kim MD, PhD: Nothing to Disclose, Ji Hyun Youk MD: Nothing to Disclose, Yun Joo Park MD, PhD: Nothing to Disclose, Cheong Soo Park: Nothing to Disclose

PURPOSE

Nothing to Disclose
To evaluate the association of the BRAFV600E mutation with sonographic features and clinicopathologic parameters in a large-scale study population with conventional papillary thyroid carcinoma (PTC).

**METHOD AND MATERIALS**

This was an institutional review board-approved retrospective study with waiver of informed consent. Between January and July 2010, 688 patients who underwent thyroidectomy for conventional PTC were enrolled. The sonographic features, clinicopathologic parameters and the presence of BRAFV600E mutation were retrospectively reviewed. The rate of BRAFV600E mutation was calculated. The sonographic features and clinicopathologic parameters were compared between the BRAF-positive PTC and BRAF-negative PTC. The association of sonographic features with BRAFV600E mutation was evaluated in papillary thyroid microcarcinoma (PTMC group) and PTC larger than 10mm (PTC>10mm group), respectively.

**RESULTS**

The BRAFV600E mutation was detected in 69.2% (476 of 688). The sonographic features were not significantly different between the BRAF-positive and negative PTC, also in both PTMC and PTC>10mm groups, respectively. The BRAFV600E mutation was associated with male gender, large tumor size, extrathyroidal extension, central and lateral lymph node metastasis, and advanced tumor stage (P=.028 for the patients' sex, P<.0001 for tumor size, extrathyroidal extension, lymph node metastasis and tumor stage).

**CONCLUSION**

The BRAFV600E mutation was not associated with sonographic features, regardless of tumor size in PTC patients, but was associated with poor clinicopathologic parameters.

**CLINICAL RELEVANCE/APPLICATION**

Therefore, preoperative BRAFV600E mutation analysis for thyroid nodule with suspicious sonographic features could be recommendable for risk stratification and initial surgical approach of PTC.

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**SSK17-04 Dynamic contrast-enhanced MRI in the Differentiation of Posttreatment Changes from Tumor of the Head and Neck**

*Young Jun Choi MD (Presenter): Nothing to Disclose, Jung Hwan Baek: Nothing to Disclose, Yu Sub Sung: Nothing to Disclose, Jeong Hyun Lee MD, PhD: Nothing to Disclose*

**PURPOSE**

The aim of this study was to investigate the value of dynamic contrast-enhanced MRI (DCE-MRI) with model-free analysis in differentiation of viable tumor from posttreatment changes.

**METHOD AND MATERIALS**

We enrolled twenty-two patients with malignant tumors of the head and neck after definitive treatment, who underwent DCE-MRI during follow-up. Patients were divided into viable tumor (n=11) or post-treatment (n=11) groups according to the results of biopsy or clinical and radiologic follow-up. Patterns of time-signal-intensity (TSI) curves were classified including "progressive increment" as type I, "plateau" as type II and "washout" as type III. Patterns of TSI curves and DCE-MRI parameters including whole area-under-the-curve (AUC) and rAUC were compared between two groups (rAUC = [AUC of the initial 90 seconds]/[AUC of the final 90 seconds]). Inter-reader agreement was also tested by two independent readers for TSI curve pattern analysis.

**RESULTS**

TSI curve patterns for viable tumor vs. posttreatment changes were 13.6% vs. 86.7% for type I, 50% vs. 13.6% for type II, and 36.4% vs. 0% for type III, which was significantly different by statistical test (P<.05). Whole AUC and rAUC were also significantly different between two groups (P<.05, each). ROC curve analyses showed TSI curve pattern as the best single predictor of the presence of viable tumor with sensitivity of 86.4% and specificity of 86.4% (P<.0001; optimum cutoff with type II). The inter-reader agreement was excellent with χ-value of 0.887.

**CONCLUSION**

TSI curve pattern derived from DCE-MRI is a potential noninvasive imaging biomarker for differentiation of viable tumor from post-treatment changes in patients with head and neck malignancy.

**CLINICAL RELEVANCE/APPLICATION**

TSI curve pattern derived from DCE-MRI is a potential noninvasive imaging biomarker for differentiation of viable tumor from post-treatment changes in patients with head and neck malignancy.

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**SSK17-05 The Prognostic Value of First FDG PET Response Following Re-irradiation with Stereotactic Body Radiotherapy Plus Cetuximab in Patients with Recurrent Previously-irradiated Squamous Cell Carcinoma of the Head and Neck: Results from a Phase II Trial**

*John A. Vargo MD (Presenter): Nothing to Disclose, Robert L. Ferris MD, PhD: Nothing to Disclose, David Clump: Nothing to Disclose, Barton F. Branstetter MD: Nothing to Disclose, Carl Seynnaeve MD: Nothing to Disclose*
SSK17-07

Use of Pretreatment Semiquantitative and Quantitative Dynamic Contrast-Enhanced Magnetic Resonance Imaging in Predicting Sensitivity of Concurrent Chemoradiation in Nasopharyngeal Carcinoma

ZHENYU DENG MD : Nothing to Disclose
Tingting WANG MD : Nothing to Disclose
Meng LIN (Presenter) : Nothing to Disclose
Xiaoduo YU : Nothing to Disclose
Michael GIBSON MD : Nothing to Disclose
Jonas T. JOHNSON MD : Nothing to Disclose
Dwight E. HERON MD : Nothing to Disclose

PURPOSE
Locally-recurrent previously-irradiated head-and-neck cancer (rHNC) remains a significant clinical challenge, with limited options for unresectable disease. Recently, SBRT + cetuximab has emerged as a viable regimen with reduced toxicity and shorter treatment time compared to conventional options. Response evaluation in patients with recurrent disease is complicated by anatomical distortion from prior treatment and recurrent tumor. As part of a Phase II trial examining SBRT + cetuximab in rHNC, assessment by PET/CT at 2-months was included as a secondary metric to better define the role of PET/CT as an early & more sensitive biomarker of response compared to CT alone.

METHOD AND MATERIALS
From July 2007 to March 2013, patients >18 with inoperable locoregionally-confined rHNC within a previously-irradiated field receiving >= 60Gy, ECOG 0-1, & normal hepatic/renal function were enrolled. Patients received concurrent cetuximab (400mg/m2 on day -7 then 250mg/m2 on days 0 and +8) plus SBRT (40-44Gy in 5 fractions over 1-2 week). The primary endpoints: loco regional progression-free survival (PFS) & treatment-related toxicity. Secondary end-points: response rates and changes in tumor glucose metabolism post-therapy as assessed by subjective interpretation of the FDG PET/CT.

RESULTS
Fifty patients were enrolled, of which 48 were eligible. Median follow-up for surviving patients was 18 months (range: 10 -70). Per protocol first FDG PET/CT was performed 8 week post-treatment in 44 patients (92%). Response as assessed by first PET/CT was as follows: progression 36%, stable disease 14%, partial response 30%, and complete response 21%, respectively. Complete metabolic response by first FDG PET/CT was a significant predictor of progression free survival (1-year:71% vs. 25%, p = 0.049) and overall survival (1-year 67% vs. 35%, p = 0.047).

CONCLUSION
Complete metabolic response by FDG PET/CT appears to be an early predictor of overall outcome following SBRT + cetuximab. Further ongoing analysis within this recently complete phase II trial will help to better clarify the prognostic significance of FDG-PET/CT in comparison to traditional anatomical CT-based response metrics.

CLINICAL RELEVANCE/APPLICATION
In a phase II protocol examining SBRT + cetuximab for patients with rHNC, we show potential efficacy with good response rates & complete response by 2-month PET/CT may guide further management.
Resonance Imaging in Predicting Sensitivity of Concurrent Chemoradiation in Nasopharyngeal Carcinoma

Meng Lin (Presenter): Nothing to Disclose, Xiaoduo Yu: Nothing to Disclose, Lin Li MD: Nothing to Disclose, Dehong Luo MD: Nothing to Disclose, Chun-Wu Zhou MD: Nothing to Disclose, ZHENYU ZHOU: Nothing to Disclose

PURPOSE

To evaluate the use of pretreatment semi-quantitative and quantitative dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) in predicting sensitivity of concurrent chemoradiation in nasopharyngeal carcinoma.

METHOD AND MATERIALS

36 patients with nasopharyngeal carcinoma proved by nasopharyngoscope and biopsy pathology (from January to December 2013) underwent DCE-MRI exams before concurrent chemoradiation. Semi-quantitative and quantitative parameters of the mean (delineation of maximum area of tumor) and hot area (depicted on Ktrans map) were processed by GenIQ software (GE) including MaxSlop, CER, IAUGC, Ktrans, Kep and Ve. The patients were re-examined MRI during treatment (with dose of 50Gy) and after treatment (at the end of conventional treatment). According to the tumor regression rate after treatment, the patients were classified into group complete response (CR) and group non-CR including partial response (PR) and stable disease (SD). The correlations between pretreatment parameters and tumor regression rate were analyzed. Parameters between group CR and non-CR were compared by independent T-test. The value of parameters on predicting CR were assessed by ROC.

RESULTS

Tumor regression rate during and after treatment showed positive correlation with tumor mean and hot area IAUGC, Ktrans, Kep, mean Maxslop and hot area CER ($r$: 0.341 ~ 0.608, $P$:  

CONCLUSION

Pretreatment semiquantitative and quantitative DCE-MRI were capable of predicting sensitivity of concurrent chemoradiation in nasopharyngeal carcinoma.

CLINICAL RELEVANCE/APPLICATION

Pretreatment semi-quantitative and quantitative parameters of DCE-MRI has potential to be helpful in individualized therapy.

Correlations between Perfusion and Intravoxel Incoherent Motion (IVIM) Diffusion in Nasopharyngeal Carcinoma

yu xiao ping MD (Presenter): Nothing to Disclose, Li Fei Ping: Nothing to Disclose, Lu Qiang: Nothing to Disclose

PURPOSE

To study the potential correlations between MR perfusion parameters and intravoxel incoherent motion (IVIM) parameters in nasopharyngeal carcinoma (NPC), and hence investigate the underlying clinical significance.

METHOD AND MATERIALS

A total of 30 patients detected with NPC (21 men, 9 women) were enrolled in this study. Content forms were obtained from all patients prior to the study. All patients underwent dynamic contrast-enhanced T1-weighted MR perfusion and multi-b value based IVIM diffusion exams ($b=0, 50, 80, 100, 150, 200, 400, 600, 800, 1000$ s/mm²) on a 1.5T scanner. For each primary tumor, MR perfusion parameters including Ktrans (volume transfer constant), Ve (volume fraction), FPV (fractional plasma volume) and kep were obtained and recorded from the perfusion data. Additionally, IVIM parameters (ADCstandard, ADCslow, ADCfast, Fraction of ADCfast) were obtained from the IVIM diffusion MR maps. Pearson correlation coefficients between the two groups were obtained to evaluate the potential correlations between MR perfusion parameters and IVIM diffusion parameters.

RESULTS

The Ktrans ,Kep ,Ve and FPV values of NPC were $0.336±0.094$/min, $1.502±0.420$/min, $0.234±0.053$ and $0.008±0.009$ respectively; whereas the standardADC, slowADC,fastADC, fraction of fastADC of the corresponding NPC were $(0.950±0.175)×10^{-3}$ mm²/s, $(0.685±0.113)×10^{-3}$ mm²/s, $(0.020±0.018)×10^{-3}$ mm²/s and $(0.315±0.102)×10^{-3}$ mm²/s respectively. Ve value revealed a significant correlation with fastADC values($r=0.450$, $p=0.013$). Ktrans value showed a positive correlation with fastADC values($r=0.378$, $p=0.039$). However Kep and FPV values did not show significant statistical correlation with the IVIM parameters in NPC(table 1).

CONCLUSION

Ktrans and FPV values of the perfusion imaging showed significant correlation with the IVIM parameters, such correlation was not seen in between other perfusion parameters and IVIM parameters. The underlying physiological mechanism is to be studied.

CLINICAL RELEVANCE/APPLICATION

The correlations between MR perfusion parameters and intravoxel incoherent motion diffusion parameters is helpful in understanding the relation between the two MR exams on nasopharyngeal carcinoma.
Head and Neck Low-tube-Voltage 80-kVp CT of Primary and Recurrent Squamous Cell Carcinoma: Evaluation of Objective and Subjective Image Quality

Jan-Erik Scholtz (Presenter): Nothing to Disclose, Johannes Kraft: Nothing to Disclose, Eva-Maria Noske: Nothing to Disclose, Boris Schulz MD: Nothing to Disclose, Claudia Freiliesen: Nothing to Disclose, Boris Bodelle MD: Nothing to Disclose, Iris Burck MD: Nothing to Disclose, Jens Wagenblast MD: Nothing to Disclose, Josef Matthias Kerl MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Ralf W. Bauer MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Thomas Lehnert MD: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose, Julian Lukas Wichmann MD: Nothing to Disclose

PURPOSE

To investigate a low-tube-voltage 80-kVp acquisition technique for computed tomography (CT) of head and neck primary and recurrent squamous cell carcinoma (SCC) with regard to objective and subjective image quality.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board, and written informed consent was waived. We retrospectively evaluated 65 patients (47 male, 18 female; mean age: 62.1 years) who underwent head and neck dual-energy CT due to biopsy-proven primary (n = 50) or recurrent (n = 15) SCC. 80-kVp and standard blended 120-kVp image series were compared. Image noise and signal attenuation of detected malignancy, cervical vessels and various soft tissue structures were measured, tumor signal-to-noise (SNR) and contrast-to-noise ratio (CNR) were calculated. Subjective image quality was rated by two independent reviewers using a 5-point grading scale regarding overall image quality, lesion delineation, image sharpness, and image noise. Interobserver agreement was calculated using intraclass correlation coefficient (ICC).

RESULTS

Mean tumor attenuation (153.8±41.2 vs. 97.1±29.2 HU), SNR (10.7±6.9 vs. 8.3±4.9), CNR (8.1±5.4 vs. 4.8±4.9), and subjective tumor delineation (score, 4.65 vs. 4.07) were significantly increased (all \(P<0.001\)) with 80-kVp acquisition compared to standard blended 120-kVp images. Interobserver agreement was substantial (ICC, 0.74; 95% confidence intervals: 0.58-0.83). The calculated average dose-length-product was reduced by 48.7% with 80-kVp acquisition compared to the standard dual-energy CT examination (135.9±16.1 vs. 279.0±32.1 mGy•cm, \(P<0.001\)).

CONCLUSION

Head and neck CT with low-tube-voltage 80-kVp acquisition provides increased tumor delineation, SNR, and CNR for CT imaging of primary and recurrent SCC compared to standard 120-kVp acquisition with an accompanying significant reduction of radiation exposure.

CLINICAL RELEVANCE/APPLICATION

Head and neck CT with low-tube-voltage 80-kVp acquisition may improve delineation of squamous cell carcinoma with a simultaneous reduction of radiation dose.

NRS-WEA

Neuroradiology Wednesday Poster Discussions

Scientific Posters

NR

AMA PRA Category 1 Credits™: .50

Wed, Dec 3 12:15 PM - 12:45 PM  Location: NR Community, Learning Center

Participants

Moderator
Pratik Mukherjee MD, PhD: Research Grant, General Electric Company Medical Advisory Board, General Electric Company

Sub-Events

NRS431

Should We Perform Half-body or Whole-body 18F-FDG PET-CT in the Management of Head and Neck Cancers? (Station #1)


PURPOSE

18F-FDG PET-CT has been playing a significant role in the management of head and neck (HandN) malignancies. There have been recent suggestions that half-body (above diaphragm) PET-CT may be sufficient...
for the management of HandN cancer patients. This study aims to determine if half-body PET-CT is a safe practice option, or should we stick to whole-body PET-CT.

**METHOD AND MATERIALS**

A 6-year-period (2008-2013) retrospective analysis of 729 consecutive PET-CT scans of HandN cancer patients was performed in order to record the incidence of below-diaphragm metastases and below-diaphragm synchronous primary malignancies. The four main indications of PET-CT in HandN cancers are: pre-treatment staging of high-risk of disseminated disease, metastatic cervical lymphadenopathy with unknown primary, assessment of therapeutic response and detection of recurrence/relapse.

**RESULTS**

A total of 664 Squamous Cell Carcinoma (SCC) and 65 Nasopharyngeal Carcinoma (NPC) cases were studied. 35/729 (4.8%) cases showed below-diaphragm metastases (liver, renal, adrenal, retroperitoneal and lumbar vertebral metastases), 24 out of 664 (3.3%) by SCC and 11 out of 65 (16.9%) by NPC. 52/729 (7.1%) cases showed synchronous primary malignancies, of which 32 (4.4%) were below-diaphragm (colonic, pancreatic, bladder cancers and retroperitoneal lymphoma). In total, 84/729 (11.5%) HandN cases had either below-diaphragm metastases or below-diaphragm synchronous primary malignancies.

**CONCLUSION**

A significant proportion of HandN patients, over 10%, have either below-diaphragm metastases or below-diaphragm synchronous primary malignancies. Half-body (above diaphragm) PET-CT would have missed these lesions, leading to mis-staging of disease and mis-management of patients. It is important to keep whole-body PET-CT in practice in the management of HandN cancers. This is more so in the management of NPC compared to SCC.

**CLINICAL RELEVANCE/APPLICATION**

It is essential to perform whole-body PET-CT in the management of HandN Cancers. Recently suggested half-body scan misses a significant proportion of below-diaphragm metastases and synchronous cancers.

**NRS432**

**Assessment of Response to Chemoradiotherapy for Nasopharyngeal Carcinoma: Value of Dynamic Contrast-Enhanced MR Imaging at 3 T (Station #2)**

Chen Yunbin MD : Nothing to Disclose, Dechun Zheng MS (Presenter): Nothing to Disclose, Xiangyi Liu BS : Nothing to Disclose, Weibo Chen PhD : Nothing to Disclose, Queenie Chan PhD : Nothing to Disclose, Youping Xiao : Nothing to Disclose, Wang Ren : Nothing to Disclose

**PURPOSE**

To prospectively investigate the value of dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) to early predict chemoradiotherapy (CRT) response of nasopharyngeal carcinoma (NPC).

**METHOD AND MATERIALS**

Forty-two patients with advanced NPC scheduled for neoadjuvant chemotherapy (NAC) following by CRT were recruited and received three DCE-MRI exams before treatment (Pre-Tx), 3 days (Day3-Tx) and 40 days (Day40-Tx) after chemotherapy initiation on 3T clinical scanner system (Achieva TX, Philips Healthcare). RECIST 1.1 criteria was applied to assess tumor response to NAC and CRT. After two cycles of NAC, both complete response (CR) and partial response (PR) patients were categorized into responders, and stable disease (SD) into non-responders. We used DCE-Tool (Philips Healthcare, Best, Netherlands) to measure kinetic parameters (Ktrans, Kep, ve, and vp) from primary tumors based on extended Tofts model. Kinetic parameters and their corresponding changes Δparameter(0-X) (X=3 or 40) were compared between responders and non-responders using student T or Mann-Whitney U test.

**RESULTS**

After two cycles of NAC, 27 of 41 patients were categorized into responders; and 31 of 41 into responders at the end of CRT. Response to NAC is correlated with short-term control (P=0.01). Compare to non-responder group, the responder group presented significantly larger ΔKtrans(0-3) (0.068 vs -0.078 min-1), ΔKep(0-3) (0.071 vs -0.111 min-1) and Δve(0.009 vs -0.031) values after NAC (p<0.05). The CR group after CRT exhibited significantly lower Ktrans(Day40-Tx) than residual group (0.264 vs 0.35 min-1, p =0.05) and larger ΔKtrans(0-3) by contrary (0.044 vs -0.069 min-1, p =0.05). For the above parameters, we gained high sensitivity (range from 74.1% to 90%) and moderate to high specificity (range from 50% to 84.3%) to distinguish non-responders from responders, with promising diagnosis efficiency range from 69.3% to 88%

**CONCLUSION**

Our study showed that DCE-MRI was feasible to non-invasively monitor therapy response of NPC. Changes of kinetic parameters early after treatment were potential markers for NPC patients who received NAC treatment following by CRT.

**CLINICAL RELEVANCE/APPLICATION**

Vasculature assessment by DCE-MRI prior and during NAC process is valuable to evaluate tumor response to NAC and CRT in NPC. DCE-MRI might afford supplementary non-invasive prognostic markers for NPC.

**NRS433**

**Can Galectin-3 be a Useful Marker for Papillary Thyroid Microcarcinoma? (Station #3)**

Dechun Zheng MS (Presenter): Nothing to Disclose, Youping Xiao : Nothing to Disclose, Dechun Zheng MS (Presenter): Nothing to Disclose, Queenie Chan PhD : Nothing to Disclose, Youping Xiao : Nothing to Disclose, Wang Ren : Nothing to Disclose

**PURPOSE**

Vasculature assessment by DCE-MRI prior and during NAC process is valuable to evaluate tumor response to NAC and CRT in NPC. DCE-MRI might afford supplementary non-invasive prognostic markers for NPC.
Hye Mi Gweon MD (Presenter):  Nothing to Disclose, Eun Ju Son MD, PhD:  Nothing to Disclose, Ji Hyun Youk MD:  Nothing to Disclose, Jeong-Ah Kim MD, PhD:  Nothing to Disclose

PURPOSE
To determine the utility of galectin-3 in preoperative fine-needle aspiration (FNA) cytology for papillary thyroid microcarcinoma (PTMC)

METHOD AND MATERIALS
Between June 2011 and December 2012, 530 consecutive patients with PTMC who underwent surgery and preoperative ultrasonography (US)-guided FNA with galectin-3 immunostaining were reviewed. Galectin-3 considered positive if the percentage of tumor cells showing definite cytoplasmic immunostaining exceeded 5%. US features and clinicopathologic results were compared between PTMC with galectin-3 positive and negative. Fisher exact test or chi-square test was used for statistical analysis. The median tumor size was 6 mm (range, 1-10 mm).

RESULTS
Of the 530 PTMCs, 203 (38.3%) PTMCs had galectin-3 positive in preoperative FNA samples. There was no significant difference in US features between galectin-3 positive and negative PTMCs. There was no significant correlation in extracapsular invasion (43.8% vs. 40.1%, p=0.415) and lymph node metastasis (27.1% vs. 24.2%, p=0.473).

CONCLUSION
The sensitivity of galectin-3 in FNA samples was low (38.3%) in PTMC. Preoperative expression of galectin-3 in FNA cytology did not correlate with US findings nor associate with pathological parameters such as extracapsular invasion and LN metastasis in PTMC.

CLINICAL RELEVANCE/APPLICATION
Previous published studies reported high sensitivity and diagnostic accuracy of galectin-3 for distinguishing benign and malignant thyroid nodules and significant correlation with galectin-3 expression and clinicopathologic results. However, galectin-3 in FNA cytology may be not useful for small thyroid nodule less than 10 mm.

NRS434

Application of a Support Vector Machine Learning Algorithm towards the Accurate Identification of Alzheimer’s Dementia with Perfusion Arterial Spin Labeled MR Imaging (Station #4)

Cyrus Raji MD, PhD (Presenter):  Nothing to Disclose, Weiying Dai PhD:  Nothing to Disclose, Oscar Lopez MD :  Nothing to Disclose, H. Michael Gach PhD :  Nothing to Disclose, Lewis H. Kuller MD :  Nothing to Disclose, Paul Thompson PhD :  Nothing to Disclose, Michael D. Kuo MD :  Consultant, Boehringer Ingelheim GmbH Consultant, Confluence Life Sciences, Inc, James T. Becker PhD :  Nothing to Disclose

PURPOSE
Alzheimer’s disease (AD) is the most common cause of dementia and early accurate diagnosis is of great interest. Perfusion MR imaging with arterial spin labeling (ASL) quantifies regional cerebral blood flow that can alter very early in the course of neurodegenerative disease when symptoms of memory loss are often subtle. Perfusion ASL MR imaging therefore holds promise to identify AD before symptoms are clinically expressed. Machine learning methods such as support vector machine (SVM) offer a robust approach to quantitatively delineate normal individuals from AD. The purpose of this study was to test SVM for improved AD diagnosis on perfusion ASL MR imaging with structural MR for comparison.

METHOD AND MATERIALS
Study subjects were recruited from the population based Cardiovascular Health Study-Cognition study: 24 subjects, 12 controls and 12 persons with AD in 2002-2003 by NINCDS-ARDA Criteria with average age of 78. All MRI data were acquired using a 1.5 T GE Signa system (Milwaukee, WI, LX Version), after each subject provided informed consent either directly or by their caregiver per with institutional review board approval. Multi-slice continuous ASL was acquired. T1-weighted spoiled gradient-recalled echo (SPGR) images covering the whole brain were also acquired in orthogonal planes. SVM was applied on all structural and perfusion MR images using the Probid software (KC, London, http://tinyurl.com/l6frtdd).

RESULTS
Figure 1 shows screen shots from the Probid Graphical User Interface displaying results of an SVM analysis in both perfusion ASL (Figure 1a) and structural SPGR (Figure 1b) MR imaging. Class 1 (red circles) represents persons with AD and Class 2 (blue Xs) depict controls. Machine learning with SVM of perfusion ASL MR imaging is able to separate AD from control with 92% sensitivity, 92% specificity, and 92% accuracy. For SPGR MR structural imaging, classification was less effective with 42% sensitivity, 75% specificity, and 58% accuracy.

CONCLUSION
Machine learning SVM methods in perfusion MR imaging are able to separate AD from control with high sensitivity, specificity, and accuracy. Applying the same methodology to SPGR images is comparatively less effective for the same purpose.

CLINICAL RELEVANCE/APPLICATION
Fully automated machine learning with support vector machine (SVM) MR imaging could be very effective in the early diagnosis of AD.
Fully automated machine learning algorithms can be applied to perfusion ASL MR images for highly accurate identification of Alzheimer’s dementia. Such methods may be readily applied in clinical environments for improved diagnosis.

NRS435

Value of Diffusion-weighted Imaging in the Diagnosis of Benign and Malignant Lesions of the Tongue (Station #5)

Shujian Li (Presenter): Nothing to Disclose

PURPOSE

To observe the value of diffusion-weighted imaging (DWI) and ADC value in the diagnosis and differential diagnosis of benign and malignant lesions of the tongue.

METHOD AND MATERIALS

75 patients with lingual lesions, including 32 benign lesions and 43 malignant tumors underwent conventional MRI, contrast-enhanced MRI and DWI with b values of 0 and 1000 s/mm² before therapy. ADC maps were reconstructed, and the ADC values of the lingual lesions were calculated. The receiver operating characteristic curves (ROC) were constructed using optimal cut point of ADC to differentiate between benign lesions and malignant tumors of the tongue. The areas under the ROC curve for ADC were also calculated.

RESULTS

The mean ADC of benign lesions was (1.84±0.47) × 10⁻³mm²/s. The mean ADC of malignant tumors was (1.12±0.21) × 10⁻³mm²/s. Malignant tumors had lower ADCs than benign lesions (t = -8.038, P

CONCLUSION

Diffusion-weighted imaging can be applied as a complementary tool in the detection of benign and malignant lesions of the tongue.

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted imaging can be applied as a complementary tool in the detection of benign and malignant lesions of the tongue.

NRS437

Abnormal Baseline Brain Activity in Patients with Pulsatile Tinnitus: A Resting-state fMRI Study (Station #7)

Han Lv (Presenter): Nothing to Disclose, Zhenchang Wang MD, PhD: Nothing to Disclose, Fei Yan: Nothing to Disclose, Zhaohui Liu MD: Nothing to Disclose, Pengfei Zhao MD: Nothing to Disclose, Ting Li: Nothing to Disclose, Cheng Dong: Nothing to Disclose

PURPOSE

The aim of this study is to investigate whether altered baseline brain activity presents in patients with pulsatile tinnitus using resting-state functional magnetic resonance imaging (rs-fMRI) technique.

METHOD AND MATERIALS

The present study enrolled unilateral pulsatile tinnitus (PT) patients (n=42) and age-, sex-, and education matched normal control subjects (n=42) to investigate the brain structural changes, Amplitude of low-frequency fluctuation (ALFF) differences and their relationships with the clinical data between the two groups.

RESULTS

Compared with normal controls, structural changes were not present in patients group. PT patients showed significant increased ALFF in the bilateral precuneus, bilateral inferior frontal gyrus (IFG), and decreased ALFF in multiple occipital areas. Moreover, the increased THI score and PT duration was correlated with increased ALFF in precuneus and bilateral IFG. The increased ALFF in precuneus may reflect PT awareness as well as tinnitus related distress. The abnormal ALFF in bilateral IFG may relate with PT awareness, and may reflect the changed brain functional connectivity of PT patients. The decreased ALFF in multiple occipital brain areas is considered as a downregulation adjustment of the AOAs.

CONCLUSION

The abnormalities of spontaneous brain activity reflected by ALFF measurements in the absence of structural changes may provide insights into the neural reorganization in PT patients.

CLINICAL RELEVANCE/APPLICATION

The abnormalities of spontaneous brain activity reflected by ALFF measurements in the absence of structural changes may provide insights into the neural reorganization in PT patients.

NRS438

T1-DCE MRI for Targeting Navigated Biopsies in Intracranial Neoplasms (Station #8)
CONCLUSION

age-related changes in ADCs are expected. value and/or histogram width during the course, excluding 2 younger patients aged 2 and 6 years, where large labyrinthine hemorrhage. Those patients with acute extracranial pathologies showed increases in ADC peak histogram parameters. Four patients were diagnosed with acute craniofacial bone infarcts and another 3 with indications. One patient who developed multiple cerebral hemorrhages 3 days later showed increases in both widths ($r=-0.37$, $P=0.003$, hematocrit: $r=-0.37$, $P=0.003$, reticulocyte count: $r=0.32$, $P=0.011$), while no significant correlations were observed for histogram widths. Of 62 DWI studies, 36 DWI were imaged for acute intracranial volume, ADC peak value and histogram width were derived. The clinical chart was re-reviewed, ($3,899/74ms$ TR/TE, $89$ EPI-factor and $b=0, 1,000s/mm^2$). After generation of ADC histogram of the whole brain ADC Histogram Analysis in Sickle Cell Disease Patients: Correlation with Clinical Presentation and Longitudinal Changes in Histogram Parameters (Station #9)

NRS439

Memi Watanabe MD (Presenter): Nothing to Disclose, Karen Buch MD : Nothing to Disclose, Herman Jara PhD : Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co , Osamu Sakai MD, PhD : Speaker, Bracco Group Speaker, KYORIN Holdings, Inc Speaker, Eisai Co, Ltd

PURPOSE

To assess whether the quality of brain biopsies defined by permeability maps based on $T_1$-dynamic contrast-enhanced (DCE) MRI differs from biopsy site selection determined by a standard mapping method ($T_1$+gadolinium maps).

METHOD AND MATERIALS

In 12 brain tumor patients (5 glioblastoma (GBM), 1 anaplastic astrocytoma (AA), 1 oligoastrocytoma (OA), 5 meningioma), preoperative MRI were performed to guide neurosurgical biopsies; the examination encompassed a $T_1$-DCE permeability sequence at 3.0 Tesla (flip angle, 8°; dynamic scans, 50; voxel size, $1.57 \times 1.6 \times 3.0$ mm, $ap \times rl \times cc$) as well as a 3D $T_1$ sequence after iv gadobutrol (Gadovist) administration (0.1 mmol/kg body weight). Regions of interest (ROI) for tumor biopsies were defined either by choice of a neurosurgeon based on $T_1$-weighted gadolinium-enhanced images ($T_1$+Gd), or by a neuroradiologist based on permeability ($k_{trans}$) and extravascular extracellular volume fraction ($ve$) hot-spots. Subsequently, biopsies at these locations of the tumor were retrieved using a dedicated software (iPlanNet/BrainLab). A blinded neuropathologist compared biopsy histology to a reference histology based on separate large biopsies.

RESULTS

A total of 21 glioma (14 GBM, 5 AA, 2 OA) and 10 meningioma navigated biopsies were taken. Of these, 9 GBM biopsies were exclusively selected by $k_{trans}$ maps (neuroradiologist), whereas 5 were chosen based on $T_1$+Gd maps (neurosurgeon, standard method). 4/9 (44.4%) of $k_{trans}$ defined GBM biopsy histologies, but only 1/5 (20.0%) of $T_1$+Gd based biopsy histologies matched the reference histological diagnosis which based on large biopsy samples. In retrospective analysis, ROI based on $T_1$+Gd showed lower average $k_{trans}$ permeability and ve than those selected by permeability maps ($617.56$ vs. $43.15$ 10^{-3}/min; ve $2.57$ vs. 0.16).

CONCLUSION

ROI selection based on $k_{trans}$ permeability maps may improve the diagnostic quality of glioma biopsies.

CLINICAL RELEVANCE/APPLICATION

Unfavourable choice of CNS biopsy location may lead to doubtful diagnoses and false treatment. $T_1$-DCE MRI planned biopsy may improve the diagnostic quality of biopsy samples over standard $T_1$+Gd based biopsy location.

Brain ADC Histogram Analysis in Sickle Cell Disease Patients: Correlation with Clinical Presentation and Longitudinal Changes in Histogram Parameters

PURPOSE

To investigate the potential changes in apparent diffusion coefficient (ADC) histograms of the normal-appearing brains in patients with sickle cell disease (SCD) associated to the clinical manifestations.

METHOD AND MATERIALS

Following IRB approval, a retrospective review of brain diffusion-weighted imaging (DWI) performed during 2005-2008 identified 62 MRI studies of 44 SCD patients (age range 2-48 years) with no apparent brain abnormalities on conventional MRI. All subjects were imaged at 1.5T MR scanner with a protocol including DWI ($3,899/74ms$ TR/TE, $89$ EPI-factor and $b=0, 1,000s/mm^2$). After generation of ADC histogram of the whole brain, ADC peak value and histogram width were derived. The clinical chart was re-reviewed, $t$-test and Fisher’s exact test correlating clinical and histogram parameters.

RESULTS

Significant correlations were noted between ADC peak values and clinical parameters (hemoglobin level: $r=-0.37$, $P=0.003$, hematocrit: $r=-0.37$, $P=0.003$, reticulocyte count: $r=0.32$, $P=0.011$), while no significant correlations were observed for histogram widths. Of 62 DWI studies, 36 DWI were imaged for acute presentations often with crisis-related or stroke-like symptoms and showed significant increases in histogram widths ($P=0.014$), but not in ADC peak values ($P=0.06$), compared to DWI performed for non-acute indications. One patient who developed multiple cerebral hemorrhages 3 days later showed increases in both histogram parameters. Four patients were diagnosed with acute craniofacial bone infarcts and another 3 with labyrinthine hemorrhage. Those patients with acute extracranial pathologies showed increases in ADC peak value and/or histogram width during the course, excluding 2 younger patients aged 2 and 6 years, where large age-related changes in ADCs are expected.

CONCLUSION

To investigate the potential changes in apparent diffusion coefficient (ADC) histograms of the normal-appearing brains in patients with sickle cell disease (SCD) associated to the clinical manifestations.

METHOD AND MATERIALS

Following IRB approval, a retrospective review of brain diffusion-weighted imaging (DWI) performed during 2005-2008 identified 62 MRI studies of 44 SCD patients (age range 2-48 years) with no apparent brain abnormalities on conventional MRI. All subjects were imaged at 1.5T MR scanner with a protocol including DWI ($3,899/74ms$ TR/TE, $89$ EPI-factor and $b=0, 1,000s/mm^2$). After generation of ADC histogram of the whole brain, ADC peak value and histogram width were derived. The clinical chart was re-reviewed, focusing on hematological studies, clinical course and diagnosis. Statistical analyses were performed using $t$-test and Fisher’s exact test correlating clinical and histogram parameters.

RESULTS

Significant correlations were noted between ADC peak values and clinical parameters (hemoglobin level: $r=-0.37$, $P=0.003$, hematocrit: $r=-0.37$, $P=0.003$, reticulocyte count: $r=0.32$, $P=0.011$), while no significant correlations were observed for histogram widths. Of 62 DWI studies, 36 DWI were imaged for acute presentations often with crisis-related or stroke-like symptoms and showed significant increases in histogram widths ($P=0.014$), but not in ADC peak values ($P=0.06$), compared to DWI performed for non-acute indications. One patient who developed multiple cerebral hemorrhages 3 days later showed increases in both histogram parameters. Four patients were diagnosed with acute craniofacial bone infarcts and another 3 with labyrinthine hemorrhage. Those patients with acute extracranial pathologies showed increases in ADC peak value and/or histogram width during the course, excluding 2 younger patients aged 2 and 6 years, where large age-related changes in ADCs are expected.

CONCLUSION
In SCD patients with normal-appearing brains by conventional MRI, abnormalities in ADC histograms may be suggestive of pathological conditions such as intracranial hypertension. Therefore, careful imaging evaluation and clinical observation should be considered.

**CLINICAL RELEVANCE/APPLICATION**

Abnormal ADC histogram in a SCD patient may be suggestive of pathological condition despite normality on conventional MRI, and careful imaging evaluation and clinical observation should be considered.

**NRE264**

**Snot So Bad: Paranasal Sinus Normal Anatomy, Important Anatomic Variants, and What the Endoscopic Surgeon Wants to Know before and after Endoscopic Sinus Surgery (Station #10)**

William D. Hwang MD (Presenter): Nothing to Disclose, Mahmud Mossa-Basha MD: Nothing to Disclose, Greg E. Davis: Nothing to Disclose, Yoshimi Anzai MD: Nothing to Disclose

**TEACHING POINTS**

1. To review complex paranasal sinus anatomy in the preoperative setting based on an endoscopic approach and systematic imaging checklist. 2. To review important anatomic variants in sinus anatomy and how they can affect the surgical approach. 3. To describe the components of functional endoscopic sinus surgery (FESS) and review expected findings on post operative scans.

**TABLE OF CONTENTS/OUTLINE**

Paranasal sinus imaging anatomy and review of drainage pathways with correlation of endoscopic and virtual CT images important anatomic variants and incidental findings for the sinus surgeon to consider, with emphasis on ‘CLOSE’ mnemonic: Cribiform (Keros classification), Lamina (dehiscent?), Onodi (present?), Sphenoid (are they symmetric, is the optic nerve or carotid artery dehiscent), Ethmoid (is the anterior ethmoid artery present on a mesentery or embedded in bone) Checklist for standardized imaging reports including sinus symmetry, sinus disease, drainage pathway of the frontal sinuses, frontoethmoid cell classification (ie Kuhnl cells) Review of goals and elements of functional endoscopic sinus surgery (FESS) procedure Expected findings status post FESS Complications and findings associated with unsuccessful FESS (such as residual uncinate) and evaluation of new patients who are candidates for revision FESS

**NRE173**

**Dynamic Susceptibility Contrast-Enhanced Perfusion MR Imaging of Infectious Focal Brain Lesions: A Pictorial Review (Station #12)**

Eduardo Portela De Oliveira MD (Presenter): Nothing to Disclose, Valdecio Hilio Floriano MD, PhD: Nothing to Disclose, Ulysses Santos Torres MD: Nothing to Disclose, Antonio Ronalder Spotti: Nothing to Disclose, Antonio Soares Souza MD: Nothing to Disclose, Waldir Antonio Tognola: Nothing to Disclose, Jose Roberto Lopes Ferraz-Filho: Nothing to Disclose

**TEACHING POINTS**

Although conventional techniques of structural MRI with gadolinium-based contrast agents have a fundamental and well-established role in the diagnosis, evaluation and follow-up of brain lesions, dynamic susceptibility contrast-enhanced perfusion MR imaging (DSC-MRI) is a very important tool for characterizing the microcirculation of lesions. The purposes of this education exhibit are: 1) To review the clinical usefulness of DSC-MRI for the assessment of focal brain lesions, also discussing the implications of such method for the differentiation between infectious and neoplastic lesions. 2) To illustrate the main imaging findings of infectious lesions and to present cases mimicking neoplasms on conventional MRI. Radiologists should know the principles underlying the application of this complementary non-invasive tool and use it to improve the characterization of focal brain lesions, ultimately narrowing the differential diagnoses and avoiding unnecessary biopsies.

**TABLE OF CONTENTS/OUTLINE**

This exhibit will use a case-based approach to demonstrate characteristic MRI findings with emphasis in DSC-MRI in a range of infectious focal brain lesions. Representative cases will include pyogenic abscesses, toxoplasmosis, tuberculosis, cysticercosis, fungal infections, among others.

**NRE231**

**Hydrocephalus: Modernity and Mythology (Station #13)**

Jacques Romano MD (Presenter): Nothing to Disclose, Andrew Kobets MD: Nothing to Disclose

**TEACHING POINTS**

The learner will better appreciate the large gap between modern theories of hydrocephalus and its common understanding. We are taught in the major texts as well as in our training that communicating hydrocephalus is the result of an imbalance between CSF production at the choroid plexus and CSF resorption at the arachnoid granulations. This is known as the bulk flow theory which is easy to understand and explain. It is logically consistent and convincingly provides the learner with the illusion of understanding. Unfortunately, this explanation is inconsistent with many experimental and therapeutic observations. For example, third ventriculostomy is a procedure used to treat communicating hydrocephalus. But this procedure does not improve CSF resorption nor affect CSF production. We discuss the hydrodynamic theory which is more difficult to explain and understand but nevertheless more consistent with many of the relevant facts.

**TABLE OF CONTENTS/OUTLINE**

Imaging Findings in Hydrocephalus CSF production, resorption and turnover Problems with the bulk flow theory Monroe-Kelly doctrine Windkessel effect Hydrocephalus as a disorder of compliance and hydrodynamic theory How to explain: effectiveness of 3rd ventriculostomy temporal horns first to expand 4th ventricle last to expand References
**Human Papillomavirus and Epidermal Growth Factor Receptor in Oropharyngeal Squamous Cell Carcinoma: Application of Dynamic Contrast Enhanced MR Imaging by Histogram Analysis (Station #1)**

Yoon Seong Choi MD : Nothing to Disclose, Jinna Kim MD : Nothing to Disclose, Mina Park MD : Nothing to Disclose, Sung Jun Ahn MD : Nothing to Disclose, Seung-Koo Lee MD, PhD (Presenter): Nothing to Disclose

**PURPOSE**

The purpose of this study was to investigate the differences in dynamic contrast-enhanced MR imaging (DCE-MRI) parameters according to the status of human papillomavirus (HPV) and epidermal growth factor receptor (EGFR) biomarker in oropharyngeal squamous cell carcinoma (SCC) by histogram analysis.

**METHOD AND MATERIALS**

DCE-MRI was performed in a total of 21 consecutive patients with pathologically confirmed oropharyngeal SCC, and parameter maps composed of Ktrans (microvascular permeability), Ve (extravascular-extracellular space volume), and Vp (plasma volume) were obtained. Enhancing tumors were manually segmented on each slice of parameter maps to contain the entire tumor volume. The histogram parameters consisting of 25th, 50th, 75th percentile, mean value, skewness, and kurtosis of the DCE-MRI parameters were calculated and compared between the subgroups based on HPV and EGFR biomarker status using Wilcoxon rank-sum test.

**RESULTS**

From the histogram analysis of Ktrans maps, mean Ktrans value were significantly lower (P = 0.036) and positively skewed in EGFR overexpression group. And mean Ktrans value was higher in HPV-positive group without significant difference (P = 0.164). Other DCE parameters, Ve and Vp, were not significantly different between the subgroups.

**CONCLUSION**

Our preliminary evidence using histogram analysis of DCE-MRI parameters (Ktrans) based on whole tumor volume suggests that it may be useful to assess tumor microenvironment associated with molecular biomarkers in oropharyngeal SCC.

**CLINICAL RELEVANCE/APPLICATION**

Histogram analysis of Ktrans value may be a noninvasive imaging-based parameter that can be used to evaluate biomarker profiles in oropharyngeal SCC.

**Ultrasound-guided Fine Needle Biopsy of Occult Cervical Lymphadenopathy in Patients with Well Differentiated Thyroid Cancer: Accuracy and Impact on Clinical Decision Making; Seven Year Experience of an Anticancer Oncological Hospital (Station #2)**

Myrsini Gkeli (Presenter): Nothing to Disclose, Victoria Kartsouni : Nothing to Disclose, Eleni Dokoz : Nothing to Disclose, Sofia Sfika : Nothing to Disclose, Smaragda Angeli : Nothing to Disclose, Dimitra Daskalopoulou : Nothing to Disclose

**PURPOSE**

To determine whether ultrasound guided fine needle biopsy (Ug-FNB) is an effective procedure for diagnosing non palpable cervical lymphadenopathy in patients with known well differentiated thyroid cancer (DTC).

**METHOD AND MATERIALS**

This is a retrospective study that concerns 1654 non-palpable cervical lymph nodes in 1285 patients with known DTC who were examined by ultrasonography (U/S) and Ug-FNB for possible metastases before surgery and during the postoperative follow-up, in the period from 2006 and up to 2012. Final diagnosis was determined by histopathological exam of excision biopsy or by clinical and U/S follow-up for more than 12 months. Diagnostic yield, sensitivity, specificity, accuracy and complications of Ug-FNB were evaluated.

**RESULTS**
From 1285 patients with known DTC, 65% were in primary staging and treatment and 35% had total thyroidectomy (TT) with or without central neck dissection. Cytological diagnosis was made in 1646 of 1654 nodes yielding a diagnostic rate of 99.5%. From 1646 cervical lymph nodes (CLN) that had an adequate Ug-FNB, cytology showed metastases in 794 and benign findings in 852 nodes. All malignant nodes underwent surgery. No false positive results were mentioned. From the 852 benign nodes, 189 underwent initial TT and local cervical lymph nodes dissection and 27 nodes underwent an excisional biopsy. The remaining 636 nodes were unchanged or had regressed spontaneously on clinical and US follow-up, for more than 12-month monitoring period. Five false negative cytological results were referred. In the differentiation of benign from metastatic non palpable CLNs, Ug-FNB had a sensitivity and specificity of 99.4% and 100%. The positive predictive value, negative predictive value and accuracy in diagnosis of malignancy were respectively 100%, 99.4% and 99.7%. There were no procedure related complications.

CONCLUSION

Ug-FNB is a safe and efficient procedure for early detection of metastatic CLNs in patients with DTC. This is of great clinical importance because it optimizes surgical and radiation therapy treatments based on a balanced decision between the need of local radical excision, correct disease staging, and limiting the risk of complications.

CLINICAL RELEVANCE/APPLICATION

Ug-FNB is a safe and efficient procedure in diagnosis of occult metastatic CLNs in patients with DTC, obviating unnecessary local radical excision or an excisional biopsy

Shear Wave Elastography of Thyroid Nodules in a Large Scale Study: Is It a Predictor of Thyroid Malignancy? (Station #3)

Ah Young Park MD (Presenter): Nothing to Disclose, Eun Ju Son MD, PhD: Nothing to Disclose, Kyung Wha Han BS: Nothing to Disclose, Ji Hyun Youk MD: Nothing to Disclose, Jeong Ah Kim MD, PhD: Nothing to Disclose, Cheong Soo Park: Nothing to Disclose

PURPOSE

To validate the usefulness of shear wave elastography (SWE) in predicting thyroid malignancy with a large-scale quantitative SWE data.

METHOD AND MATERIALS

This was an institutional review board-approved retrospective study with waiver of informed consent. 476 thyroid nodules in 453 patients who underwent gray-scale US and SWE before US-guided fine-needle aspiration biopsy (US-FNA) or surgical excision were included. Gray-scale findings and SWE elasticity indices (EIs) were retrospectively reviewed and compared between benign and malignant thyroid nodules. The optimal cut-off values of EIs for predicting malignancy were determined. The diagnostic performances of gray-scale US and SWE for predicting malignancy were analyzed and compared between the gray-scale US findings only and the combined use of gray-scale US findings with SWEs.

RESULTS

All EIs of malignant thyroid nodules were significantly higher than those of benign (P ≤ .001). The optimal cut-off values of each EI for predicting malignancy were Emean: 85.2 kPa, Emax: 94.0 kPa, Emin: 54.0 kPa. Emean (OR 3.071, P=.005) or Emax (OR 3.015, P=.003) were the independent predictors of thyroid malignancy. Combined use of gray-scale US findings and each EI showed elevated sensitivity (95.0% vs 92.9%, P=.005) and AUC (0.820 vs 0.834, P=.005) for predicting malignancy, compared with the use of gray-scale US findings only.

CONCLUSION

Combining gray-scale US findings and each EI showed elevated sensitivity and elevated AUC for predicting malignancy, compared with the use of gray-scale US findings only. Therefore, we suggest that quantitative SWE findings of Emean ≥ 85 kPa or Emax ≥ 94 kPa with suspicious gray-scale US findings of thyroid nodules could be used as useful predictor for malignancy in routine clinical situation.

CLINICAL RELEVANCE/APPLICATION

Quantitative parameters of SWE were predictive factors of thyroid malignancy and SWE evaluation combined with gray-scale US was adjunctive to the diagnostic performance of gray-scale US for predicting thyroid malignancy.

Diffusion Complexity of Gray Nucleus in Alzheimer’s Disease: An Initial Diffusion Kurtosis Imaging Study (Station #4)

Rui Hu MS (Presenter): Nothing to Disclose, Yanwei Miao: Nothing to Disclose, Wei-Wei Wang MD, PhD: Nothing to Disclose, Lemei Tang MD: Nothing to Disclose, Minting Zheng: Nothing to Disclose, Qingwei Song BS, BEng: Nothing to Disclose

PURPOSE

To initially exploit diffusion complexity changes of gray nucleus in Alzheimer’s disease (AD) by using diffusional kurtosis imaging (DKI).

METHOD AND MATERIALS
Twenty three cases of clinically confirmed AD and Twenty four age- and sex- matched healthy volunteers underwent MR DKI scanning on a 3.0 T MR imaging scanner. The DKI parameters, including MK, Ka, Kr, MD, Da, Dr and FA, were measured on bilateral head of caudate nucleus, dentate nucleus, putamen, globus pallidus, red nucleus and substantia nigra in AD patients and controls. Two independent samples t-test was used to compare the mean values of parameters in all brain regions between the AD and healthy groups. Receiver operating characteristic (ROC) test were used to assess the ability of regional diffusion measures to discriminate differences between groups. The correlations between DKI parameters and MMSE score were tested using Pearson’s correlation.

RESULTS

Compared to the healthy group, the mean value of MK, Ka and Kr markedly increased in substantia nigra, MK value increased in head of caudate nucleus, and Ka value decreased in dentate nucleus(P

CONCLUSION

DKI may be a new sensitive tool to quantitatively detect diffusion complexity of gray nucleus in AD patients.

CLINICAL RELEVANCE/APPLICATION

DKI is useful for evaluating the structure change of gray nucleus in AD patients.

**NRS445**

**Evaluative Study of HRMRI Effectiveness in Assessing MCA Stenosis (Station #6)**

Shanshan Xie BMedSc, MMed (Presenter): Nothing to Disclose, Jingliang Cheng MD : Nothing to Disclose, Yong Zhang DO : Nothing to Disclose

**PURPOSE**

To explore the diagnostic value of high-resolution MRI (HRMRI) in the evaluation of middle cerebral artery (MCA) stenosis or occlusion using MRA and DSA.

**METHOD AND MATERIALS**

Fifty-five (33 males and 22 females, aged from 18 to 68 years old, mean age 44.8±11.2) patients with MCA territory symptoms underwent preliminary MRA or CTA to detect ipsilateral MCA stenosis. Thereafter, all the patients underwent MRA, HRMRI and DSA, with an average interval of 3.4 days. Based on the results of DSA, the gold standard, and compared with MRA, the diagnostic value of HRMRI was analyzed for measuring the degree of MCA stenosis.

**RESULTS**

55 segments were diagnosed consistently by MRA, HRMRI and DSA. The rate of coincidence between HRMRI and DSA was 83.6%(46/55). The overestimation rate of MRA was 61.8% (34/55). The MCA stenosis rates were (70±17)%,(68±19)% and (85±20)% on HRMRI, DSA and MRA, respectively. There was no statistical difference observed to evaluate the degree of stenosis by HRMRI and DSA (Z=-1.192, p=0.233), whereas observed significant statistical difference between HRMRI and MRA (t=-6.604, P=0.000). HRMRI-derived value correlated more significantly r with DSA (Pearson’s r=0.893, P=0.000) than with MRA (Spearman’s r=0.602, P=0.000). HRMRI and DSA conformed well in evaluation of the stenosis rate (Kappa= 0.773), meanwhile, 0.355 between HRMRI and MRA.

**CONCLUSION**

For evaluating MCA stenosis or occlusion, HRMRI consists with DSA better than MRA does. HRMRI, therefore possesses the potential to be the gold standard for diagnosing cerebral artery stenosis.

**CLINICAL RELEVANCE/APPLICATION**

HRMRI may become the standard method to detect MCA stenosis, where the results are in consistent with DSA and the overestimation of MRA is avoided.

**NRS446**

**Resting-state Functional Magnetic Resonance Imaging in the Assessment of Patients with Neuromyelitis Optica (Station #7)**

Fernanda Cristina Rueda Lopes MD (Presenter): Nothing to Disclose, Fernanda Miraldi MD : Nothing to Disclose, Soniza Alves-Leon PhD : Nothing to Disclose, Roberto Cortes Domingues MD : Nothing to Disclose, Vanessa Granado Alves Itagiba MD : Nothing to Disclose, Emerson L. Gasparetto MD : Nothing to Disclose

**PURPOSE**

Our objective was to investigate NMO patients using the resting-state functional magnetic resonance imaging (RS fMRI) compared to the controls, regarding the default-mode network and the visual network, in order to evaluate the cortical adaptations in NMO.

**METHOD AND MATERIALS**

We studied 28 patients with NMO spectrum [mean age 38 years (SD +/- 3,2, 18 female), and also 19 sex and age matched controls. All participants signed informed consent. A magnetic resonance imaging (MRI) was
performed in a 1.5 Tesla scanner with protocol that included 3D T1 GRE weighted-images and resting-state functional MRI. fMRI data was post-processed using MELODIC (FMRIB's Software Library, fsl). The fMRI data set was decomposed using independent component analysis (ICA) to identify large-scale patterns of functional connectivity and a 'dual-regression' approach was carried out allowing voxel-wise comparisons of resting functional connectivity between both groups. Threshold-Free Cluster Enhancement (tfce) maps of comparison between both groups were analysed, and the corrected p-corrected maps were also considered. A p-value of 0.05 was considered statistically significant.

RESULTS

Fourteen components were computed in the entire subject group by ICA, including default-mode (DMN) and visual networks. In the DMN, the evaluation of tfce maps showed areas of significantly higher synchronization in NMO patients compared to healthy controls in the parietal lobes, precuneus region and also in the right hippocampus (p<0.01), that remained after p-correction. Also for DMN, controls had areas of higher synchronization in the frontal areas in relation to the patients in the tfce maps. In the visual network, there were increased synchronization values in the whole occipital cortex in NMO patients compared to controls (p<0.01) in both maps.

CONCLUSION

NMO patients have an increased synchronization during rest in the parietal and precuneus areas of the default-mode network as a form of compensation for the decreased synchronization in the frontal area. Also, the higher synchronization values found in the occipital cortex in patients may be a form of compensation for the optical neuritis.

CLINICAL RELEVANCE/APPLICATION

Neuromyelitis optica (NMO) spectrum is an auto-imune demyelinating disease usually related to optical neuritis and extensive myelitis. Diffusion Tensor Imaging (DTI) has shown diffuse white matter damage, but the cortex was poorly studied in such disease.
PURPOSE
To quantitatively assess the neovascularization after the bypass surgery in children with Moyamoya disease (MMD), using 'syngo iFlow' software.

METHOD AND MATERIALS
From August 2012 to March 2014, a total of 33 pediatric MMD patients (14 male and 19 female, mean age 8.0 years, range 3~19 years) underwent conventional transfemoral cerebral angiography (TFCA) before and after the indirect revascularization surgery. From the syngo iFlow color-coded images from lateral ICA, ECA and CCA angiograms taken pre- and post-operatively, time-signal intensity curves were generated at the regions-of-interest (ROI) corresponding to the EDAS surgical flap sites. Time-to-peak (TTP) and area-under the curve (AUC) values were obtained from the time-intensity curves. These TTP and AUC values were adjusted for those of time-intensity curves at the input arteries. Changes in adjusted TTP and AUC values at CCA and changes in adjusted AUC values at ICA and ECA angiograms after the surgery were compared across the postoperative clinical outcome scores (4-point scale, 4=excellent, 3=good, 2=fair and 1=poor) and Mathushima’s angiographic revascularization scores (3-point scale, 3 = good, 2 = fair and 1 = poor) by using the Jonckheere-Terpstra test for ordered alternatives.

RESULTS
Adjusted TTP decreased significantly after revascularization surgery at CCA angiogram. And the difference of pre and post-operative adjusted TTP at CCA angiogram were significantly different for the clinical outcome groups (p=.002). Adjusted AUC values at CCA angiogram (p<.001) and ECA angiogram (p<.001) increased significantly after surgery. Changes in adjusted AUCs at ICA angiograms showed no significant difference between the clinical outcome groups. Changes in adjusted TTPs (p =.010) and AUCs at CCA angiograms (p<.001) and AUCs at ECA angiograms (p<.001) were also significantly different for the revascularization score groups.

CONCLUSION
Postoperative changes in quantitative perfusion values obtained with 'syngo iFlow' software showed significant correlation with clinical and angiographic scores. These values can be used as objective parameters for evaluating the post-operative neovascularization status in children with MMD.

CLINICAL RELEVANCE/APPLICATION
With 'syngo iFlow' software, we can provide the quantitative parameters for the neovascularization status and these values can be used as objective predictors of the clinical outcomes.

NRE130
The Limbic System: What the Radiologist Needs to Know (Station #10)
Ana Sanchez Martin MD, PhD (Presenter), Nothing to Disclose, Juan Antonio Juanes Mendez MD, PhD: Nothing to Disclose, Carolina Luisa Calvo Corbella MD: Nothing to Disclose, Andres Framinan MD, PhD: Nothing to Disclose, Patricia Carreno Moran MD, PhD: Nothing to Disclose, Francisco Maria Salgado MD, PhD: Nothing to Disclose, Begona Garcia Castano: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to review the Limbic System...
1. Anatomy using MPR, MIP, VR.
2. Connections with Tractography.
3. Vascularity with angioCT, angioMR and angiography.
4. Function and pathology and correlate the imagine with the clinical.

TABLE OF CONTENTS/OUTLINE
Anatomy The Limbic System includes: 1. Limbic Lobe. 2. Subcortical structures. Connections The main structures of the limbic system are interrelated by a complex system of connections. 1. Circuit of Papez. 2. Intrinsinc connections of the hippocampus. 3. Efferent fibers from the hippocampal region. 4. Bidireccional limbic fiber tracts. 5. Limbic connections between the telencephalon, diencephalon and central midbrain structures. Vascularity 1. The main vessels of the limbic system are the anterior and posterior cerebral arteries, the anterior choroidal artery, and branches arising from the circle of Willis. 2. The deep venous drain, basal vein of Rosenthal and internal cerebral veins, form the vein of Galen that drains into the straight sinus and finally drains to the confluence of sinuses. Function and pathology 1. It is involved with learning, memory, emotional behavior and influences on neuroendocrine and autonomic mechanisms. 2. It is implicated in the pathophysiology of temporal lobe epilepsy and certain neuropsychiatric disorders.

NRE273
The Otodystrophies: A Pictorial Review (Station #11)
Pareen Mehta MD: Nothing to Disclose, Zaihlen Shariff Keller MD (Presenter): Nothing to Disclose, Mark S. Shiroishi MD: Nothing to Disclose, Alexander Lerner MD: Nothing to Disclose, John L. Go MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To review the spectrum of bony dysplasias, which may involve the temporal bone
and result in conductive, sensorineural, or mixed hearing loss. To acquaint the attendee with the imaging appearance of common and rarer types of otodystrophies.

TABLE OF CONTENTS/OUTLINE

Unique group of temporal bone disorders associated with bony dysplasia. Basic demographics and pathophysiology of a spectrum of otodystrophies (including Paget’s disease, fibrous dysplasia, osteopetrosis, pyknodysostosis, diaphaseal dysplasia (Camurati-Engleman Disease), osteogenesis imperfecta, and otosclerosis). Review imaging findings on both CT and MRI. Provide case examples from a major academic institution.

NRE189

A Dozen Cranial Nerves with Dozens of Schwannomas: Diagnostic Approach to Intracranial and Skull Base Cranial Nerve Schwannomas (Station #12)

Aaron Skolnik MD (Presenter): Nothing to Disclose, Kim Learned MD: Nothing to Disclose, Linda Jane Bagley MD: Nothing to Disclose, Laurie A. Loevner MD: Nothing to Disclose

TEACHING POINTS

1. Review the general MR imaging features of cranial nerve (CN) schwannomas. 2. Demonstrate the scope of CN schwannomas arising from the intracranial and skull base courses of each of the 12 CNs highlighting relevant anatomic features of the courses of the cranial nerves. 3. Correlate the patient’s clinical presentation with the location and degree of mass effect and end organ sequelae to aid in diagnosis of CN schwannomas.

TABLE OF CONTENTS/OUTLINE

1. General imaging features of cranial nerve (CN) schwannomas
   a. Classic appearance: oval avidly enhancing mass
   b. Commonly heterogeneous enhancement, cystic degeneration and rarely hemorrhage
2. Illustrative examples of CN schwannomas affecting all 12 CNs including typical and atypical examples highlighting relevant anatomic considerations and structures affected by mass effect. Correlation of anatomic knowledge with clinical presentation can aid in detection and characterization of causative schwannoma, for example, a patient with diplopia warrants careful evaluation of the ambient cistern. End organ effects, for example, atrophy of muscles of mastication or extra-ocular muscles can aid in ability to diagnose nerve of origin. Bilateral CN VIII and other CN schwannomas in Neurofibromatosis type II

NRE016-b

A Montage of Monikers and Mimickers in the Neck: Uncommon Neck Masses with Clinical, Surgical, Radiologic, and Pathologic Correlation (hardcopy backboard)

Michael Lanfranchi MD: Nothing to Disclose, Daniel Matheson Adams MD (Presenter): Nothing to Disclose, Sergey Kochkine MD: Nothing to Disclose, Harprit Singh Bedi MD: Nothing to Disclose, Richard Wein: Speakers Bureau, Bristol-Myers Squibb Company

TEACHING POINTS

The differential diagnosis for neck masses includes common entities such as lymphadenopathy, squamous cell carcinoma, and lymphoma; but also includes many entities that are less frequently seen.

The emphasis of this exhibit is to review uncommon neck masses.

The exhibit is a case-based review that will allow the learner to review pertinent clinical signs and symptoms, radiographic features, surgical findings, and pathologic correlates pertaining to uncommon neck masses.

TABLE OF CONTENTS/OUTLINE

Cases include (but are not limited to) the following: Castleman’s Disease, Hibernoma, Paratracheal air cyst, Kikuchi-Fujimoto Disease, Fibromatosis, Chronic Sclerosing Sialoadenitis, Chondrosarcoma of the Cervical Spine.
Introduction to MR Spectroscopy


LEARNING OBJECTIVES

1) To explain the physiological principles of metabolic profiles in normal brain tissue. 2) To show characteristic MR spectra in various CNS diseases. 3) To explain the means by which MR spectroscopy can assist in assessment of brain tumor grade. 4) To indicate uses of MR spectroscopy in evaluating disease progression and treatment response.

Spinal Infections

E. Turgut Tali MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the imaging findings of spinal infections. 2) Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management/safety, and cost. 3) Compare indications and contraindications of specific image-guided procedures. 4) Improve basic knowledge and skills relevant to clinical practice.

ABSTRACT

Spinal infection is a significant cause of morbidity and mortality. This entity is notoriously difficult to differentiate clinically from degenerative processes, noninfective inflammatory disorders, and spinal neoplasm. MRI is modality of choice for the spinal infections. Low signal areas and interruption of the cortical continuity, destruction of the cortical margins are typical on T1WI whereas high signal of affected areas of the vertebral body and disc is typical on T2WI for the spondylodiscitis. Contrast enhancement is the earliest sign and pathognomonic in the acute inflammatory episode and even subtle infection then persists to a varying degree for several weeks or months. Recent epidemiologic studies point to an increasing prevalence of spinal epidural infection. MRI demonstrates soft tissue mass within the epidural space encroaching upon the theca or spinal nerves. Frequently, long segment iso-hyperintense epidural mass lesion with hypointense thickened, displaced dura on T1- and T2WI is observed. Pyogenic leptomeningitis is the most common bacterial infection of the spinal axis. On MRI, the precontrast T1WI may be either normal or may reveal nonspecific abnormalities. T2WI are of limited use since the signal intensity of CSF may obscure the meningeal structures. Postcontrast T1WI may show inflamed dura or nerve sheath with possible involvement of the spinal cord. Infection of the spinal cord is relatively rare. MRI findings of myelitis may differ in a wide spectrum from mild edema, swelling with mild or no contrast enhancement to prominent edema and abscess formation with diffuse, patchy or ring enhancement.

BOOST: CNS Tumor Board—Case-based Review of MR Imaging and Treatment Management for the Radiologist and Radiation Oncologist (An Interactive Session)

Multisession Courses

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50
Wed, Dec 3 3:00 PM - 4:15 PM  Location: S103CD

Participants

Christina I. Tsien MD (Presenter): Nothing to Disclose
Whitney B. Pope MD, PhD (Presenter): Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Amgen Inc Research Consultant, Tocagen Inc Consultant, Celldex Therapeutics, Inc Consultant, Guerbet SA

Michael Vogelbaum MD (Presenter): Research Consultant, Infuseon Therapeutics, Inc

Patrick Y. Wen MD (Presenter): Research Consultant, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Describe the imaging characteristics of gliomas and other brain tumors. 2) Recognize the substantial heterogeneity that exists within these tumor types and understand the prognostic and predictive variables that allow for the appropriate selection of therapeutic choices. 3) Explain the role of each modality including surgery, radiotherapy and chemotherapy in managing these tumors.

ABSTRACT

PURPOSE
To assess the pattern of artifacts with high signal intensity in the brain stem on Diffusion Weighted Image (DWI) and determine if the artifacts in the brain stem could be corrected by DWI using two different phase encoding direction.

METHOD AND MATERIALS
This retrospective study included 726 patients who visited emergency department (ED) with minor neurologic symptoms and performed DWI to exclude central brain lesions. DWI protocol in ED included MRI scan with posteroanterior phase encoding direction (PA-PED) for whole brain and reversed phase encoding direction (anteroposterior direction, AP-PED) for brain stem. We defined the brain stem lesion showing high signal intensity on DWI as “artifact” if the corresponding lesion on follow up MRI disappeared or the patient’s symptom was improved on clinical follow up. Finally, we included 106 patients with 126 lesions in this study. Two emergency radiologists assessed the pattern of location, size and shape of artifacts in brain stem on DWI with PA-PED compared with those with AP-PED by consensus. Locations of artifacts were classified according to anatomy of brain stem and vascular territory: 7 levels of brain stem and 4 vascular territories (anteromedial, anterolateral, lateral and posterior group). Shapes of artifacts were classified into linear, dot and V-shape. It was assessed whether the artifacts in brain stem could be corrected by changing the phase encoding direction.

RESULTS
The artifacts in the brain stem on DWI with PA-PED significantly presented in the posterolateral territory and level 3-5, compared with those with AP-PED which significantly presented in the anterior portion and level 6 and 7 (P<.001). The shapes of artifact between two groups were significantly different: linear or dot shape (PA-PED) vs. V shape (AP-PED) (P<.001). All artifacts with high signal intensity in the brain stem on DWI with PA-PED or AP-PED were completely corrected on DWI with reversed phase encoding direction (n= 126/126, 100%).

CONCLUSION
The artifacts in the brain stem on DWI manifest different location pattern and shape. All artifacts with high signal intensity in the brain stem can be corrected by DWI with reversed phase encoding direction.

CLINICAL RELEVANCE/APPLICATION
DWI with reversed phase encoding direction is recommended in the initial evaluation of suspected artifact mimicking infarction based on the knowledge of the characteristic pattern of artifacts in the brain stem on DWI.

SSM07-03
Is It Possible to Accurately Diagnose Cerebral Venous Sinus Thrombosis on Noncontrast CT?

PURPOSE
With its highly variable clinical presentation, the diagnosis of cerebral venous sinus thrombosis (CVST) challenging. Noncontrast CT is still the preferred imaging exam in most emergency departments. The aim is to investigate the possibility of accurate diagnosis for CVST on noncontrast C.
METHOD AND MATERIALS

There were 35 cases with CVST (case group) and 40 cases without CVST (control group). All cases received noncontrast CT scan. The two groups were matched by age and gender. Two radiologist blindly reviewed all CT examinations and made decision together. Another experienced radiologist measure CT value of cerebral venous sinus and summary clinical history and symptoms. Independent samples t test was performed between two groups, and receiver operating curve was performed to get critical value of venous sinus for diagnosis. Attenuation of venous sinus (critical value) (A), relative history (SLE, nephropathy, pregnancy etc)(B), symptoms (headache and/or spasm) (C),hemorrhagic infarct and/or epicranium swelling on CT (D) were taken as four variables. We calculated sensitivity, specificity and reliability of each variable for diagnosis of CVST. The impression were compared via grading of the mentioned variables (1-3 points) and the sum of each case in both groups were analyzed (Chi-square test / Fisher exact test).

RESULTS

Attenuation of venous sinus in case group was significantly higher than control group (P<0.001). The best critical value for diagnosis was 68HU (Youden index = 0.886). The best single indicator was variable A (specificity 93%), followed by variable D (specificity 77%), while the other two indicators were of no statistical significance in two groups. According to the results, variable A was considered as 3 points, variable D as 2, both variable B and C as 1. The score of B, C or D variable can be accumulated repeatedly. The case with total score no less than 5 points is highly correlated with clinical diagnosis as CVST in following up. The sensitivity, specificity and reliability were 83%, 100% and 94%, respectively ( P<0.01).

CONCLUSION

Combined with relative history, symptoms and noncontrast CT findings, we can make an accurate diagnosis for CVST.

CLINICAL RELEVANCE/APPLICATION

For the patients who have relative history, especially with headache and/or spasm, noncontrast CT is a valuable exam to exclude CVST and make a decision for further imaging.

SSM07-04

Improvements in Subjective and Objective Image Quality in Emergency Non-contrast CT of the Head, Reconstructed with a Novel Third-generation Modelled Iterative Reconstruction Algorithm

Kevin Lian MD (Presenter): Nothing to Disclose, Brian Black BSc: Nothing to Disclose, Stephen Choy MD: Nothing to Disclose, Ana-Maria Bilawich MD: Nothing to Disclose, Jason Ronald Shewchuk MD: Nothing to Disclose, Katharine Grant PhD: Employee, Siemens AG, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Savvas Nicolaou MD: Nothing to Disclose

PURPOSE

Accurate interpretation of Head CT demands high image contrast and spatial resolution from a CT system. This study aims to assess the image quality effects of a novel third generation modelled iterative reconstruction algorithm (SAFIRE+, Siemens Healthcare, Forchheim, Germany) compared to the prior generation of SAFIRE in helical non contrast CT of the head.

METHOD AND MATERIALS

50 consecutive patients underwent helical unenhanced head CT over a 5 day period using a dual source 128-slice CT system. Images were reconstructed with standard FBP, SAFIRE (strength 1, 3, 5) and SAFIRE+ (strength 1, 3, 5). Objective and subjective image quality were compared between images reconstructed with SAFIRE and SAFIRE+ at corresponding strength levels. Objective measures of image quality include image noise, signal-to-noise ratio, and contrast-to-noise ratio. Subjective rating of grey-white differentiation, coarse noise, posterior fossa streak artifact, and overall diagnostic acceptability were scored out of 10 by two reviewers in consensus. Statistical analysis was performed with paired student’s t-test and Wilcoxon signed rank test.

RESULTS

SAFIRE+ demonstrated statistically significant reduction in objective noise and improvement in signal-to-noise ratio at all reconstruction strengths (p<0.01 for all comparisons). SAFIRE+ showed significant improvement in contrast-to-noise ratio as compared with SAFIRE5 (2.0±0.6 vs 1.8±0.5, p<0.01). There was a statistically significant improvement in grey-white differentiation, diagnostic acceptability, streak artifact, and subjective noise when SAFIRE+ images were subjectively compared with SAFIRE5.

CONCLUSION

Third generation modelled iterative reconstruction offers improvement in both objective and subjective image quality of head CT. Subjective and objective benefits over SAFIRE were better appreciated at higher reconstruction strengths.

CLINICAL RELEVANCE/APPLICATION

SAFIRE+ is an easy software upgrade that offers evolutionary improvements in image quality which may enhance diagnostic accuracy and better guide clinical decisions.
Using Non-linear Blending Technique Optimizes Vessel Visualization of Cerebral Dual Energy CT Angiography in Spontaneous Subarachnoid Hemorrhage Patients

Dan Wang (Presenter): Nothing to Disclose, Qiaowei Zhang MD, PhD: Nothing to Disclose, Wenming Zhang: Nothing to Disclose, Renbiao Chen: Nothing to Disclose

PURPOSE

To investigate the image quality of cerebral dual energy CT angiography (DECTA) using a non-linear image blending technique as compared with the conventional linear blending method in patients with spontaneous subarachnoid hemorrhage (SAH).

METHOD AND MATERIALS

Thirty consecutive spontaneous SAH patients underwent a dual-source, dual energy (80kV and Sn140kV mode) cerebral CTA were retrospectively reviewed with ethical committee permission. Optimized images using non-linear blending method were generated and compared with the 0.6 linear blending images by evaluating cerebral artery enhancement, attenuation of SAH, image noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) respectively using paired Student t test. Two radiologists independently assessed subjective vessel visualization per-segment on maximum intensity projection (MIP) images using a 5-point scale (5 = excellent, 1 = un-diagnosable). The inter-observer agreement was calculated by kappa test; and the segmental scorings of the two image sequences were estimated by Wilcoxon-Mann-Whitney (WMW) tests.

RESULTS

The non-linear blending images obtained higher cerebral artery enhancement (307.24±58.04HU) but lower attenuation of SAH (67.07±6.79HU) and image noise (7.18±1.20HU), thus achieving better SNR (43.92±11.14) and CNR (34.34±10.25), compared to those of linear blending images (235.47±46.45HU for cerebral artery enhancement, 70.00±6.41HU for attenuation of SAH, 8.39±1.25HU for image noise, 28.86±8.43 for SNR and 20.37±7.74 for CNR) (all p<0.01). The segmental scorings of the non-linear blending image (31.6% segments with score of 5, 57.4% 4, 11% 3) ranged significantly higher than those of linear blending images (11.5% 5, 77.5% 4, 11% 3) (p<0.01). The inter-observer agreement was excellent (kappa=0.762).

CONCLUSION

The non-linear image blending technique improved vessel visualization of cerebral DECTA by optimizing contrast enhancement in spontaneous SAH patients.

CLINICAL RELEVANCE/APPLICATION

Use of non-linear blending technique with DECT optimizes vessel visualization of cerebral CTA for patients with spontaneous SAH.

Derivation of Virtual Non-contrast CT Head Images from Dual Energy Head CT Angiography Studies: Potential Feasibility of Replacing Routine Non-contrast Head CT with Virtual Non-contrast CT

Shamir Rai BSC (Presenter): Nothing to Disclose, Chesnal Dey Arepalli MD: Nothing to Disclose, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Rita Chiu MD: Nothing to Disclose, Savvas Nicolaou MD: Nothing to Disclose

PURPOSE

Virtual non-contrast (VNC) images are derived from dual energy (DE) contrast enhanced CT scans. The purpose of this study is to evaluate the whether the VNC images derived from DE head CT angiography (CTA) are of diagnostic quality in patients presenting with acute stroke symptoms.

METHOD AND MATERIALS

A total of 50 consecutive patients with acute stroke symptoms were retrospectively identified between Dec. 1, 2013 and Feb. 5, 2014 from a single institution’s emergency department. All the patients underwent both a non-contrast CT (NCCT) and DE head CTA at 100 kV and 140 kV. Quantitative analysis of the NCCT and the generated VNC Head images were performed using circular region of interests (ROIs) with an area of 22.8mm² centered on both caudate heads (grey matter), internal capsules, corona radiata and centrum semiovale. The SNR and CNR were calculated. The CTDvol (mGy), DLP (mGycm) were recorded. The effective dose was calculated using the established ratio of 0.0021. Two radiologists, with combined 20 years of experience were blinded and retrospectively interpreted the VNC CT images in comparison to the routine NCCT, assessing for pathology and diagnostic acceptability. The VNC CT scans were graded 1 (non-diagnostic), 2 (decreased image quality, unlikely to be diagnostic), 3 (decreased image quality with potential to be diagnostic), 4 (decreased image quality but diagnostic), 5 (diagnostic study).

RESULTS

The median subjective score for assessment of the virtual non-contrast study for reader 1 and reader 2 were 4±1 and 4±0.75. The effective dose in the DE CTA scans was significantly lower than in the non-contrast CT heads (1.652 msv±0.1986 and 1.955 msv ±0.4843 respectively, (p

CONCLUSION

VNC CT scans were determined to be diagnostic with reduced image quality. This has the potential to replace routine non-contrast studies.

CLINICAL RELEVANCE/APPLICATION

Optimized head VNC CT protocols are currently in development. With enhancement in VNC CT algorithms, stroke assessment could be limited to a single DE CTA thereby reducing radiation exposure to the patient.
Neuroradiology (Cerebral Ischemia, Hemorrhage & Vessel Wall Imaging)

Radiologic-histopathologic Correlation of Pre-mortem and Post-mortem Cerebral Microbleeds in the Elderly

**Purpose**
Microbleeds are radiologically defined as small, punctiform hypointense brain lesions of signal loss on gradient-echo T2* or susceptibility weighted imaging (SWI). Due to the increasing application of susceptibility imaging and increasing magnetic field strength, the detection rate of microbleeds increases notably in the elderly. We assessed the pre-mortem MRI radiologic-histopathologic correlation of cerebral microbleeds in the elderly.

**Method and Materials**
This retrospective study identified all cases of brain autopsy during a 10-year period from 1.1.2000 and 31.12.2010. 1064 cases were autopsied as part of a systemic procedure in the local academic geriatric hospital. 134 of those cases had pre-mortem MRI. Histopathologic slices were obtained in all cases with cerebral T2* lesions corresponding to the anatomic findings on MRI and evaluated independently by 2 experienced neuropathologists.

**Results**
13 cases had 15 hypointense lesions on gradient-echo T2*w imaging on pre-mortem MRI. In 8 / 13 patients, there was a concordance between MRI and histopathology (true positive rate of 61.5%). In 3 / 13 patients, the T2* lesions did not correspond to histopathologic lesion (microcalcification as “microbleed mimic” in 1 / 13, absent lesion in 2 / 13), corresponding to a false positive rate of 23.1%. In 2 / 13 patients there were additional multiple microbleeds on histopathology indicating a false negative rate of 15.4%

**Conclusion**
The majority (8/13 cases) of hypointense lesions on T2* imaging correspond to histopathologically confirmed microbleeds. MRI was false positive in 3/13 cases and one microbleed mimics was a microcalcification. Conversely, in 2/13 cases MRI was false negative. Additional post-mortem MRI is currently repeated in selected cases to assess the number of new microbleeds appearing in the delay between pre-mortem MRI and death.

**Clinical Relevance/Application**
Better understanding of the radiologic-histopathologic correlation of hypointense brain lesions on T2* and SWI will enable a more accurate discrimination of cerebral microbleeds versus microbleed mimics.

Evaluative Study of HRMRI Effectiveness in Assessing MCA Stenosis

**Purpose**
To explore the diagnostic value of high-resolution MRI (HRMRI) in the evaluation of middle cerebral artery (MCA) stenosis or occlusion using MRA and DSA.

**Method and Materials**
Fifty-five (33 males and 22 females, aged from 18 to 68 years old, mean age 44.8±11.2) patients with MCA territory symptoms underwent preliminary MRA or CTA to detect ipsilateral MCA stenosis. Thereafter, all the patients underwent MRA, HRMRI and DSA, with an average interval of 3.4 days. Based on the results of DSA, the gold standard, and compared with MRA, the diagnostic value of HRMRI was analyzed for measuring the degree of MCA stenosis.
RESULTS

55 segments were diagnosed consistently by MRA, HRMRI and DSA. The rate of coincidence between HRMRI and DSA was 83.6% (46/55). The overestimation rate of MRA was 61.8% (34/55). The MCA stenosis rates were (70±17)%, (68±19)% and (85±20)% on HRMRI, DSA and MRA, respectively. There was no statistical difference observed to evaluate the degree of stenosis by HRMRI and DSA (Z=-1.192, p=0.233), whereas observed significant statistical difference between HRMRI and MRA (t=-6.604, P=0.000). HRMRI-derived value correlated more significantly r with DSA (Pearson's r=0.893, P=0.000) than with MRA (Spearman's r=0.602, P=0.000). HRMRI and DSA conformed well in evaluation of the stenosis rate (Kappa= 0.773), meanwhile, 0.355 between HRMRI and MRA.

CONCLUSION

For evaluating MCA stenosis or occlusion, HRMRI consists with DSA better than MRA does. HRMRI, therefore possesses the potential to be the gold standard for diagnosing cerebral artery stenosis.

CLINICAL RELEVANCE/APPLICATION

HRMRI may become the standard method to detect MCA stenosis, where the results are in consistent with DSA and the overestimation of MRA is avoided.

SSM16-03

Characterizing Relationships of DTI, fMRI, and Motor Recovery in Stroke Rehabilitation Using Brain-Computer Interface Technology

Jie Song MS : Nothing to Disclose, Brittany Young (Presenter) : Nothing to Disclose, Zack Nigogosyan : Nothing to Disclose, Leo Walton : Nothing to Disclose, Veena A. Nair PhD : Nothing to Disclose, Scott Grogan BS : Nothing to Disclose, Mitch Tyler : Nothing to Disclose, Dorothy Farrar-Edwards : Nothing to Disclose, Kristin Caldera : Nothing to Disclose, Justin Sattin : Nothing to Disclose, Justin Williams : Nothing to Disclose, Vivek Prabhakaran MD, PhD : Nothing to Disclose

PURPOSE

Few studies have combined diffusion tensor imaging (DTI) and fMRI in a multi-modal approach to characterize and track stroke recovery. This study examines changes in the structural integrity of the posterior limb of the internal capsule (PLIC) and in corticomotor activity during movement of the impaired hand in stroke patients receiving therapy using a novel Brain-Computer Interface (BCI) device and investigates whether these changes relate to motor functional recovery.

METHOD AND MATERIALS

Nine stroke patients (ages 48-68, 6M) with persistent upper extremity impairment were given up to 15 sessions of interventional rehabilitation therapy of the affected hand using BCI with integrated tongue and functional electrical stimulations. Anatomical, DTI, and fMRI images were collected pre-, mid-, and post-therapy using a GE 3T MRI scanner. Functional images were acquired as patients performed unilateral finger tapping of the affected hand. Fractional anisotropy (FA) values were calculated for each PLIC, as were counts of active voxels in the motor cortex. Motor function was tested at each scan session using Action Research Arm Test (ARAT) and Stroke Impact Scale (SIS).

RESULTS

PLIC-FA values were significantly lower in the ipsilesional vs. contralesional hemisphere, and a bilateral pattern of corticomotor activity was observed during fMRI. Ipsilesional PLIC-FA negatively correlated with ipsilesional corticomotor activity. ARAT and SIS Hand Function scores correlated with PLIC-FA but not corticomotor activity. Pre-therapy FA also correlated with post-therapy ARAT and SIS Hand Function. Differences and correlations p<0.05.

CONCLUSION

Preserved integrity of the ipsilesional PLIC may contribute to better motor outcomes, demanding less cortical activity within the ipsilesional motor cortex. Furthermore, PLIC-FA may be helpful in tracking and predicting motor functional recovery in stroke patients receiving BCI intervention.

CLINICAL RELEVANCE/APPLICATION

Characterizing the relationship among DTI, fMRI, and behavioral measures in stroke patients is key in developing new biomarkers to predict and track motor recovery.

Feasibility of T1-WI 3D-TSE to Assess Atherosclerosis in Stroke Patients

Woo Jin Lee MD (Presenter) : Nothing to Disclose, Bomi Gil : Nothing to Disclose, Eu Hyun Kim MD : Nothing to Disclose, Jin Hee Jang MD : Nothing to Disclose, Hyun Seok Choi MD : Nothing to Disclose, So Lyung Jang : Nothing to Disclose, Kookjin Ahn MD, PhD : Nothing to Disclose, Bum-Soo Kim MD, PhD : Nothing to Disclose

PURPOSE

Intracranial atherosclerosis is one of the causes of stroke. Because MR angiography cannot demonstrate vessel...
wall, vessel wall imaging is important to detect vulnerable atherosclerotic plaque. We hypothesized T1-WI 3D-TSE with black-blood preparation (T1-SPACE) can be useful to evaluate intracranial arterial wall. The goal of this study was to evaluate feasibility of T1-SPACE to detect intracranial atherosclerosis in nonsymptomatic and stroke patient.

**METHOD AND MATERIALS**

From September 2012 to November 2013, eighteen non-symptomatic and twenty two acute stroke patients who underwent both TOF and T1 SPACE using 3.0 Tesla MR System were enrolled. Patients with underlying malignancy, moyamoya disease, vasculitis, other systemic disease, such as rheumatoid arthritis were excluded. Outer margin of intracranial arterial wall was assessed on T1-SPACE, and inner margin was assessed on TOF source image (TOF-SI). After co-registration of T1-SPACE and TOF-SI, luminal area (LA) of basilar artery (BA) and cavernous segment of both distal internal cerebral arteries (ICA) were measured on T1-SPACE and TOF-SI respectively. Vessel wall thickness was measured by subtracting measurement of TOF-SI from measurement of T1-SPACE at following locations: BA, both supracinoid ICAs and M1 segment of both middle cerebral arteries. Burden index (BI) is defined as the sum of measured wall thickness of five intracranial arteries.

**RESULTS**

Correlation of LA from TOF-SI and T1-SPACE shows significant correlation in both groups (P<0.001). Correlation coefficient was as higher in non-symptomatic patients (0.909) than that of stroke patients (0.762). The LA of T1-SPACE was significantly higher in stroke patients than control group (P=0.006). However, LA of TOF was not significantly different between two groups (P=0.143). The BI (7.7±2.3 mm²) of stroke patents were significantly higher than that (3.1±1.1mm²) of non-symptomatic patients (P=0.012).

**CONCLUSION**

The LA of T1-SPACE was higher in stroke patients than normal control group. Thickness of intracranial arterial wall of stroke patients was significantly higher than that of control group.

**CLINICAL RELEVANCE/APPLICATION**

It is feasible to assess the degree of atherosclerosis of intracranial arteries using T1-SPACE and TOF source images. The result showed significant differences of intracranial wall thickness between stroke patients and control group.

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**Whether there Exist Neurons That Could Be Resuscitated in Patients with Acute Stroke after Onset of 36 Hours: Evaluation with Amide Proton Transfer (APT) MRI**

Xiaojie Luo MD (Presenter): Nothing to Disclose, Jinyuan Zhou PhD : Nothing to Disclose, min chen : Nothing to Disclose

**PURPOSE**

APT imaging is a new MRI methodology that can non-invasively detect tissue pH. Here, we evaluated ischemic penumbra due to tissue acidosis and prognosis in patients with acute stroke using APT imaging.

**METHOD AND MATERIALS**

Ten patients (M = 5, average years = 70.1 ± 10.7) with the onset of acute stroke symptoms (uncertain onset <24h, n = 2; 24h~36h, n = 8) from the anterior or posterior circulation were included in this study. They were underwent MRI 4 times, which would be first MR scanning after hospitalization, and then one day, one week and one month after treatments. Amide Proton Transfer (APT) images (saturation time 0.8 s, saturation power 2 µT) and Diffusion Weighted Images (DWI) were included in the scanning protocols under 3.0 Tesla MR scanner. APT images were calculated using magnetization transfer ratio asymmetry at 3.5ppm with respect to water. APT intensity values in normal-appearing white matter (NAWM) were compared with those of ischemic regions. Comparison of ischemic regions between DWI and APT images was reported. NIHSS (National Institute of Health stroke scale) score of each patient was assessed before and after courses of treatments.

**RESULTS**

On average, ischemic regions (APT value, -0.40% ± 0.14%) in patients showed significantly reduced (p < 0.0001) APT effects compared with NAWM (APT value, 0.23% ± 0.12%). Ischemic regions were about 10%-50% larger in APT images than in DWI (final infarct region), or just alike in size between two modalities in first MR scanning after hospitalization. In some cases, regions with reduced APT were not only observed at the ischemic spots, but also extended to some adjacent brain areas which might indicate potential infarction. After treatment, the findings varied between patients; generally, a trend for a reduced APT signal in the final infarct region and a restored APT signal in at-risk tissue was observed. NIHSS scores showed improved as patients’ ischemic regions in APT images became smaller. However, patients with similar size in two modalities did not show better prognosis.

**CONCLUSION**

APT images could be more accurate in defining the ischemic penumbrag, thus help to determine therapy and improve prognosis.

**CLINICAL RELEVANCE/APPLICATION**

Patients with acute stroke after onset of 36 hours might still have neurons that can be resuscitated, and APT images would help to detect the tissues.
Active Brain Regions during Sleep Using Electroencephalography-Functional Magnetic Resonance Imaging

Sameeksha Malhotra: Nothing to Disclose, Grace Yuewen Duan (Presenter): Nothing to Disclose, Todd B. Parrish PhD: Co-owner, Pain Id, LLC

PURPOSE

With techniques allowing the simultaneous acquisition of electroencephalogram (EEG) and functional magnetic resonance imaging (fMRI) data, active brain regions during different stages of the human sleep cycle were determined. This allows a greater understanding of sleep and its role in processing information.

METHOD AND MATERIALS

Data were collected using a Siemens 3T TIM Trio magnet and Neuroscan Maglink 64 channel MRI compatible EEG. A standard EPI BOLD sequence was acquired for 45 minutes while the subject slept. Sequence parameters were TR=2s, TE=20ms, thirty two 1.7 mm in plane and 3 mm thick slices. The EEG data oscillations were used to determine the duration of each sleep stage. The respective MR images were grouped by sleep stage, motion corrected, and spatially smoothed. Specific regions of interest (ROIs) were extracted to create correlation maps, visualized using Mango software. Correlation matrices were created using MATLAB to display neuronal connectivity among all ROIs.

RESULTS

Results suggest that brain activity is localized in the ROIs during sleep stage two. In rapid eye movement (REM) sleep, brain activity associated with the selected ROI is also present in most other brain regions. Hippocampal activity is most prevalent in all investigated stages, followed by thalamus, posterior cingulate, and amygdala activity. Brain activity in stage one and REM is similar, although REM activity is less concentrated to the ROI. The correlation matrices indicate that most brain regions show weak correlation with one another in sleep stages one and two, whereas in REM sleep, most brain regions are strongly associated with the others (Figure 1).

CONCLUSION

Stage two is considered deeper sleep than stage one, showing diminished brain activity. REM sleep shows the most neuronal connectivity because it involves consolidating memories and dreaming, which requires much regional interaction.

CLINICAL RELEVANCE/APPLICATION

EEG-fMRI data can lead to an improved understanding of brain activity during sleep, which may help in diagnosing sleep disorders.

Reliability Correction for Functional Connectivity: Clinical Relevance and Implementation

Sophia Mueller MD (Presenter): Nothing to Disclose, Danhong Wang: Nothing to Disclose, Michael D. Fox: Nothing to Disclose, Ruiqi Pan: Nothing to Disclose, Jie Lu MD, PhD: Nothing to Disclose, Kucheng Li: Nothing to Disclose, Randy L. Buckner: Consultant, Pfizer Inc Consultant, Johnson & Johnson, Hesheng Liu: Nothing to Disclose

PURPOSE

Disease-related alterations in neuronal networks can be estimated using functional connectivity MRI (fcMRI). However, signal to noise ratio (SNR) of fcMRI is distributed non-uniformly across the cortex leading to systematic biases in network estimates including attenuated correlation in low SNR regions. This bias can be accounted for using test-retest reliability-based attenuation correction. To expand the applicability of this approach in clinical studies, where repeated sessions might not be available, we tested if reliability can be estimated from split data of a single session. Next, we applied this "split session approach" to publically available clinical data to demonstrate that reliability is influenced by age, neuropsychiatric state and scanner type.

METHOD AND MATERIALS

Reliability estimated in a longitudinal dataset (n=25, 5 repeated scanning sessions) was compared to a reliability map based on a single split session of this dataset. Next, reliability maps were derived from 6 data
sets (26 children and 26 matched adults scanned at a 3T Siemens scanner, 25 subjects with autism and their 25 matched controls scanned at a 3T Siemens scanner, 17 children scanned at a 3T GE scanner and 17 matched children scanned at a 3T Siemens scanner).

RESULTS

The reliability map derived from the "split-session" approach showed a high degree of similarity to the reliability map obtained from 5 sessions (r =0.81, Fig. A). Reliability distribution significantly differed between children and young adults (Fig. B1), autism subjects and normal controls (Fig. B2), and between data collected using a Siemens versus a GE scanner (Fig. B3). The medial temporal lobe, a brain area prone to susceptibility artifacts, consistently showed low reliability in all study groups.

CONCLUSION

fcMRI reliability distribution is influenced by age, neuropsychiatric state, and scanner type, suggesting the necessity to account for its impact on fcMRI estimates when comparing subject cohorts. The fact that reliability can be estimated based on split data of a single session makes reliability-based attenuation correction a readily available tool to improve the neurophysiological validity of fcMRI data.

CLINICAL RELEVANCE/APPLICATION

Our analyses revealed that reliability distribution is influenced by age, neuropsychiatric status and scanner type, suggesting the necessity to account for its impact on fcMRI estimates in patient control studies.

SSM17-03

Validation of Motor Network on Resting-state fMRI with Direct Cortical Stimulation for Glioma Cases

Yinyan Wang (Presenter): Nothing to Disclose, Tianyi Qian PhD: Nothing to Disclose, Lei Wang: Nothing to Disclose, Jun Ma MD: Nothing to Disclose, Tao Jiang: Nothing to Disclose

PURPOSE

Aiming at evaluating the reliability of the rs-fMRI in depicting the motor functional plasticity following brain tumors, we include a cohort of glioma cases with a tumor involved in the motor area. To calculate/generate the functional correlation map, four seed regions were selected from each case according to either anatomical mark or task-based functional activation in each hemisphere.

METHOD AND MATERIALS

A total of 14 consecutive patients (9 males) with gliomas treated were participated in this study. fMRI data were acquired on a SIEMENS Magnetom Trio 3T (Siemens, Germany), with using echo-planar imaging (EPI). Intra-operative ECS mapping was performed using a bipolar electrode with a 5-mm interelectrode distance. Peak areas of the task-based activations were selected as the seed regions in the lesion hemisphere and healthy hemisphere. The spatial distributions of motor network were obtained by computing the correlation coefficient between each seed regions and the whole brain.

RESULTS

Receiver operating characteristic (ROC) curves of various functional neuroimaging analyses were acquired by calculating the sensitivity and specificity under different thresholds. Motor functional brain regions located by ECS were considered as the reference. In group level, among five analyzing methods, task-based functional MR achieved the highest accuracy in predicting the hand motor area according to the ROC curve. Its sensitivity and specificity are 81.6% and 80.0% for the patient group at the fixed-threshold analysis. For seed-dependent functional connectivity mapping, motor networks calculated from task-determined seeds have higher conformity with ECS result, when compared to ones acquired from the anatomy-determined seeds. The motor functional network calculated from unilateral task-based seed showed a similar high reliability to task fMRI in predicting the motor plasticity determined by ECS.

CONCLUSION

Resting-state functional MR imaging can be used to perform individualized locating of motor functional area and in consequence assist surgical planning in patients with brain tumors. Methods of seed selection influence the accuracy in predicting functional areas for clinical cases.

CLINICAL RELEVANCE/APPLICATION

When tumor involved the motor area, the most reliable motor network was calculated from the seed which was determined by unilateral task-based activation.

SSM17-04

Thalamic Resting-state Functional Connectivity: Disruption in Patients with Type 2 Diabetes

Yu-Chen Chen (Presenter): Nothing to Disclose, Gao-Jun Teng MD: Nothing to Disclose

PURPOSE

To explore the disrupted thalamic functional connectivity and its relationships with cognitive dysfunction in type 2 diabetes mellitus (T2DM) by using resting-state functional magnetic resonance imaging (fMRI).

METHOD AND MATERIALS
A total of 38 T2DM patients and 39 well-matched healthy controls participated in the resting-state fMRI, T1-weighted imaging and diffusion-tensor imaging (DTI) scans. The thalamic functional connectivity was characterized by using a seed-based whole-brain correlation method and compared T2DM patients with healthy controls. Pearson correlation analysis was performed between thalamic functional connectivity and clinical data. All individuals provided written informed consent and this study was approved by the Research Ethics Committee of the Affiliated Zhongda Hospital of Southeast University.

RESULTS

When compared with healthy controls, T2DM showed significantly decreased functional connectivity of the thalamus mainly in the right temporal cortex, precentral gyrus and bilateral occipital cortex; Increased functional connectivity of the thalamus was detected in the left cerebellum, bilateral frontal cortex and cingulum (p<0.05, corrected for AlphaSim). In T2DM patients, the complex figure test-delayed score and the verbal fluency test score were positively correlated with the thalamic functional connectivity of the right cuneus and the left inferior temporal gyrus, respectively (r=0.575, p<0.01; r=0.591, p<0.01). Moreover, there was no structural damage (thalamic atrophy and DTI abnormalities) in the thalamus of T2DM patients.

CONCLUSION

T2DM patients develop disrupted thalamocortical functional connectivity, which is associated with cognitive impairment in selected brain regions. Resting-state thalamocortical connectivity disturbance can be used as an early diagnostic marker for evaluating the cognitive dysfunction in T2DM.

CLINICAL RELEVANCE/APPLICATION

This study investigates the thalamic functional connectivity to shed light on the development and progression of cognitive dysfunction in patients with type 2 diabetes.

SSM17-05

Changes in Functional Connectivity Correlate with Behavioral Gains in Stroke Patients after Therapy Using a Brain-Computer Interface Device

Brittany Young (Presenter): Nothing to Disclose, Zack Nigogosyan: Nothing to Disclose, Alexander B. Remsik BA: Nothing to Disclose, Leo Walton: Nothing to Disclose, Jie Song MS: Nothing to Disclose, Veena A. Nair PhD: Nothing to Disclose, Scott Grogan BS: Nothing to Disclose, Mitch Tyler: Nothing to Disclose, Dorothy Farrar-Edwards: Nothing to Disclose, Kristin Caldera: Nothing to Disclose, Justin Sattin: Nothing to Disclose, Justin Williams: Nothing to Disclose, Vivek Prabhakaran MD, PhD: Nothing to Disclose

PURPOSE

BCI technology is being incorporated into new stroke rehabilitation devices, but little is known about brain changes associated with its use. We examine functional connectivity changes associated with BCI-based interventional therapy.

METHOD AND MATERIALS

We collected anatomical and functional MRI of 9 stroke patients (ages 48-68, 6M) with persistent upper extremity motor impairment before, during, and after therapy using a novel BCI system. Subjects performed finger tapping of the impaired hand during fMRI. Action Research Arm Test (ARAT), 9-Hole Peg Test (9-HPT), and Stroke Impact Scale (SIS) domains of Hand Function (HF) and Activities of Daily Living (ADL) were also assessed. Group-level analyses examined changes in whole-brain task-based functional connectivity (FC) to seed regions in the motor network observed during and after BCI therapy. Changes in FC at both the network and the connection levels were examined for correlations with changes in behavioral measures.

RESULTS

Whole-brain FC analyses seeded in each thalamus showed FC increases from baseline at mid-therapy and post-therapy (p<0.05). Average motor network FC increased post-therapy, and changes in average network FC correlated (p<0.05) with changes in performance on ARAT (R²=0.21), 9-HPT (R²=0.41), SIS HF (R²=0.27), and SIS ADL (R²=0.40). Multiple individual connections within the motor network correlated in change from baseline with changes in behavioral measures; many involved the thalamus, with change in each of four behavioral measures significantly correlating with change in at least one thalamic connection.

CONCLUSION

Changes in FC occur with the administration of rehabilitative therapy using a BCI system. The correlations noted between FC measures and behavioral outcomes indicate that both adaptive and maladaptive changes in FC may develop with this therapy and suggest a brain-behavior relationship that may be stimulated by the neuromodulatory component of BCI therapy.

CLINICAL RELEVANCE/APPLICATION

Characterizing brain connectivity changes with stroke rehabilitation using brain-computer interface (BCI) technology informs neuroplastic mechanisms associated with BCI therapy.
PURPOSE
To evaluate resting-state functional connectivity and its correlation to neurocognitive impairment in patients with HIV.

METHOD AND MATERIALS
In this cross-sectional study, we evaluated 19 HIV patients (14 males; 5 females; mean age 55.5 years; mean education 11.3 years) and 17 seronegative controls matched by sex, gender and education. The seropositive group included 9 HIV patients without neurocognitive disorder (HAND +) and 10 HIV patients with asymptomatic or mild neurocognitive disorder (HAND -). We used resting-state functional MRI to evaluate average connectivity, local clustering, within-module connectivity, and between-module connectivity of left and right posterior cingulate gyrus (PCC) and left and right medial prefrontal cortex (mPFC). A completed detailed neuropsychological assessment was administered to evaluate executive functions, memory, attention, speed of information, motor skills and verbal language. The statistical analysis was performed assessing the correlation between connectivity among those areas and the neuropsychological tests results.

RESULTS
HAND + patients presented a lower (i.e. more normal) PCC clustering than HAND - patient (p value

CONCLUSION
HAND + patients presented a connectivity pattern more similar to controls than HAND - patients, and those results presented an opposite correlation with the attention coefficient, suggesting a preserved cognitive functioning due to compensation.

CLINICAL RELEVANCE/APPLICATION
Resting-state functional MRI could be used as a potential noninvasive biomarker for neurocognitive impairment in HIV infection.
were validated by comparing pre-surgical maps of 51 resected patients with histology. Following initial validation, the maps were used for clinical decisions. The sensitivity and PPV of rCBV/KTranse (DSC/DCE MRI) to tumor regions in the TRAMs was studied in subgroups of 207/20 MRI exams.

RESULTS
Histological validation confirmed that regions of efficient clearance of the contrast agent >1hr post contrast injection represent morphologically active tumor while regions of contrast accumulation represent non-tumor tissues with 100% sensitivity and 92% PPV to active tumor regions. Following initial validation, the maps were used for making 232 clinical decisions. In 67 cases the decision was to continue follow-up and in 165 to change treatment (surgery, chemoradiation, radiation treatments, switch to Avastin, etc). The sensitivity and PPV of rCBV/KTrans to tumor regions in the TRAMs were found to be 23%/17% and 100%/90%, respectively.

CONCLUSION
Delayed MRI enables complete separation between tumor (negative signal) and treatment effects (positive signal) with high sensitivity and PPV and is currently being used for clinical decisions by 25 physicians referring patients to the study. In addition, the high resolution TRAMs may also be used for planning high precision treatments. The high PPV of rCBV/KTrans assures that high values of these parameters reflect tumor, but the low sensitivity suggests that most tumors (77%/83%) depicted in the TRAMs will result in false negative values.

CLINICAL RELEVANCE/APPLICATION
Delayed contrast MRI provides high resolution differentiation between tumor/treatment-effects in brain tumor patients and therefore may be applied for decision making and treatment planning

SSM18-02
Combined Use of Apparent Diffusion Coefficient and Cerebral Spinal Fluid Biomarkers Improves Sensitivity and Specificity of Diagnosing Primary Central Nervous System Lymphoma

Ramon Francisco Barajas MD : Nothing to Disclose , James Rubenstein : Nothing to Disclose , Marc Christopher Mabray MD (Presenter) : Nothing to Disclose , SooNmeet Cha MD : Nothing to Disclose

PURPOSE
The diagnosis of primary central nervous system lymphoma (PCNSL) using morphologic MR imaging can be challenging given its lack of sensitivity and specificity. Therefore, we aimed to determine if the combined use of MRI derived apparent diffusion coefficient (ADC) and cerebral spinal fluid (CSF) biomarkers (chemokine ligand (CXCL) 13 and interleukin (IL) 10) improves the diagnostic capabilities of PCNSL in a cohort of patients with enhancing brain lesions.

METHOD AND MATERIALS
89 patients with newly diagnosed enhancing brain lesions (45 PCNSL, 21 metastatic tumor, 14 Glioblastoma, and 9 acute demyelinating disease) detected by MR imaging underwent CSF sampling in this HIPPA compliant CHR approved study. CSF samples provided standardized CXCL-13 and IL-10 concentrations (pg/ml).

Co-registered ADC maps (GE Functool v4.4) allowed for placement of regions of interest about the enhancing lesions. Lesion minimum, 25th percentile, and mean relative ADC (rADC) values were calculated as a ratio of white matter values. Student’s T-test compared differences between groups. Linear regression was performed with Pearson correlation. Receiver operating characteristic analysis provided threshold values. P-value less than 0.05 equated statistical significance.

RESULTS
rADC values were significantly decreased and CSF biomarkers increased within PCNSL (rADCmin= 0.72, rADC25th= 0.91, rADCmean= 0.98, CXCL-13= 3382, IL-10= 1773) when compared to other enhancing brain lesions (rADCmin= 1.15, rADC25th= 1.39, rADCmean= 1.36, CXCL-13= 113, IL-10= 5.93; P <0.01). rADC minimum, 25th percentile, and mean values demonstrated a significant correlation with CXCL-13 alone (R> 0.32, P < 0.05). CXCL-13 value >340 provided a sensitivity and specificity of 89% and 75% for the diagnosis of PCNSL. Mean rADC threshold value of 1.2 provided the best diagnostic capability (sensitivity 95%, specificity 64%). A multi-parametric diagnostic model using CXCL-13 and rADC provided a sensitivity and specificity of 100% and 94%.

CONCLUSION
The combined use of MRI derived ADC and CSF derived CXCL-13 biomarkers improved the diagnostic capability of PCNSL within this cohort of patients.

CLINICAL RELEVANCE/APPLICATION
The MRI and CSF derived multparametric diagnostic model utilized in this study could negate the need for tissue sampling prior to the implementation of medical therapy in patients with PCNSL.

SSM18-03
MR-ADC Histogram Moments, Distances, and Percentiles in Management of Choroid Plexus Tumors, and Correlation with Histopathology and Ki-67

Shanker Raja MD (Presenter) : Nothing to Disclose , Sadeq W. AlDandan MBBS : Nothing to Disclose , Sharad P. George MD : Nothing to Disclose , Abdullah AlRashed MBBS : Nothing to Disclose , Ahmad Lary
Choroid plexus tumors (CPT) are rare pediatric tumors, histologically classified as papilloma (CPP), atypical (atCP), and Ca (CPCa). We explored if ADC histogram moments, percentiles and distances would be helpful for further management of pts. with CPT.

**METHOD AND MATERIALS**

Normalized voxel ADC ratios (tumor/normal tissue) in 11 pts (male=6, female=5; mean age=7 yrs (range=3-516 months), were obtained by co-flagging CPT on coregistered T1W-C+ images and ADC maps (MIMvista workstation, Cleveland, USA). The VOI data were exported to EXCEL for histogram generation, computation of histogram moments (mean, SD, kurtosis, and skewness), percentiles/IQR (interquartile range); in addition intra and inter-group histogram distances (Bhattacharyya distance and Chi-square distance) were estimated. Multiple histogram metrics including SD, 95th percentile, and IQR were correlated with Ki-67 index.

**RESULTS**

Subtype group means were as follows: SD (0.18, 0.28, 0.36), 95th percentile (1.47, 1.82, 2.40), and IQR (0.18, 0.25, 0.43) in CPCa, CPP and atCP respectively. SD and 95th percentile were good differentiators between CPP and CPCa. Histogram estimates for individual atCP overlapped with those of CPCa and CPP. Intragroup subtype means of the histogram distances were as follows: Bhattacharyya distance (0.73, 0.61, 0.75) and Chi-square distance (1.36, 1.07, 1.38) in CPP, atCP, and CPCa respectively. Intergroup cross histogram distances were not helpful in classifying individual CPT (CPCa vs CPP). Good correlation between Ki-67 and 95th percentile (r= -0.7), and SD (r= -0.66) were noted.

**CONCLUSION**

Detailed analysis of ADC histogram metrics, especially histogram moments and percentiles appears promising for the management of CPT. Our findings need to be confirmed in a larger series.

**CLINICAL RELEVANCE/APPLICATION**

MR-ADC 95th percentile and SD were notable differentiators between CPP and CPCa; while the observed overlap of histogram metrics in individual atCP lesions with those of CPP and CPCa may have management implications.

**Impact of Antiangiogenic Therapy on MR Biomarkers and How They Can Predict Treatment Response**

**PURPOSE**

To assess the value of MR based biomarkers in the prediction of high grade glioma (HGG) response to antiangiogenic agents and the impact of anti-angiogenic treatment in genetic, metabolic and pathologic profiles of HGG in a preclinical mouse model.

**METHOD AND MATERIALS**

We have serially evaluated 44 mice, 17 during treatment with a mAb against VEGF and 27 controls on a dedicated 7T MR scanner using an orthotopic mouse model of HGG. After tumor implantation MR was performed with 4 days intervals and mice sacrificed at treatment completion or when showing signs of progression. Tumors and normal contralateral brain were studied for histopathology, RT-qPCR and 1H HRMAS. Treatment response was assessed using the RECIST criteria and based on Fischer's linear discriminant analysis predictive models were built of treatment response. Spearman's correlations were obtained between genetic and metabolic profiles of treated and untreated mice.

**RESULTS**

Among treated mice 10 responded and 7 did not respond to treatment. Response was associated with significant increase in survival and decrease in tumor growth. Decrease mADC, mCBV, mCBF and mMTT and increased T2* were identified as MR biomarkers of response. Fischer's discriminative analysis applied to T2 and DWI image datasets obtained before and on D2 after the 1st treatment separated responders from non-responders with an accuracy of 92%. Gene expression biomarkers of response included underexpression of survivin, caspase 3, HIF1α, hexokinase 2, EGF, integrin α5, VE-cadherin, galectin 3 and MMP13 and overexpression of CXCL12 and SOX1. VEGF-A expression in responders and non-responders did not show a statistically significant difference. Spectroscopic biomarkers of response included decreased levels of lactate, lipids, choline and its metabolites, myoinositol and inhibitory neurotransmitters and increased levels of NAA.

**CONCLUSION**

In a mouse model of HGG we identified MR imaging, genetic and spectroscopic biomarkers of response to antiangiogenic treatment. Using Fischer's discriminative analysis T2 and DWI image datasets discriminated responders from non-responders with 92% accuracy as soon as the second day after the 1st treatment.

**CLINICAL RELEVANCE/APPLICATION**

Timely prediction of treatment response to biologically targeted drugs will allow appropriate selection of patients.
who will benefit from continued treatment and identify those who will need a different course of action.

**Monitoring Radiation Therapy of Metastatic Brain Tumors from Small Cell Lung Cancer Using Non-Gaussian Diffusion MRI**

Frederick C. Damen PhD (Presenter): Nothing to Disclose, Shun-Yu Gao MD: Nothing to Disclose, Lei Tang MD: Nothing to Disclose, Yi Sui MS: Nothing to Disclose, Kejia Cai PhD: Nothing to Disclose, Ying-Shi Sun MD, PhD: Nothing to Disclose, Xiaohong Joe Zhou PhD: Nothing to Disclose

**PURPOSE**

Parameters derived from non-Gaussian diffusion models, such as Fractional Order Calculus (FROC) model, have shown excellent correlation to important tissue properties such as heterogeneity and microstructure, opening new possibilities of using multi-parametric diffusion imaging markers for diagnosis and early assessment of tumor treatment. The purpose of this study is to monitor radiation therapy of metastatic brain tumors from small cell lung cancer in order to provide timely feedback on the success, or failure, of the treatment.

**METHOD AND MATERIALS**

This study was performed, with IRB approval, on 5 patients (49.4±7.9 yr) with a total of 16 clinically proven metastatic brain tumors from small cell lung cancer. Diffusion weighted images were acquired using 17 b-values (0 - 4000 s/mm2) prior to radiation therapy and after every 3rd treatment. Diffusion coefficient D, intra-voxel tissue heterogeneity index β, and mean free diffusion length μ, were calculated by fitting the multi b-value diffusion images to the FROC model. ROIs were selected on pretreatment solid tumor regions, guided by T1+C, T2, FLAIR, and the DWI images. Means and standard deviations of D, β, and μ, were evaluated at each time point and analyzed versus the time relative to the start of treatment and accumulated radiation dosage (Gy) at 3Gy/fraction over 10 fractions given daily.

**RESULTS**

Tumor treatment responses consistent with positive post treatment neurological exams exhibited (a) increased mean (e.g., ΔD=0.2x10^-3 mm2/s) and standard deviation (e.g., ΔD=0.1x10^-3 mm2/s) of D, (b) decreased mean of β (e.g., Δβ=0.1), and (c) elevated mean of μ (e.g., Δμ=0.5μm). These findings can be explained by increased necrosis, decreased cellularity, and a high degree of intra-voxel tissue heterogeneity associated with treatment. Increased standard deviation of D suggested variation of treatment response throughout the tumors, as expected in haphazardly organized microstructures.

**CONCLUSION**

The additional information on intra-voxel heterogeneity provide by β, together with cellularity revealed by D and μ, can be used to more reliably and timely assess the radiation therapy efficacy of metastatic brain tumor from small cell lung cancer. Parameters from the FROC model may provide a sensitive way for monitoring cancer treatment.

**CLINICAL RELEVANCE/APPLICATION**

Timely feedback on the efficacy of cancer treatment is useful for optimizing treatment strategies.

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**Comparison of Contrast-Enhanced MP-RAGE Imaging and Whole Brain T1w 3D-Black-Blood 3T-MRI for the Diagnosis of Brain Metastases**

Nora Navina Kammer MD (Presenter): Nothing to Disclose, Eva Maria Coppenrath MD: Nothing to Disclose, Karla Maria Treitl MD: Nothing to Disclose, Hendrik Kooijman: Employee, Koninklijke Philips NV, Maximilian F. Reiser MD: Nothing to Disclose, Tobias Saam MD : Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG

**PURPOSE**

To evaluate a commercially not available gadolinium-enhanced isotropic 3D-whole-brain-black-blood T1w-TSE sequence with variable flip angles (T1w-VISTA) for the diagnosis of brain metastases in comparison with a conventional gadolinium-enhanced T1w-MP-RAGE sequence.

**METHOD AND MATERIALS**

We prospectively included 48 patients with known or suspected intracranial tumors and 15 controls without any evidence of intracranial tumors. All patients underwent both standard contrast-enhanced MP-RAGE and a T1w-VISTA (resolution=0.8 mm3 isotropic, scan time 4:43 minutes) at 3-Tesla (Philips Ingenia). For each patient the number of metastases was determined by two experienced radiologists. For each individual lesion, the maximum diameter, the diagnostic confidence (5-point Likert scale), the visual assessment of contrast enhancement (3-point Likert scale) as well as the contrast-to-noise ratio (CNR) was assessed.

**RESULTS**

14 patients presented with metastases, in 6 cases contrast enhanced VISTA was acquired before MP-RAGE. Significantly more metastases were found in the T1w-VISTA sequence compared to the conventional MP-RAGE sequence (63 metastases vs. 37 metastases; p < 0.05).

**CONCLUSION**

Black-blood 3D-T1w-VISTA provides significant advantages for the detection of cerebral tumors by nearly doubling the contrast-to-noise ratio of metastases compared to a conventional MP-RAGE sequence. This leads to a higher number of detected metastases and a higher diagnostic confidence.
CLINICAL RELEVANCE/APPLICATION
3D-T1w-VISTA black-blood imaging is superior for tumor detection compared to the conventional "white-blood" MP-RAGE sequence.

MSCN51
Case-based Review of Neuroradiology (An Interactive Session)

Multisession Courses

NR
HN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 8:30 AM - 10:00 AM   Location: S100AB

Participants
Director
Pina Christine Sanelli MD Nothing to Disclose

Sub-Events

MSCN51A Adult Brain
Pamela Whitney Schaefer MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the key neuroimaging characteristics of various adult cerebral disease entities. 2) Use pertinent imaging features and key clinical factors to formulate a pertinent differential diagnosis for various adult cerebral pathologies. 3) Discuss the utility of various imaging techniques for evaluating various adult cerebral disorders. 4) Review pertinent anatomy as it pertains to common adult cerebral pathologies.

MSCN51B Adult Spine
Gordon K. Sze MD (Presenter): Investigator, Remedy Pharmaceuticals, Inc

LEARNING OBJECTIVES

1) To analyze findings on imaging examinations of the spine. 2) To characterize unusual findings and provide a differential diagnosis.

MSCN51C Adult Head and Neck
Hugh D. Curtin MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To use imaging findings to differentiate head and neck lesions that can occur in similar locations. 2) To identify and evaluate imaging landmarks that determine changes in treatment.

RC606
Glands of the Head and Neck

Refresher/Informatics

NR
HN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 8:30 AM - 10:00 AM   Location: E350

Sub-Events

RC606A Salivary Imaging
Ilona Maria Schmalfuss MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Understand advantages and disadvantages of salivary gland imaging. 2) Discuss application of diffusion weighted imaging in work-up of salivary gland abnormalities. 3) Generate differential diagnostic considerations based on acuity of symptom onset, distribution of lesion(s) and imaging appearance. 4) Outline potential difficulties in the work-up of salivary gland abnormalities.

Thyroid Imaging

Ashley Hawk Aiken MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the incidence, significance and natural history of incidental thyroid nodules and differentiated thyroid cancer respectively. 2) Know the current literature and best practice recommendations for further imaging evaluation (US) and FNA of the incidental thyroid nodule. 3) Recognize the indications for cross-sectional imaging in the pre-operative evaluation of thyroid cancer.

ABSTRACT

The evaluation of thyroid nodules and masses is a broad, complex and controversial topic. This presentation aims to look at the current evidence for three of the most common clinical scenarios: 1. Incidental thyroid nodule on CT or MRI: When to recommend ultrasound or biopsy? 2. Palpable thyroid mass: What is the best test? 3. Preoperative evaluation of a thyroid mass with cancer diagnosis: What is the best test? Thyroid nodules are extremely common, with approximately 50% at autopsy. Most of these nodules are less than a centimeter. Thyroid cancer is also common, but not nearly as common as thyroid nodules, with approximately 2-5% at autopsy. Thyroid cancer incidence is on the rise without a significant change in mortality rate. There is some evidence that a rising incidence of subcentimeter papillary thyroid cancer results from increased detection on CT. There are no current guidelines for the management of these extremely common incidental thyroid nodules. This presentation will review the current literature and suggest some practical guidelines to help radiologists decide how to report these nodules. The combination of size criteria and clinical risk factors such as age is the best approach to date. The common practice of using a 10 mm size threshold alone to recommend US is arbitrary and results in excessive work-up of these incidental nodules, cost and patient anxiety. Current evidence suggests that a stratification approach, incorporating aggressive imaging findings, age younger than 35-40 years, and a 15-mm cutoff for triaging work-up, may reduce this excess work-up of benign ITNs while capturing the same proportion of thyroid malignancies. Ultrasound is the study of choice for the evaluation of an intrathyroidal mass or nodule. CT has no signs that help to differentiate malignant from benign thyroid nodules and is therefore not the study of choice. The Society of Radiologists in Ultrasound (SRU) has developed ultrasound criteria to determine high-risk nodules and prompt fine needle aspiration (FNA) for diagnosis. The SRU recommends FNA for the following US characteristics: 1. 1 cm & microcalcification 2. > 1.5 cm solid or coarse calcifications 3. > 2 cm mixed solid & cystic components 4. Nodule w/ substantial growth 5. Nodule w/ abnormal cervical lymph nodes The American Thyroid association (ATA) guidelines also currently recommend ultrasound as the preoperative study of choice for evaluation of an uncomplicated thyroid gland or nodule. CT has no signs that help to differentiate malignant from benign thyroid nodules and is therefore not the study of choice. The Society of Radiologists in Ultrasound (SRU) has developed ultrasound criteria to determine high-risk nodules and prompt fine needle aspiration (FNA) for diagnosis. The SRU recommends FNA for the following US characteristics: 1. 1 cm & microcalcification 2. > 1.5 cm solid or coarse calcifications 3. > 2 cm mixed solid & cystic components 4. Nodule w/ substantial growth 5. Nodule w/ abnormal cervical lymph nodes The American Thyroid association (ATA) guidelines also currently recommend ultrasound as the preoperative study of choice for evaluation of uncomplicated thyroid cancer. However, cross-sectional imaging should be recommended for cases with: 1. Aggressive pathology 2. Clinical signs of extra-thyroidal extension: vocal cord palsy, fixed mass, dysphagia, respiratory symptoms, etc. 3. Lateral compartment lymphadenopathy by palpation or ultrasound Many thyroid cancer experts would also consider cross sectional imaging for ultrasound or palpable central compartment lymphadenopathy.

active handout


Parathyroid Imaging

C. Douglas Phillips MD (Presenter): Stockholder, MedSolutions, Inc Consultant, Guerbet SA

LEARNING OBJECTIVES

1) Discuss the history of parathyroid imaging. 2) Understand current imaging modalities and their strengths and weaknesses. 3) Know the current surgical approach to parathyroid disease. 4) Understand the contribution of physiologic imaging of parathyroid disease.

ABSTRACT

Parathyroid imaging for patients with primary hyperparathyroidism (PHT) has gone through a series of changes that have been brought about because of the necessity of very precise localization of the abnormal parathyroid gland or glands. In the current surgical paradigm, minimally invasive parathyroid surgery (MIPS) is the sought after technique, demanded by patients and offering the lowest cost and most efficacious method to address an abnormal gland. Radiologists offer much to this patient population. Cross-sectional imaging is very often offered to this patient group and precise localization of parathyroid tissue is the goal. Surgeons do not want to operate on normal glands, and they do not want to explore necks. They must be directed to tissue that is parathyroid tissue, and not lymph nodes, and not other potential visceral space masses. Ectopic parathyroid tissue is also a vexing problem. In the setting of ectopic parathyroid tissue, the classic localizing techniques may fail, and a gland that is not evident on the oft-performed and often first line imaging modality (Tc-99m SESTAMIBI) may be problematic. We will discuss the contribution of CT, MR, US and nuclear medicine to visualize parathyroid tissue.
Sub-Events

RC610A  Thyroid Nodules: When and What to Biopsy
Jill Eve Langer MD (Presenter): Consultant, BioClinica, Inc

LEARNING OBJECTIVES

1) Discuss the sonographic characteristics that are associated with a high probability that a thyroid nodule is likely malignant or likely benign. 3) Gain an understanding of the rationale of the current guidelines for recommending thyroid fine needle aspiration.

ABSTRACT

As an overview, this presentation will review the epidemiology of thyroid nodules and correlate the sonographic findings with the risk of malignancy or the likelihood that the appearance represents a benign hyperplastic thyroid nodule rather than a true neoplasm. Additionally, the rationale for current guidelines for recommending thyroid fine needle aspiration will be discussed. The prevalence of palpable thyroid nodules is estimated to be 6.4% in women and 1.5% in men between 30 to 60 years of age, living in iodine-sufficient regions. However, high resolution sonography of the neck has been shown to be a much more sensitive technique than palpation, detecting nodules in 19 to 67% of randomly selected adults, with detection rates greater in women and increasing with age for both genders. Fortunately the vast majority of sonographically detected thyroid nodules are benign, hyperplastic regions of the thyroid. Fine-needle aspiration biopsy (FNA) is still considered the most reliable diagnostic test to determine if a thyroid nodule is malignant. Malignant nodules account for approximately 5% of all nodules that undergo palpation-guided FNA and approximately 10 to 15% of nodules that undergo sonography-guided FNA procedures. Analysis of the sonographic features of thyroid nodules has become the preeminent non-invasive tool for analyzing the risk of malignancy of thyroid nodules and aids in selecting which nodules should undergo fine needle aspiration (FNA). A number of recently published guidelines and consensus statements emphasize that the sonographic appearance of a nodule is a superior predictor of malignancy compared with nodule size or palpability and that when sonographic features of malignancy are noted, the nodule should undergo FNA. A number of sonographic features have shown a high specificity for the diagnosis of thyroid cancer and include marked hypoechogenicity, the presence of microcalcifications, infiltrating or micro-lobulated borders, and a taller-

RC610B  Post-Thyroidectomy Neck
Carl C. Reading MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the sonographic appearance of recurrent and metastatic disease, and other abnormalities, in the post-operative neck.

ABSTRACT

In the post-thyroidectomy neck, ultrasound surveillance is a highly effective method to evaluate for residual and recurrent disease. Recurrence can occur anywhere within the neck, but typically is located in the mid and low internal jugular chains and thyroid bed region. Abnormal cervical lymph nodes can be recognized with a high degree of accuracy due to abnormal size, shape, internal architecture, and color Doppler appearance. In patients with suspected metastatic papillary cancer, the presence of internal fluid or calcifications is highly predictive of malignancy. Abnormal nodal color Doppler flow including peripheral (non-hilar), increased, and irregular flow is highly predictive of malignancy. Within the post-operative thyroid bed, itself, residual thyroid tissue, tumor recurrence, and suture granulomas can occur. FNA for cytologic analysis of suspected abnormalities can be performed, and the addition of thyroglobulin and calcitonin assay of the specimen, for papillary and medullary cancer, respectively, adds a high degree of accuracy to this procedure.

RC610C  Parathyroid and Other Neck Masses
Mary Catherine Frates MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the best method to detect abnormalities of the parathyroid gland. 2) Gain understanding of the wide variety of lesions that can be found in the neck outside of the thyroid gland. 3) How to differentiate between these lesions based on their sonographic characteristics.

RC650  Image-guided Biopsy of the Spine (Hands-on Workshop)
Refresher/Informatics

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 8:30 AM - 10:00 AM Location: E260

Participants
Moderator
John L. Go MD : Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss and demonstrate spine biopsy techniques including CT and fluoroscopic approaches, anatomic landmarks, needle selection, special technical considerations for dealing with soft tissue masses, and fluid accumulations, lytic and blastic lesions, and hypervascular conditions. 2) Hands on exposure will be provided in order to familiarize participants with the vast number of biopsy devices that are clinically available. 3) Training models will also be used in order to teach technical skills with respect to approach and technique. 4) Advantages and disadvantages of various biopsy devices and techniques, and improve their understanding of how to maximize the reliability and safety of these spine biopsy procedures.

ABSTRACT

Sub-Events

RC650A Pre- and Postbiopsy Assessment
Richard Silbergleit MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address to complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

RC650B Equipment Used for Image-guided Biopsies of the Spine
Michele Hackley Johnson MD (Presenter): Committee member, Boston Scientific Corporation

LEARNING OBJECTIVES

1) Demonstrate the types of needles used for spine biopsy. 2) Selecting the proper types of needles used for spine biopsy. 3) Case demonstration of the proper use of single or coaxial needle sets for spine biopsy and the advantages or disadvantages of each.

RC650CThoracic and Lumbar Biopsies
John L. Go MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.

RC650D Cervical Spine Biopsies
A. Orlando Ortiz MD, MBA (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the various approaches used to biopsy lesions of the cervical spine. 2) Determine the selection of the proper needles to use to biopsy the spine. 3) Provide case examples of cervical biopsies and the thought process used to perform these procedures.

ABSTRACT

Cervical spine biopsies can be challenging procedures to perform, hence they tend to be performed by a limited number of proceduralists. C-spine biopsy is often performed to evaluate potential neoplastic or infectious processes of the cervical spine. The key to performing these procedures effectively and safely is in appropriate patient selection, careful image analysis in order to properly position the patient and choose an approach, identification of critical structures (such as the carotid artery) and neck spaces that should be avoided, and use of coaxial biopsy techniques. The procedure can be safely performed with CT and/or CT fluoroscopy. Specimen sampling principles and specimen handling are also discussed they can help to optimize this procedure.
Disc Biopsy and Aspiration
Amish H. Doshi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

VSNR51
Neuroradiology Series: Brain Tumors

Series Courses

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AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75
Thu, Dec 4 8:30 AM - 12:00 PM Location: N228

Participants
Moderator
Rivka Rachel Colen MD: Nothing to Disclose
Moderator
Timothy Roberts PhD: Nothing to Disclose

Sub-Events
VSNR51-01 Brain Tumor Imaging-from Structure to Individual Biology
Soonmee Cha MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review current state-of-the-art MR imaging techniques for diagnosis and management of brain tumors. 2) Describe recent progress and advances in molecular genetics of brain tumors and illustrate how these advances impact imaging interpretation. 3) Present strengths and pitfalls of advanced physiologic MR imaging techniques in the assessment of tumor activity following therapy.

VSNR51-02 Identification of Glioblastoma Radiophenotypes in Patients with 1p/19q Co-deletion
Ahmed M. Amer MD: Nothing to Disclose, Gini A. Thomas MBBS: Nothing to Disclose, Jixin Wang PhD: Nothing to Disclose, Pascal O. Zinn MD: Nothing to Disclose, Rivka Rachel Colen MD (Presenter): Nothing to Disclose

PURPOSE
To create an imaging genomic biomarker signature in order to identify those Glioblastoma patients (GBM) with 1p/19q deletion. Recent prospective randomized clinical trials have validated correlations between 1p/19q codeletion and increased overall survival of patients treated with radiation therapy with or without chemotherapy

METHOD AND MATERIALS
Using The Cancer Genome Atlas (TCGA), we identified 99 treatment naive GBM patients for whom both gene and miRNA expression profiles including the 1p/19q codeletion status, and pretreatment brain MR Imaging from The Cancer Imaging Archive (TCIA) were available. The VASARI feature set and 3D Slicer software 3.6 (http://www.slicer.org) were used for image analysis and image review was done in consensus by 2 neuroradiologists. Fluid Attenuated Inversion Recovery (FLAIR) was used for segmentation of the edema/cellular infiltration and Post GD T1-weighted imaging (T1WI) for segmentation of tumor enhancement and necrosis. Imaging parameters were then correlated with 1p/19q deletion status and gene expression profiles. Multiple complex biomarker signatures based on gene profiling and survival were created.

RESULTS
A novel imaging biomarker signature using multiple imaging parameters predicted 1p/19q co-deletion in patients with GBM. These were also associated with overall survival and progression-free survival.

CONCLUSION
Imaging genomic signatures can be expected to promote a more robust personalized approach to patient care and accelerate drug development and help stratify patients in clinical trials. An imaging biomarker signature was created using both qualitative and quantitative imaging parameters that predicted 1p/19 deletion status and expression.
CLINICAL RELEVANCE/APPLICATION

Prediction of 1p/19q status promotes a more effective personalized therapy and help stratify patients in clinical trials.

Longitudinal 3D MR Spectroscopic Imaging of 2-Hydroxyglutarate in Patients with Mutant IDH1 Glioma Undergoing Radiochemotherapy

Ovidiu C. Andronesi MD, PhD (Presenter): Nothing to Disclose, Franziska Loebel MD: Nothing to Disclose, Wolfgang Bogner MSC: Nothing to Disclose, Malgorzata Marjanska PhD: Nothing to Disclose, Elizabeth Gerstner MD: Nothing to Disclose, Andrew S Chi MD, PhD: Nothing to Disclose, Tracy T. Batchelor MD: Nothing to Disclose, Daniel P Cahill: Nothing to Disclose, Bruce R. Rosen MD, PhD: Research Consultant, Siemens AG

PURPOSE

The hallmark metabolic alteration of mutant IDH gliomas is the production of 2-hydroxyglutarate (2HG) which may play a central role in downstream effects. Hence, 2HG may be an ideal biomarker for both diagnosing IDH mutations and monitoring response to treatment. 2HG can be measured in-vivo by magnetic resonance spectroscopy and there is significant interest in developing methodology that performs reliably in patients. Here we present results obtained with a new 3D MR spectroscopic imaging (MRSI) sequence that maps 2HG over the entire volume of the tumor during treatment.

METHOD AND MATERIALS

A robust 3D MRSI sequence for 2HG imaging was newly developed by integrating adiabatic J-difference spectral editing, spiral imaging, and real-time motion correction. The acquisition parameters were: TR=1.6s, TE=68ms, FOV=200x200x200 mm3, acquisition matrix 10x10x10, NA=20, acquisition time TA=9:55 min:s. Spectra were fitted with LCModel software. Measurements were performed on a 3T MR scanner. 3D MRSI was performed in 20 patients with mutant IDH1 gliomas (WHO grades II-IV) consented with an approved IRB protocol. A baseline scan was done after surgery and before start of adjuvant treatment. At the moment 9 patients have completed a second post-treatment scan. Adjuvant treatment included radiotherapy and/or chemotherapy. The post-treatment scan was done in a time interval of 1-3 months after treatment.

RESULTS

Detectable levels of 2HG were measured in all patients that did not have gross total resection of tumor. 3D metabolic maps were obtained for 2HG, choline, N-acetyl-aspartate, glutamate-glutamine, and lactate. In 9 patients who have undergone both pre- and post-treatment scans, 4 demonstrated marked decrease (30-50%) in the levels of 2HG after completion of adjuvant therapy as shown in Figure 1. The remainder showed partial reduction of 2HG, with no patients showing increased 2HG levels.

CONCLUSION

We demonstrate for the first time that 3D imaging of 2HG is clinically feasible in patients with IDH1 mutated gliomas. Quantification of 2HG levels in a cohort of mutant IDH glioma patients shows measurable changes during treatment.

CLINICAL RELEVANCE/APPLICATION

2HG imaging could be used to answer clinically important questions of true-/pseudo-response and true-/pseudo-progression in mutant IDH glioma patients. 3D mapping of 2HG and other metabolites is important to capture tumor heterogeneity and reduce variability in longitudinal studies.

Prognostic Value of ADC and Its Correlation with Methylguanine-DNA-Methyltransferase (MGMT) Promotor Methylation Status and Epidermal Growth Factor Receptor (EGFR) Amplification and Survival in Glioblastoma Multiforme (GBM)

Romina Zalazar MD (Presenter): Nothing to Disclose, Miguel David Hernandez Arguello MD: Nothing to Disclose, Jose Luis Zubieta: Nothing to Disclose, Jose Luis Solorzano: Nothing to Disclose, Paula Barquin Garcia MD: Nothing to Disclose, Maria De Los Reyes Garcia de Eulate: Nothing to Disclose

PURPOSE

To analyse whether apparent diffusion coefficient (ADC) values correlate with survival and with methylguanine-DNA-methyltransferase (MGMT) promoter methylation status and epidermal growth factor receptor (EGFR) amplification on glioblastoma multiforme (GBM).

METHOD AND MATERIALS

72 patients with untreated GBM before surgery were analysed (mean time MRI-Surgery=6 days). Patients were followed-up for at least 12 months or until death. A ROI were drawn on ADC-map in the highest restriction region of the tumor and on the normal-appearing contralateral white matter (NCWM). ADCmin-values and ADC-index defined as a ratio between tumoral ADCmin and NCWM-ADCmean were evaluated. MGMT-status(n=60), EGFR amplification(n=53), KPS, tumoral and residual volume, progression-free survival (PFS) and overall survival (OS) were analysed. Kaplan-Meier and Cox-regression model were performed.
RESULTS

53 patients had complete resection. Presurgical and post-surgical mean tumoral volume were 42.4cm³ and 0.57cm³ respectively. Non methylated-MGMT-status (n=27) and low ADC values (<0.7) correlates with a decrease in PFS and OS (p<0.001). EGFR amplification (n=19) was correlated with a decrease in PFS (p=0.029) only when low ADC values and non--methylated-MGMT-status were present. EGFR amplification was not correlated with a poor outcome in the group of higher ADC values and MGMT methylated status (p<0.001). On Kaplan-Meier analyses MGMT-status correlated better with PFS (p=0.002), while ADC values correlate better with OS (p<0.001). In the multivariate analysis low ADC values and MGMTNM status were significant predictors of prognosis when they were adjusted by clinical variables (p= 0.001 and p=0.037, respectively).

CONCLUSION

The combined use of ADC values and MGMT-status are stronger predictors than using separated in GBM and could modulate outcome in patients with EFGR amplification.

CLINICAL RELEVANCE/APPLICATION

ADC values in GBM correlates significantly with survival, independently of the MGMT and EGFR status. Therefore, ADC values could be used as independent predictors of survival in those patients.

VSNR51-05

Automated Task-Free Resting-State Functional MRI to Define Critical Margins in Surgical Planning for Brain Tumor Surgery

Wolfgang Gaggl PhD (Presenter): Researcher, Prism Clinical Imaging, Inc, Svyatoslav Vergun: Nothing to Disclose, Matthew Andreoli: Nothing to Disclose, Veena A. Nair PhD: Nothing to Disclose, Vivek Prabhakaran MD, PhD: Nothing to Disclose

PURPOSE

Resting state functional MRI (rs-FMRI) enables clinicians to define critical areas and margins for pre-surgical planning of brain tumor resections without requiring the active participation of the patient. While task-based FMRI has gained utility in the clinical environment, rs-FMRI needs to be automatized and verified in tumor patients to be useful as a reliable clinical tool.

METHOD AND MATERIALS

Data were acquired from 48 patients (24 with brain tumors, 24 epilepsy and vascular lesions) including rs-FMRI, task-based FMRI, diffusion tensor imaging (DTI) and structural MRI on 1.5T and 3T MRI scanners. Data were preprocessed (Allen EA, 2011) using AFNI (NIH, Bethesda, MD) and FSL (Oxford, UK) and decomposed into individual functional network components using independent component analysis (ICA) implemented in the GIFT toolbox (MRN, Albuquerque, NM) calculated for 28 and 75 components. ICA components were both manually identified by a trained radiologist overlaid on the anatomical and DTI images and compared by spatial correlation to published template components from healthy subjects (Calhoun, 2008). Predictive values from radiologist vs. automation where generated as well as ranked cross-correlation values.

RESULTS

Reproducible ICA components could be identified from both the 28 and 75 component analyses. Higher component numbers resulted in higher spatial detail and higher classifier values, but occasionally led to functional networks distributed across several components. The median classifier achieved better than 80% agreement. Using the non-deformable MNI registration to warp templates into subject space, templates showed considerable overlap with the tumor in some instances. Calculated ICA components, however, followed the outline of the tumor highlighting functional gray matter as classified by a clinician.

CONCLUSION

Our automated classification allows extraction of functional network components quickly with good agreement to the manual reader and with seamless integration into the existing clinical FMRI workflow. A larger functional component template library for use with clinical patient populations is currently underway for further validation and improvement of classification accuracy.

CLINICAL RELEVANCE/APPLICATION

Task-free functional MRI can aid in identification of eloquent brain tissue in tumor resections by outlining functional networks and critical margins where active patient participation is not possible.

VSNR51-06

Role of the Radiologist in Pre-op Brain Tumor Mapping

John L. Ulmer MD (Presenter): Stockholder, Prism Clinical Imaging, Inc Medical Advisory Board, General Electric Company

LEARNING OBJECTIVES

1) Discuss the differences between image-centric and patient-centric perspectives in clinical Neuroradiology and presurgical brain mapping. 2) Cite the utility of clinical assessments and the electronic medical record in
VSNR51-07  Imaging Biomarkers of CNS Tumor Treatment Response
Benjamin Michael Ellingson MS, PhD (Presenter): Research Consultant, MedQIA Imaging Core Laboratory Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Tocagen Inc Research Consultant, Boston Scientific Corporation Research Consultant, Amgen Inc Research Grant, Siemens AG Research Grant, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Participants will comprehend the current RANO criteria and its limitations in practice. 2) Participants will comprehend and be able to apply digital T1 subtraction for quantification of tumor response. 3) Participants will gain an appreciation for how to use T2/FLAIR to measure response, challenges associated with T2/FLAIR, and potential solutions for measuring nonenhancing tumor response. 4) Participants will comprehend basic and advanced diffusion MR biomarkers to treatment response. 5) Participants will comprehend basic and advanced perfusion MR biomarkers to treatment response. 6) Participants will comprehend basic and advanced PET imaging response.

ABSTRACT

Depths of novel imaging biomarkers are now available for evaluating biological response to new therapies in CNS tumors. The current course will briefly outline the current Response Assessment in Neuro-Oncology (RANO) criteria and individual limitations to the current criteria. The use of T1 subtraction and FLAIR maps as a method for measuring enhancing tumor volume in the presence of agents that reduce vascular permeability will be discussed. T2/FLAIR response, challenges associated with interpreting T2/FLAIR response, and a potential solution for measuring nonenhancing tumor response using T2 relaxometry will be described. This course will outline simple and advanced diffusion MR biomarkers for patient stratification and response assessment, including ADC histogram analysis, functional diffusion mapping, voxel-wise proliferation and invasion modeling, and DREAM-MRI. Simple and advanced perfusion MR biomarkers, including DSC-MRI, DCE-MRI, and a new pharmacokinetic perfusion-diffusion model will be described. The use of pH-weighted MR response to therapy will also be discussed using CEST imaging. Lastly, basic and advanced PET imaging techniques will be described in the context of response assessment and drug target efficacy.

VSNR51-08  The DTI Challenge Initiative on the Standardized Evaluation of DTI Tractography for Neurosurgical Planning
Sonia Marie-Aurore Pujol PhD (Presenter): Nothing to Disclose, Alexandra J. Golby MD : Nothing to Disclose, William M. Wells PhD : Nothing to Disclose, Carlo Pierpaoli : Nothing to Disclose, Laurent Chauvin MS : Nothing to Disclose, Hatsuho Mamata MD, PhD : Nothing to Disclose, Guido Gerig : Nothing to Disclose, Martin Stynen : Nothing to Disclose, Isiah Norton : Nothing to Disclose, Sylvain Goutard : Nothing to Disclose, Caroline Brun : Nothing to Disclose, Olivier CominOWick PhD : Nothing to Disclose, Guang Cheng : Nothing to Disclose, Gabriel Girard : Nothing to Disclose, Alessio Moscato : Nothing to Disclose, Maged Gobran BMEDSc : Nothing to Disclose, Ye Li : Nothing to Disclose, Ali R. Khan PhD : Nothing to Disclose, Jeremy Lecoeur PhD : Nothing to Disclose, Riza Guler : Nothing to Disclose, Jan Klein PhD : Nothing to Disclose, JoY Matsui : Nothing to Disclose, Yoshitaka Masuľan PhD : Nothing to Disclose, Sudhir Pathak : Nothing to Disclose, Peter Neher : Nothing to Disclose, Hannah Nndin Salihan : Nothing to Disclose, Aymére Stamm : Nothing to Disclose, Manabu Tamura : Nothing to Disclose, Wendy Shi : Nothing to Disclose, Antonio Tristan MSC : Nothing to Disclose, Sinchai Tsao MS : Nothing to Disclose, Gopalkrishna Veni : Nothing to Disclose, Carl Fredrik Westin PhD : Nothing to Disclose, Yasukazu Kajita : Nothing to Disclose, Xiaolei Chen : Nothing to Disclose, Yoshiihiro Muragaki : Nothing to Disclose, Arya Nabavi MD : Nothing to Disclose, Ron Kikinis MD : Nothing to Disclose

PURPOSE

To provide standardized evaluation of Diffusion Tensor Imaging (DTI) tractography algorithms for mapping white matter pathways during glioma resection.

METHOD AND MATERIALS

Nineteen tractography teams reconstructed the corticospinal (CST) tract on a series of 11 cases presenting with a glioma near the motor cortex area (high-grade n=7, low-grade n=4), in the three editions of the DTI Tractography Challenge at the MICCAI 2011, 2012 and 2013 conference. The datasets included DTI scans (20 and 30 gradient directions, b-value=1000 s/mm2) acquired on a 3T scanner, and co-registered T1-weighted and FLAIR scans with segmented tumor and edema. Participating teams were required to submit part of their tractography results prior to the workshop, and to process two cases in a limited time at the event. Five neurosurgeons and four DTI experts evaluated and discussed the tractography reconstructions using a web-based questionnaire with standardized views of the tractography results. Variability among methods was quantified based on the Dice coefficient of bundle overlap of the voxelized tracts.

RESULTS

The 232 corticospinal tracts submitted to the three editions of the DTI Challenge workshop showed a large inter-algorithm variability (average Dice coefficient of overlap: 0.23(tumor), 0.22(contralateral)). Standardized review of the results demonstrated that most algorithms could reconstruct the CST projection to the cortical motor foot area and identified limitations in the ability of some methods to track the lateral projections to the face and hand areas, as well as false-negative and false-positive tracts in both hemispheres. Improvements of the tractography reconstructions from year 1 to year 3 indicate this collaborative effort is a learning experience for the community.

CONCLUSION

DTI tractography reconstructions are complex geometric models of white matter anatomy that can provide clinically relevant information for the planning of glioma resection in eloquent areas. By providing a benchmark
for the standardized evaluation of tractography algorithms on a common series of clinical data, the DTI tractography challenge initiative aims to accelerate the translation of novel tractography tools from research to the clinics.

**CLINICAL RELEVANCE/APPLICATION**

Standardized evaluation of DTI tractography techniques can help establish the validity of tractography-derived information to assist in neurosurgical decision-making.

**VSNR51-09 Distinguishing Pseudoprogression from True Progression or Recurrence of Malignant Glioma Using Amide Proton Transfer MR Imaging**

Bo Ma: Nothing to Disclose, Xiaohua Hong: Nothing to Disclose, Meiyun Wang MD, PhD: Nothing to Disclose, Hong Zhang MD: Nothing to Disclose, Jaishri Blakely MD: Nothing to Disclose, Jinyuan Zhou PhD (Presenter): Nothing to Disclose

**PURPOSE**

Amide proton transfer (APT) imaging is a novel molecular imaging approach that generates MRI contrast based on endogenous cellular proteins in tissue. The purpose of this study was to determine whether APT imaging can distinguish pseudoprogression from true progression or recurrence in patients with malignant glioma.

**METHOD AND MATERIALS**

Total 53 patients with pathologically confirmed high-grade gliomas (anaplastic astrocytoma or glioblastoma) were assessed. All patients provided written informed consent as required. Eligibility criteria included: treated with concurrent chemotherapy and radiation therapy (CCRT) after surgical resection, developed new or enlarged contrast enhanced lesions after CCRT, and had standard clinical MRI before and after CCRT. APT-MRI scanning was performed at 3T (3D sequence; 15 slices; 4.4 mm thickness). APT-weighted MRI signals were calculated using magnetization transfer ratio asymmetry at 3.5ppm with respect to water. MRI analysis was made, blinded to pathologic diagnosis, based on longitudinal signal changes in T2W, FLAIR, DWI and gadolinium enhancement on T1W, lasting at least six months.

**RESULTS**

Longitudinal radiological analysis showed that 39 patients had true progression or recurrence and 14 patients had pseudoprogression. The true progression or recurrence is associated with APT hyperintensity, compared to contralateral normal-appear white matter, while pseudoprogression is associated with APT isointensity to mild hyperintensity. The average APT signal intensity was significantly higher in the true progression/recurrence group (2.76% ± 0.55%) than in the pseudoprogression group (1.19% ± 0.40%, P < 0.001). Based on the receiver operating characteristic (ROC) analysis, the cutoff APT signal intensity value was 1.89%, with a sensitivity of 100% and a specificity of 92.9%.

**CONCLUSION**

The APT-MRI signal may be a valuable imaging biomarker to distinguish between tumor progression or recurrence and pseudoprogression whose diagnosis typically needs repeated surgery or longitudinal MRI scanning over several months.

**CLINICAL RELEVANCE/APPLICATION**

APT image can help distinguish pseudoprogression from true progression or recurrence. Such a distinction may avoid the time-consuming longitudinal MRI analysis and repeated craniotomy or biopsy.

**VSNR51-10 Early Post-Bevacizumab Change in rCBV from DSC-MRI Predicts Overall Survival in Recurrent Glioblastoma Whereas 2D-T1 Response Status Does not: Results from the ACRIN 6677/RTOG 0625 Multi-Center Study**


**PURPOSE**

ACRIN 6677/RTOG 0625 is a multi-center randomized phase II trial of bevacizumab with irinotecan or temozolomide in recurrent GBM. Pseudoresponse in patients receiving VEGF blockade has raised concerns that conventional MRI may not predict overall (OS) and progression-free survival (PFS). We compared the ability of relative cerebral blood volume (rCBV) from DSC-MRI and post-Gd 2D-T1 MRI after 2 weeks of treatment to predict OS and PFS.

**METHOD AND MATERIALS**

37/123 patients enrolled consented to DSC-MRI plus conventional MRI, 13 (mean age 54±14 years, 7 men) with DSC-MRI at baseline plus 2 weeks after start of treatment. Two central readers determined response
status at 2 weeks using 2D-T1 enhancement and Macdonald threshold criteria with adjudication if necessary. Enhancing ROIs were also defined semi-automatically from thresholded 2D-T1 difference images and used to extract mean GRE (TE=30-40ms) or SE (TE=60-105ms) rCBV (EPI, pre-load, 90° flip angle, post-processing leakage correction) normalized to normal-appearing white matter. Kaplan-Meier survival estimates and log rank test (2-sided) were used to determine if response status on 2D-T1 MRI and rCBV changes on DSC-MRI are predictive of PFS and OS, respectively. Fisher’s exact test (2-sided) was used to determine association between change in rCBV and response status on 2D-T1 MRI.

RESULTS

At 2 weeks, there were 3 responders and 10 non-responder/non-progressors (NR-NPs) on 2D-T1, and 4 positive and 9 negative changes from baseline in rCBV. One patient (NR-NP, positive rCBV change) had progressed clinically before week 2 and was excluded from PFS analyses. PFS was significantly worse for patients with increasing vs. decreasing rCBV (p=0.0034), but not for responders vs. NR-NPs (p = 0.44). Similarly, survival time was significantly shorter for patients with increasing vs. decreasing rCBV (p = 0.0015) but not for responders vs. NR-NPs (p = 0.92). There was no significant association between positive vs. negative change in rCBV and responders vs. NR-NPs on 2D-T1 MRI (p = 1.0).

CONCLUSION

After 2 weeks of anti-VEGF therapy, change in rCBV from baseline has highly significant prognostic value for PFS and OS, whereas 2D-T1 response status does not.

CLINICAL RELEVANCE/APPLICATION

Early increase in rCBV may be a useful MRI biomarker for the failure of anti-VEGF therapy, permitting a timely switch to alternative trials when necessary. Funded through NCI U01-CA079778 and U01-CA080098.

VSNR51-11 pH-Weighted Molecular MRI of Human Brain Tumors Using Amine CEST

Benjamin Michael Ellingson MS, PhD (Presenter): Research Consultant, MedQIA Imaging Core Laboratory Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Tocagen Inc Research Consultant, Boston Scientific Corporation Research Consultant, Amgen Inc Research Grant, Siemens AG Research Grant, F. Hoffmann-La Roche Ltd, Robert Harris: Nothing to Disclose, Whitney B. Pope MD, PhD: Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Tocagen Inc Research Consultant, Celldex Therapeutics, Inc Consultant, Guerbet SA, Timothy F. Cloughesy MD: Speakers Bureau, Merck & Co, Inc Consultant, F. Hoffmann-La Roche Ltd Consultant, Merck KGaA Consultant, Novartis AG Consultant, Celgene Corporation

PURPOSE

Acidosis is a hallmark of the tumor extracellular microenvironment. Additionally, studies have shown that tumor regions have increased amino acid uptake in order to meet high metabolic demands. Chemical exchange saturation transfer (CEST) MRI is a non-invasive imaging technique that can provide molecular information about the functional groups of molecules. The CEST signal is sensitive to many factors that affect chemical exchange between molecules, including metabolite concentration and pH. In the current study, we develop and test CEST MRI targeted to the amino acid amine group as a pH-weighted imaging biomarker for identifying cancer tissue in patients with various brain tumors.

METHOD AND MATERIALS

Samples of glutamine in water at varying pH (4.0 to 8.6 in units of 0.2) were created at varying concentration. Additionally, samples of phenylalanine and glycine were created for the same pH range. CEST data for these samples were collected at 3T on a Siemens Trio scanner (B1=2μT, 15 100-ms RF saturation pulses, 51 spectral points, ± 5.0 ppm). A normalization image was acquired by setting B1=0. Additionally, serial CEST data for a cohort of 12 GBM patients before, during, and after radiochemotherapy. Image-guided biopsies were obtained in an additional two patients with suspected tumor recurrence.

RESULTS

Results show high CEST asymmetry in low pH values between 5.0-7.0 pH and with increasing amino acid concentration. In GBM patients, changes in elevated CEST signal during radiotherapy provided early, independent information regarding the status of the tumor. Some patients showed continual increase in CEST positive regions during therapy, which was followed by early tumor progression (Fig. 1A). In cases of confirmed pseudoprogression, no elevated CEST asymmetry was noted despite an increase in tumor volume on anatomical images (Fig. 1B). Image-guided biopsies of CEST positive locations confirmed tumor, whereas CEST negative regions showed gliosis and little tumor activity.

CONCLUSION

CEST MRI targeted to the amine protons may provide a pH-weighted imaging biomarker for identifying regions of active tumor proliferation in patients with brain tumors.

CLINICAL RELEVANCE/APPLICATION

A non-invasive imaging method for obtaining tissue pH information would be invaluable as a tool for detecting human cancers and characterizing tumor response to therapy.

VSNR51-12 New PET CNS Oncology Approaches

Lance T. Hall MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES

1) Review the role of F-18 FDG in brain tumor imaging. 2) Discuss metabolic brain tumor imaging with amino acids and proliferation markers and learn the complimentary information provided to MRI techniques. 3) Introduce novel alkylphosphocholine analogues, CLR1404 and CLR1502, that can be used for PET imaging, in vivo optical imaging, and therapy of brain tumors.

**MSCN52**

**Case-based Review of Neuroradiology (An Interactive Session)**

*Multisession Courses*

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**AMA PRA Category 1 Credits ™: 1.50**

**ARRT Category A+ Credits: 1.50**

**Thu, Dec 4 10:30 AM - 12:00 PM   Location: S100AB**

**Participants**

*Director*

Pina Christine Sanelli MD Nothing to Disclose

**Sub-Events**

**MSCN52A**

**Pediatric Brain**

Tina Young Poussaint MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To select the appropriate modality or modalities in evaluating a suspected or diagnosed case of pediatric CNS disease with focus on MR imaging. 2) To review key MR imaging features of pediatric brain diseases. 3) To evaluate neuroimaging of pediatric CNS disease as it relates to understanding the developing brain in childhood.

**MSCN52B**

**Pediatric Spine**

Nafi Aygun MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric spine. 2) Identify the key imaging features of various common pediatric spine diseases. 3) Recognize common patterns for spine and spinal cord pathology and organize these patterns into categories of diseases processes.

**ABSTRACT**

Common pediatric spine and spinal cord diseases will be discussed in a case-based format.

**MSCN52C**

**Pediatric Head and Neck**

Laurie A. Loevner MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the salient imaging features of common pathologies of the pediatric head and neck. 2) Identify pertinent anatomy in the neck and skull base through the illustration of head and neck pathology. 3) Recognize patterns for disease that allow a succinct differential diagnosis. 4) Apply radiologic findings to identify next appropriate steps in patient work-up.

**SSQ14**

**Neuroradiology (Quantitative Neuroimaging)**

*Scientific Papers*

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**AMA PRA Category 1 Credits ™: 1.50**

**ARRT Category A+ Credits: 1.50**
Sub-Events

**SSQ14-01**

**Quantitative Mapping of Cerebral Metabolic Rate of Oxygen (CMRO2) Using Quantitative Susceptibility Mapping (QSM) and Quantitative Cerebral Perfusion**

**Jingwei Zhang** BEng (Presenter): Nothing to Disclose, **Tian Liu** PhD: Nothing to Disclose, **Pascal Spincemaille** PhD: Nothing to Disclose, **Ajay Gupta** MD: Nothing to Disclose, **Thanh D. Nguyen** PhD: Nothing to Disclose, **Yi Wang** PhD: Nothing to Disclose

**PURPOSE**

The cerebral metabolic rate of oxygen (CMRO2) and the oxygen extraction fraction (OEF) are important markers of neuronal function, particularly for managing ischemic stroke. In MRI, changes in local R2* or phase induced by the deoxyhemoglobin (dHb) magnetic field have been used to estimate CMRO2. However, R2* and phase images are contaminated by blooming artifacts and highly dependent on imaging parameters. Quantitative susceptibility mapping (QSM) by deconvolving MRI signal has been developed recently and can be used to accurately quantify dHb. The purpose of this study is to demonstrate the feasibility of using QSM to map CMRO2 in the healthy human brains when combined with cerebral perfusion measurements.

**METHOD AND MATERIALS**

Healthy volunteers (n=13) were recruited in this IRB approved MRI study using 3D gradient echo (GRE) and 3D arterial spin labeling (ASL) sequences on a 3T MRI system. dHb and Ferritin contributions to voxel susceptibility measured by QSM are resolved by performing two iso-CMRO2 measurements before and 25 minutes after an oral bolus of 200 mg caffeine. Pre- and post-caffeine QSM and CBF maps were used to generate CMRO2 and OEF maps maps using mass conservation and the assumption of iso-CMRO2 pre- and post-caffeine.

**RESULTS**

A statistically significant decrease in both susceptibility (-4.6 ± 1.8 ppb, p<0.01) and CBF (-23.1 ± 6.4 ml/100g/min, p<0.01) were measured in the cortical grey matter (GM) at 25 min post-caffeine compared to the pre-caffeine values. Consistent with the decrease in CBF after the caffeine challenge, OEF significantly increased from 22.5 ± 4.1% to 36.7 ± 5.3% (p<0.01) at 25 min post-caffeine. Mean CMRO2 in the cortical GM was 129 ± 21 μmol/100g/min.

**CONCLUSION**

QSM can be used in conjunction with cerebral perfusion measurements before and after a caffeine challenge to map CMRO2 and OEF in human brains.

**CLINICAL RELEVANCE/APPLICATION**

CMRO2 and OEF maps generated from QSM and ASL have the potential to provide important markers of neuronal function in ischemic stroke and tumor.

**SSQ14-02**

**Comparing Non-linear and Linear Least Square Diffusion Tensor Fitting Algorithms on the Tract-based Spatial Statistics Workflow**

**Viljami Sairanen** MSc (Presenter): Nothing to Disclose, **Linda Kuusela**: Nothing to Disclose, **Sampsu Vanhatalo**: Nothing to Disclose, **Sauli E. Savolainen** PhD: Nothing to Disclose

**PURPOSE**

Tract-Based spatial statistics (TBSS) is commonly used to search for differences or changes in white matter structures between groups. TBSS uses diffusion tensor (DT) data-derived Fractional Anisotropy (FA) values that are usually calculated using linear least squares (LLS) tensor fit. Since FA values can be sensitive to the DT fitting algorithm used, this study was set out to evaluate the impact of LLS and non-linear least squares (NLLS) DT fitting routines in TBSS pipeline.

**METHOD AND MATERIALS**

Diffusion weighted images, based on a healthy volunteer 3T MRI data, were used as a base to generate 40 synthetic patients. Rician noise was added to images to generate two groups with Signal-Noise-Ratio of 80 dB (SNR80) and 40 dB (SNR40). We created simulated left hemisphere brain lesions in both groups by decreasing voxel intensity in three brain regions by 10, 20 and 30% respectively. DT’s were calculated for each patient using both fitting routines to obtain FA maps. The effect of fitting routines on TBSS analysis was assessed by searching for significant (Monte Carlo P-value < 0.01) differences in individual voxels in FA-skeleton from both hemispheres. In an ideal case, the TBSS would return all simulated voxels in the respective hemisphere only.

The number of false positive findings due to noise was determined from the right naive hemisphere, and it was subtracted from the number of voxels found on the left modified hemisphere. TBSS output was then evaluated as the ratio of significant voxels from the total size of the FA-skeleton in the same area.

**RESULTS**
In the SNR40 group, the number of identified modified voxels in three brain regions was markedly higher after NLLS compared to LLS method: 68% vs 17% (NLLS vs LLS; 10% signal drop brain regions), 86% vs 62% (20% signal drop brain regions), and 85% vs. 31% (30% signal drop brain regions). The difference was also seen in the SNR80 group in all three regions: 38% vs 20% (NLLS vs LLS), 73% vs 65%, and 52% vs. 32%.

CONCLUSION
Our observations show that TBSS pipeline based on FA values derived from the NLLS method is able to identify a much higher proportion of true changes than the conventional LLS-based method.

CLINICAL RELEVANCE/APPLICATION
The challenges with DT fitting in obtaining an anatomically reliable FA map presents a significant confounder in TBSS. Our work indicates that NLLS can improve the reliability of TBSS analysis.

SSQ14-03

Fronto-Parietal Cortical Parcellation Using High Resolution Inversion Recovery MRI

Eyal Lotan MD, MSc (Presenter): Nothing to Disclose , Daniel Barazany PhD : Nothing to Disclose , Ido Tavor : Nothing to Disclose , Shani Ben-Amotz : Nothing to Disclose , Gahi Greenberg : Nothing to Disclose , Galia Tsarfaty MPH : Nothing to Disclose , Chen Chaim Hoffmann MD : Nothing to Disclose , David Tanne MD : Nothing to Disclose , Yaniv Assaf : Nothing to Disclose

PURPOSE
We have recently showed that inversion recovery (IR) MRI can be used to segment the cortex into laminar shape clusters that represent cortical layers (i.e., IR-layers) in vivo and in 3D. The separation to clusters was done based on their T1 characteristics. In this study, we investigated whether the fronto-parietal neuroanatomical areas can be distinguished based on their IR-layer composition.

METHOD AND MATERIALS
On a 3.0T-MRI, healthy subjects (n=15) underwent high resolution multiple IR-MRI scans in the axial plane covering the fronto-parietal cortex. The inversion time was varied as following: 230, 432, 575, 665, 760, 920 and 1080ms. An anatomical SPGR image was acquired 1mm isotropically covering the whole brain. SPGR was analyzed using Freesurfer framework, to define the brain neuroanatomical areas. Overall 22 fronto-parietal cortical areas were selected based on their representation of the IR-MRI coverage (11 areas in each hemisphere, minimum of 10000 voxels in each area). The IR-MRI data was analyzed by Hierarchical Clustering Analysis (HCA), where a dendrogram of the IR layers among all cortical areas was computed using correlation metric scheme to quantify their similarity.

RESULTS
The multi IR-MRI images were analyzed using a multi-spectral clustering framework revealing distinct laminar shape clusters across the cortex. The analysis was able to define 5 significant similar and consistent IR layers. The dendrogram plot showed that the IR layer composition of homologous areas (i.e., matched areas of the left and right hemispheres), were the most similar. In addition, several areas were found to have shared IR-layer composition.

CONCLUSION
The IR-layer reflects the tissue microstructure, and therefore can be used as a tool for brain segmentation. We found that homologous areas in both hemispheres have similar compositions, different from other neuroanatomical areas that show distinct composition.

CLINICAL RELEVANCE/APPLICATION
IR-MRI is a powerful tool that should be combined with traditional measurements for discrimination of cyto-architectonic areas.

Atlas of Human Brain Gray Matter Connectivity

Anna Varentsova BS (Presenter): Nothing to Disclose , Shengwei Zhang BS, BEng : Nothing to Disclose , Konstantinos Arfanakis PhD : Nothing to Disclose

PURPOSE
The purpose of this study was to develop a probabilistic atlas of gray matter (GM) connectivity through probabilistic white matter (WM) fiber tractography on an artifact-free high angular resolution diffusion-imaging (HARDI) template.

METHOD AND MATERIALS
HARDI template: Turboprop DTI data were acquired on 72 human subjects using a 3T MRI scanner. Diffusion tensors from all subjects were transformed to ICBM152 space using deformable registration with explicit orientation optimization (DTI-TK, PICSL, PA). Resulting transformations were applied to the raw diffusion-weighted (DW) and non-DW data of corresponding subjects. Due to differences in spatial transformations, each voxel of the combined dataset contained DW signals for 864 unique diffusion directions. Fiber orientation distribution functions (FOD) were produced using constrained spherical deconvolution. Tractography: Probabilistic tractography was performed on the resulting HARDI template using MRtrix, with seeds placed at the WM-GM interface. Gray matter atlas: The raw T1-weighted data from all subjects were segmented into 42 cortical and subcortical GM regions per hemisphere using FreeSurfer. The GM labels from all subjects were then transformed into ICBM-152 space using the transformations generated above. Each GM voxel
in ICBM-152 space was labeled with a multi-atlas approach using the transformed labels from all subjects and a vote-rule. HARDI template and GM atlas used in the study are parts of IIT Human Brain Atlas project (https://www.nitrc.org/projects/iit2). Connectivity: A two-ROI approach was used to segment tracts connecting each pair of 84 cortical and subcortical GM regions.

RESULTS
For each pair of GM labels, the generated atlas contains a map of the probability a WM voxel belongs to the connection of the two labels. The resulting maps of connectivity are in general agreement with known brain anatomy.

CONCLUSION
This work has generated a digital atlas of human brain GM connectivity based on probabilistic tractography on an artifact-free HARDI template.

CLINICAL RELEVANCE/APPLICATION
The new atlas can be used for atlas-based segmentation in ROI studies, as a reference for spatial normalization in voxel-wise studies, as well as for labeling of voxel-wise findings.

SSQ14-05
Multiband Sequence Reduces Scan Times for Diffusion MRI and Tractography in Clinical Patients

Matthew Gregory Young, MD (Presenter): Nothing to Disclose, Benjamin Adam Cohen, MD: Nothing to Disclose, Christopher Glielmi, PhD: Employee, Siemens AG, Vito Ruggiero: Nothing to Disclose, Mary Bruno RT: Nothing to Disclose, Himanshu Bhat: Employee, Siemens AG, Timothy Michael Shepherd, MD, PhD: Nothing to Disclose

PURPOSE
Multiband pulse sequence design is a recent research tool that facilitates simultaneous acquisition of multiple slices for diffusion or functional MRI. This can be used to accelerate MRI acquisitions for user-specified temporal, spatial or angular resolutions. We investigated the potential of this new multiband technology to accelerate routine diffusion MRI acquisitions in clinical patients.

METHOD AND MATERIALS
We obtained both routine and multiband 2-slice acceleration of a diffusion MRI sequence for 25 consecutive clinical outpatients (mean age 46 ± 21 yrs, 18 female). This typical cohort for our practice included patients with normal MRI except for white matter changes (7), multiple sclerosis (4), vascular malformations (2) and postsurgical follow-up brain tumors (7). The routine diffusion MRI sequence at 3-T with a 20 channel head and neck coil had 1.5-mm in-plane resolution and 5-mm slices (3 directions, 2 averages, b-values = 500 and 1000 s/mm²). Diffusion trace images for both techniques were randomized and anonymized, then compared side-by-side by 3 board-certified neuroradiologists for diagnostic quality, artifacts and signal-to-noise ratios (SNR). Quantitation of the apparent diffusion coefficient (ADC) for frontal horn CSF and the centrum semiovale also were compared.

RESULTS
In all 25 patients, the multiband diffusion MRI acquisition was successfully acquired, free of major artifacts and considered of equivalent diagnostic quality. Multiband 2-slice acceleration reduced diffusion MRI sequence relaxation time to 3.9 sec and reduced overall scan time by 38% to 81 sec. The gray-white contrast in trace diffusion images was unchanged suggesting increased T1-weighting was negligible. There was a subtle mild decrease in SNR for the posterior fossa that did not compromise perceived image quality. There was no significant difference for the ADC of the centrum semiovale (unpaired t-test, P > 0.05) and CSF ADC differed by only 2%.

CONCLUSION
Multiband sequences can be used to reduce routine diffusion MRI acquisitions in clinical patients by 38% without compromising image quality. This novel research technology should greatly facilitate translation of multiple diffusion-based brain mapping techniques to real patients.

CLINICAL RELEVANCE/APPLICATION
Multiband sequence acceleration may accelerate clinical MRI acquisitions and finally allow translation of time-intensive diffusion-based brain mapping techniques to real clinical patients.

SSQ14-06
Regional Brain T1 and T2 Relaxometry in Healthy Volunteers Using Magnetic Resonance Fingerprinting

Chaitra Ashok Badve, MD, MBBS (Presenter): Nothing to Disclose, Alice Yu, BS, MS: Nothing to Disclose, Dan Ma, MS: Nothing to Disclose, Yun Jiang: Nothing to Disclose, Jeffrey Lloyd Sunshine, MD, PhD: Research support, Siemens AG Travel support, Koninklijke Philips NV Travel support, Sectra AB Travel support, Allscripts Healthcare Solutions, Inc, Vikas Gulani, MD, PhD: Research support, Siemens AG Royalties, General Electric Company Royalties, Bruker Corporation Contract, Siemens AG

PURPOSE
To quantify T1, T2 relaxation times of different brain regions in healthy volunteers using the novel magnetic resonance fingerprinting (MRF) technique and analyze differences based on age, gender and laterality.

METHOD AND MATERIALS
We scanned 50 healthy volunteers (M: F 23:27, age 11-72 years) on 3T MRI with the MRF protocol. Imaging was acquired through various areas of brain and T1 and T2 maps were generated. Multiple regions of interest (ROIs) were manually outlined and T1 and T2 values were extracted. The 38 ROIs included lobar white matter (WM), corpus callosum, internal capsule (IC), deep nuclei, thalami, cerebellar structures and pons. Linear regression was used to assess the relationship between T1, T2 and age. Independent t-tests were used for differences in gender. For all the right-handed individuals, paired t-tests determined differences between right and left structures.

RESULTS

T1, T2 of prefrontal, frontal and parietal WM increase with increasing age (Rt parietal T1 p-value < 10-6; PCC = 0.63 and T2 p-value < 10-5; PCC = 0.55). T1, T2 measurements of occipital and temporal WM stay relatively stable with increasing age. The values are in agreement with previous literature. There is significant age dependent decrease in T1, T2 of bilateral substantia nigra (Rt SN T1 p-value < 10-4; PCC = -0.54 and T2 p-value < 10-3; PCC = -0.40). No significant changes were seen in T1, T2 of other deep nuclei. The age dependent changes are more pronounced in males compared to females in parietal WM and centrum semiovale. In right handed individuals, T1 was lower in right frontal WM (p<0.04), right IC (p<0.001), right lentiform nucleus (p<0.0007); and T2 is lower in right frontal WM (p<10-6), right lentiform nucleus (p< 0.001) compared to left.

CONCLUSION

MRF allows simultaneous, rapid, in vivo quantification of relaxation parameters of brain. Analyses show significant differences in relaxation parameters of certain brain regions based on age, gender and handedness.

CLINICAL RELEVANCE/APPLICATION

Normal T1 and T2 relaxometry values in brain regions provide baselines for comparison with disease. A normative database will enable MRF evaluation of neoplastic, demyelinating and degenerative disease.

Evaluation of Normal-appearing Basal Ganglia in SLE Patients with Quantitative Susceptibility Mapping: Comparison between Neuropsychiatric SLE, Non-neuropsychiatric SLE, and Controls

Atsushi Ogasawara (Presenter): Nothing to Disclose, Shingo Kakeda MD : Nothing to Disclose, Keita Watanabe : Nothing to Disclose, Tian Liu PhD : Nothing to Disclose, Yi Wang PhD : Nothing to Disclose, Yukunori Korogi MD, PhD : Nothing to Disclose

PURPOSE

The assessment of the patients with neuropsychiatric systemic lupus erythematosus (NPSLE) remains challenging, because their brain MR findings are often normal; a novel objective biomarker obtained with an imaging study is required. We reported our initial experience with quantitative susceptibility mapping (QSM) in SLE patients (RSNA 2013); QSM seemed useful for the detection of subtle susceptibility changes in the basal ganglia. Therefore, the aim of this study is to compare the QSM findings of normal-appearing basal ganglia among NPSLE patients, non-NPSLE patients, and controls.

METHOD AND MATERIALS

The QSM was reconstructed from the data obtained with a 3D multi-echo spoiled gradient echo (GRE) sequence using the Morphology Enabled Dipole Inversion (MEDI) sequence. Forty-one SLE patients including 18 NPSLE and 23 non-NPSLE patients and the age/sex-matched 23 controls were enrolled. For SLE patients and controls, two radiologists independently measured mean QSM values in various brain structures (thalamus, putamen, caudate, globus pallidus, pons, corpus callosum, and frontal white matter) that appear normal on conventional MR images. We also investigated the correlation of QSM values in the putamen and medial globus pallidus with the disease duration of SLE and NPSLE (duration of the neuropsychiatric symptoms).

RESULTS

For the putamen, the NPSLE patients showed significantly higher QSM values than the non-NPSLE patients and controls (p < 0.05); there was no significant difference between the non-NP SLE patients and controls. For the globus pallidus, although the NPSLE patients showed significantly higher QSM values than the controls (p < 0.05), there was no significant difference between the NPSLE and non-NPSLE patients. In the NPSLE patients, there was a significant correlation between the QSM values of the putamen and the duration of the neuropsychiatric symptoms.

CONCLUSION

In the NPSLE patients, the putamen that appears normal on conventional MR images showed the increased susceptibility with QSM compared with the non-NPSLE patients and controls. The degree of the iron deposition in the putamen seems to reflect the duration of the neuropsychiatric symptoms.

CLINICAL RELEVANCE/APPLICATION

The QSM value of the putamen may be used as an objective biomarker for NPSLE, especially in the patients whose brain MR imaging findings are normal.

Effectiveness of Reduced MR Scan Time for Volumetric Brain Analysis

Yoshimi Anzai MD (Presenter): Nothing to Disclose, Gregory James Wilson PhD : Nothing to Disclose

PURPOSE

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CLINICAL RELEVANCE/APPLICATION

The QSM value of the putamen may be used as an objective biomarker for NPSLE, especially in the patients whose brain MR imaging findings are normal.
Preliminary Study of Distribution and Age-related Changes of Brain Iron Deposition in Healthy Subjects by Susceptibility Mapping

Yoshimi Anzai MD (Presenter): Nothing to Disclose, Gregory James Wilson PhD: Nothing to Disclose, Kenneth R. Maravilla MD: Nothing to Disclose

PURPOSE
Voxel based morphometric and volumetric brain segmentation has been used to investigate neurodegenerative disease, in particular in patients with memory loss or cognitive decline. This technique is being applied to clinical practice with availability of FDA approved software, such as NeuroQuant (CorTechs Labs Inc. CA). This automated segmentation program requires a 1.2 mm3 voxel, 3D IR-TFE (inversion recovery turbo field echo) sequence that currently takes 9 minutes duration (ADNI sequence), often resulting in patient motion in this cognitively impaired population. We have implemented and tested a shorter IR-TFE sequence (5 minutes) and compared with ADNI recommended sequences.

METHOD AND MATERIALS
All MR data was acquired on a 3T wide-bore whole-body scanner. Volumes of 12 automatically segmented (NeuroQuant) brain structures in each side of brain (total of 24 structures per subject), asymmetric index (R vs. L) of the 12 brain structures, and age adjusted percentile of hippocampal volume were recorded in both 9 min and 5 min IR-TFE sequences in four subjects. Both MR acquisition protocols are exactly the same except for application of SENSE factor 2 in R-L direction and an increase in slice oversampling factor from 1.28 to 1.4 for 5 min scan. Spearman's correlation was used for the analysis of asymmetric index and actual volume measurements of the anatomic brain structures.

RESULTS
The volume of brain structures was very similar between 9 min and 5 min scans. Average difference in brain volume of brain structures was 0.32 cc, ranging from 0.0 cc to 2.34 cc. Spearman's nonparametric correlation shows extremely high correlation for brain volumetric ($\rho=0.9977$) as well as asymmetric index ($\rho =0.9257$). (Graph 1).

CONCLUSION
By applying SENSE factor of 2 and increasing the slice-oversampling factor by 10%, we were able to reduce the scan time of brain volumetric 3D IR-TFE sequence by 45% from 9 min to 5 min. This can be easily implemented into clinical practice for application in memory-impaired patients who might benefit from quantitative brain imaging.

CLINICAL RELEVANCE/APPLICATION
Volumetric brain analysis can provide valuable information for characterizing neurodegenerative disease. We implemented a shortened sequence without compromising accuracy of volumetric analysis.
### NRS449
**Diffusional Kurtosis Imaging and Cognitive Disturbance in Idiopathic Normal Pressure Hydrocephalus (Station #1)**

**Kouhei Kamiya MD (Presenter):** Nothing to Disclose, **Koji Kamagata:** Nothing to Disclose, **Akira Nishikori:** Nothing to Disclose, **Ryuuseke Ine:** Nothing to Disclose, **Masaaki Hori MD:** Nothing to Disclose, **Masakazu Miyajima:** Nothing to Disclose, **Hajime Arai:** Nothing to Disclose, **Shigeki Aoki MD, PhD:** Nothing to Disclose, **Kuni Ohtomo MD:** Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group

**PURPOSE**

Diffusional kurtosis imaging (DKI) is a new diffusion MRI technique that can be more sensitive to tissue microstructural alterations than conventional diffusion tensor imaging. This study aimed to investigate correlations between the DKI metrics with cognitive function in patients with idiopathic normal pressure hydrocephalus (iNPH), as well as changes before and after the lumbo-peritoneal shunt (LP shunt).

**METHOD AND MATERIALS**

Twenty-nine patients with iNPH were involved. DKI data were obtained using a 3-T system with diffusion gradient in 32 directions. The mean kurtosis (MK) and fractional anisotropy (FA) maps were calculated. Cognitive measures included Mini-Mental State Examination (MMSE), frontal assessment battery (FAB), and trail-making-test-A (TMT-A). Tract-based spatial statistics (TBSS) were used to investigate the correlations between the pre-operative diffusion metrics and the cognitive measures. For those who had post-operative exams, pair-wise analyses of TBSS were also performed to look for alterations before and after the surgery.

**RESULTS**

Positive correlations with the cognitive function were observed in almost similar regions for FA and MK, predominantly in the frontal lobe and the cingulum (P < 0.05). On MK analyses, more extensive areas of the frontal subcortical white matter showed significant correlations with the FAB and TMT-A, compared with FA analyses. Pre- and post-operative images were available in 8 patients, all of whom experienced clinical improvement after LP shunt. Pair-wise analyses revealed significant decrease of MK in the anterior cingulum after the surgery.

**CONCLUSION**

Our results suggest DKI provides additional information of tissue alteration relevant with cognitive dysfunction in iNPH, and is useful especially in subcortical regions where the complexity of fiber direction can be problematic for FA analyses. Although the post-operative decrease of MK seems contradictory at the first glance, it may reflect that the post-operative brain tissue microstructural environment is not the same as the normal healthy state, and that the relationship between diffusion metrics and cognitive function is not preserved after the surgery.

**CLINICAL RELEVANCE/APPLICATION**

Diffusional kurtosis imaging successfully demonstrated tissue alteration relevant with cognitive dysfunction in idiopathic normal pressure hydrocephalus, especially in the subcortical white matter.
RESULTS
Eighty three patients were included for image analysis. 19 of 83 patients showed normal myocardial uptake on planar scintigraphy and SPECT. On the remaining 64 patients, 47 had decreased myocardial uptake on both planar imaging and SPECT (group A) and 17 had reduced myocardial uptake only on SPECT, but normal finding on planar scintigraphy (group B). SPECT had a diagnostic yield for Parkinson’s disease of 77.1% compared with 56.6% for planar imaging (p<0.001). H/M ratio from planar imaging for group A and B was 1.41±0.15 (1.20~1.53) and 1.43±0.16(1.26~1.56), respectively and showed no significant difference between the two group (p=0.23). L/M ratio for group A and B was 1.58±0.19(1.3~1.78) and 2.16±0.20 (1.96~2.37), respectively and significantly higher in B group (p=0.001).

CONCLUSION
I-123 MIGB SPECT has a significantly higher diagnostic yield for Parkinson disease than planar image. Increased lung uptake may cause false negative on planar imaging.

CLINICAL RELEVANCE/APPLICATION
Recently MIBG scan is important method for diagnosis of Parkinson’s disease. However the false negative rate is high on planar imaging. Rather than planar imaging using SPECT images would be excellent.

T2 Relaxometry in MTS versus PET and Video EEG (Station #3)

NRS451

Rajesh Kumar Vartharajaperumal MBBS, DMRD (Presenter): Nothing to Disclose, Pankaj Mehta MD: Nothing to Disclose, Mathew Cherian MD: Nothing to Disclose, Prashant Gupta MBBS, MD: Nothing to Disclose, Tejas Mohan Kalyanpur DMRD: Nothing to Disclose, Venkatesh Kasi Arunachalam MBBS, DMRD: Nothing to Disclose, Himani Agarwal MBBS, MD: Nothing to Disclose, Rahul Rajendra Arkar MBBS, DMRD, DNB: Nothing to Disclose, Prasen Prakash Shenai MBBS, DMRD: Nothing to Disclose

PURPOSE
(1) To compare the sensitivity of qualitative MRI , Quantitative MRI (T2 relaxometry ) and PET CT in evaluation of patients with mesial temporal lobe epilepsy with video EEG as reference standard. (2) To study the effectiveness of T2 relaxometry in localizing the seizure focus.

METHOD AND MATERIALS
70 consecutive cases with history of complex partial seizure referred for MRI with positive EEG findings were included in the study. The hippocampus was visually assessed for atrophy and objectively with T2 relaxometric value. and combined sensitivity of MRI with T2 Relaxometry and PET CT were compared with EEG findings.

RESULTS
Hippocampal atrophy was seen in 60% and T2 signal change in 48.6%. Qualitative MRI was concordant with video EEG in 68.65% in lateralization of the epileptogenic focus. Sensitivity of T2 relaxometry was 85.7%. Hence addition of T2 relaxometry increased the sensitivity of MRI further highlighting the role of T2 relaxometry. Lateralisation by MRI (qualitative and quantitative) and PET agreed with EEG findings in 85.7% and 88.6% respectively. Combined sensitivity of MRI and PET was 94%.

CONCLUSION
T2 relaxometry significantly improves the lateralization in seizure focus and is comparable to PET however both modalities when combined yield significantly more benefit than each individually.

CLINICAL RELEVANCE/APPLICATION
T2 relaxometry is comparable to PET, doesnt involve ionising radiation and adds significantly improved sensitivity to the evaluation of MTS.
Inter-reader Variability in Dynamic Contrast-enhanced MR Imaging (DCE-MRI) of Patients with IJV stenosis is not strongly associated with MS and cannot be considered a causative factor in this disease.

CLINICAL RELEVANCE/APPLICATION

A correlation exists between lower 1/3 segment IJV stenosis and CCSVI criteria. IJV stenosis is highly prevalent on MRV and does not distinguish between MS and control subjects. A weak correlation (Spearman-Rank - 0.4, p <0.001) exists between lower 1/3 IJV segment (p < 0.001) where a weak correlation (Spearman-Rank - 0.4, p <0.001) exists between CCSVI score and stenosis.

CONCLUSION

Fisher's exact test). For positive CCSVI there was a greater proportion of IJV stenosis >= 50 but only in the lower 1/3 (IC 71.31%-99.85%) and 88% (vs 43% and 86%) (i.c. 47.35%-99.68%).

Multimodal Image coregistration increases Diagnostic Accuracy for HNSCC cancer, both on T and N evaluation.

The secondary image coregistration is a 'low cost' diagnostic tool that increases the staging accuracy in head and neck cancer.

Zamboni et al suggest that multiple sclerosis (MS) may develop secondarly to impaired central nervous system venous outflow and describes this as Chronic Cerebrospinal Venous Insufficiency (CCSVI). Internal jugular vein (IJV) stenosis is suggested as a cause.

This study assesses the prevalence of IJV stenosis in patients with multiple sclerosis and age matched controls using contrast enhanced MR venography (CE-MRV). Potential correlation of IJV stenosis with CCSVI defined by Doppler ultrasound (US) is evaluated.

METHOD AND MATERIALS

This was a single-center, prospective, observational study of 50 subjects with a confirmed diagnosis of multiple sclerosis with age-matched controls. Research ethics approval and informed consent were obtained. Subjects were randomly selected from 6 MS categories.

CE-MRV was performed on a 3T magnet. US evaluation of the intra and extracranial circulation was used to define CCSVI criteria. Imaging results were reviewed independently by pairs of neuroradiologists blind to subject assignment. From MRV images the degree of stenosis was graded within the lower, mid and upper 1/3 segments of the IJV. US evaluation was considered positive if 2 or more CCSVI criteria were present.

RESULTS

Interobserver agreement has been found 'discrete'. About Nodal involvement: Coregistered PET/CT and MR reading session, showed diagnostic accuracy of 91% (vs 76% of PET/CT and 79%-88% of MRI-DWI/MRI-STIR), PPV 96% (vs 95% of PET/CT and 88%-86% of MRI-DWI/MRI-STIR) (i.c. 78.88%-99.89%) and NPV 80% (vs 53%, 63% and 100% of PET/CT, MRI-DWI and MR-STIR) (i.c. 42.19%-97.89%), sensitivity and specificity respectively of 92% (vs 72%, 94% and 100%) (i.c. 73.97%-99.02%), specificity of 89% (vs 89%, 67% and 56%) (i.c. 51.75%-99.72%). AUC for coregistered MR-PET/CT images was of 0.91, statistically different respect to others technique (p<0.05). ROC analysis on ADC value to differentiate benignant to malignant Nodes, showed a cut off value of 1.03x10-3 mm/s About T evaluation: Coregistered PET/CT and MRI , showed a diagnostic accuracy of 92% (vs 60% of PET/CT and 88% of MRI), sensitivity of 94% (vs 53% AND 94%) (i.e 71.31%-99.85%), specificity 88% (vs 75% and75%) (i.e. 47.35-99,68%), PPV and NPV of 94% (vs 82% and 89%) (71,31%-99,85%) and 88% (vs 43% and 86%) (i.c. 47.35%-99.68%).

CONCLUSION

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RESULTS

100 studies were undertaken. 13 could not be evaluated due to poor MRV quality. Inter-observer variability for IJV stenosis was fair for lower 1/3 (ICC 0.45 (0.24-0.61)), poor for mid 1/3 (ICC 0.18 (-0.03-0.38)) and good for upper 1/3 (ICC 0.71 (0.58-0.80)) IJV segments. IJV stenosis was identified in 85 (98%) of subjects.

CONCLUSION

IJV stenosis is highly prevalent on MRV and does not distinguish between MS and control subjects. A weak correlation exists between lower 1/3 segment IJV stenosis and CCSVI criteria.

IJV stenosis is not strongly associated with MS and cannot be considered a causative factor in this disease.
TOUCH SCREEN RECURRENT GIOBLASTOMA: RESULTS FROM THE MULTI-CENTER ACRIN 6677/RTOG 0625 STUDY (STATION #7)


PURPOSE

To study factors associated with inter-reader variability (IRV) in initial area under the gadolinium concentration curve (IAUGC), transfer constant (Ktrans) and fractional volume of the extracellular extravascular space (ve) parameters derived from DCE-MRI.

METHOD AND MATERIALS

18 patients (mean age 57.1±13.3 years, 10 men) with recurrent glioblastoma treated with bevacizumab and either temozolomide or irinotecan had analyzable DCE-MRI scans as part of the ACRIN 6677/RTOG 0625 trial. Two teams consisting of a trained neuroradiologist and technologist independently measured volumes of tumor-related enhancement (vTRE) on 3D SPGR images. Volumes of interest were registered to DCE-MRI images and parameter maps. IAUGC was defined as the area under the gadolinium contrast agent-time curve (ACTC) in T1 divided by ACTC in a vessel over the first 90 seconds. One open source software was used to derive Ktrans and ve from a standard Tofts model (www.dcemri.org). The effect of time of scan (baseline vs. post-treatment), parameter map quality (graded on a 1-3 scale), scanner magnet / sequence (3T GE vs. 1.5T Siemens vs. 1.5T GE), average tumor volume, and reader variability in tumor volume (percent difference in vTRE) on IRV (percent difference in parameter) was studied using intraclass correlation coefficient (ICC) and linear mixed models.

RESULTS

78 (14 baseline and 64 post-treatment) scans from 4 centers were evaluated. Overall mean IRV for mean and median IAUGC, mean and median Ktrans and median ve were 17.6±24.1, 16.8±23.3, 27.2±34.4, 16.1±27.0 and 26.1±34.3% respectively. ICCs for these metrics ranged from 0.905 (mean Ktrans) to 0.996 (median Ktrans) on baseline scans and from 0.477 (mean Ktrans) to 0.760 (median IAUGC) for post-treatment scans. Lack of reader agreement on tumor volume was significantly related to IRV for all parameters (p<0.002). Scanner magnet/sequence and average tumor volume were related to IRV only for mean Ktrans (p<0.05). Image quality score was related to IRV only for median Ktrans (p=0.02).

CONCLUSION

Differences in reader performance on tumor segmentation is a significant source for IRV for all parameters.

CLINICAL RELEVANCE/APPLICATION

Improving reader agreement in deriving segmentations or, alternatively, use of automated segmentation techniques may reduce the variability in parameters derived from DCE-MRI. Funded by NCI U01-CA080098 and U01-CA079778.

What Did the Surgeon Do?! A Review of Common Head and Neck Post-operative Changes and Complications (Station #8)

Ellie Song-Yi Kwak MD (Presenter): Nothing to Disclose, Daniel S. Chow MD: Nothing to Disclose, Gina Paek MD: Nothing to Disclose, Akash D. Shah MD: Nothing to Disclose, Angela Lignelli-Dipple MD: Nothing to Disclose

TEACHING POINTS

The intricate anatomy of the head and neck can be challenging for radiologists, especially in the presence of post-operative changes. For this reason, it is imperative for radiologists to understand which structures are involved in common head and neck procedures. In addition, knowledge of normal post-surgical anatomy will help radiologists identify abnormal findings and potential surgical complications which may need further management. The purpose of this exhibit is to review 1) head and neck anatomy in the context of common head and neck procedures and 2) post-operative changes and potential complications of common head and neck operations.

TABLE OF CONTENTS/OUTLINE

1. Brief review of normal head and neck anatomy. 2. Common pathologies of the head and neck. 3. Case based review of common head and neck procedures with emphasis on post-operative appearance. Ear (including Grommet, mastoidectomy, myringoplasty) Nose (including endoscopic sinus surgery, septoplasty, turbinectomy) Throat (including tonsillectomy, glosssectomy, adenoidectomy) Neck (including thyroidectomy, parathyroidectomy, submandibular gland removal) 4. Post quiz

Dynamic MR Imaging of the Temporomandibular Joint: Understanding the Joint Biomechanics (Station #9)

Monica Tafur MD (Presenter): Nothing to Disclose, Reni Biswas: Nothing to Disclose, Kyu-Sung Kwack MD, PhD: Nothing to Disclose, Won Chol Bae PhD: Nothing to Disclose, Robert Healey: Nothing to Disclose, Sheronda Statum: Nothing to Disclose, Jiang Du PhD: Nothing to Disclose, Christine B. Chung MD: Nothing to Disclose

PURPOSE

To help radiologists identify abnormal findings and potential surgical complications which may need further management. The purpose of this exhibit is to review 1) head and neck anatomy in the context of common head and neck procedures and 2) post-operative changes and potential complications of common head and neck operations.
TEACHING POINTS

The objectives are to review the biomechanical properties of the temporomandibular joint (TMJ) high-resolution pseudo-dynamic and low-resolution dynamic MRI of the TMJ and correlate the biomechanical characteristics of the disc with its MR properties. 1. The TMJ has unique biomechanical characteristics, as the bilateral TMJs must function together under compressive loads while undergoing large-scale movement. 2. Biomechanics of the osseous structures in the normal TMJ are well demonstrated using low-resolution dynamic MRI and involve translation and rotation of the mandibular condyle. 3. Changes in the disc during TMJ motion can be evaluated in high-resolution pseudo-dynamic MRI and include translation of the disc and tissue deformation due to compression. 4. Quantitative MR properties correlate with the biomechanical properties of the disc. There is a significant relation between MR (T2, T2* and UTE T1rho mapping) and indentation stiffness properties of the disc.

TABLE OF CONTENTS/OUTLINE

1. Normal biomechanics of the soft tissues of the TMJ on high-resolution sagittal and coronal MRI
2. Normal biomechanics of the osseous structures of the TMJ on low-resolution dynamic acquisition MRI
3. Correlation of biomechanical and MR properties of the TMJ articular disc

NRE107

Diagnosis, Surgery, Therapy and Follow Up in Parathyroid Disease: New Paradigms and Procedures (Station #10)

Brian M. Rodgers MD (Presenter): Nothing to Disclose, Eduard V. Kotlyarov MD, PhD: Nothing to Disclose, Email Kandil MD: Nothing to Disclose

TEACHING POINTS

As imaging physicians, we need to play an active role in the diagnosis and assist in the therapy and post-operative follow up of properly selected patients likely to have parathyroid disease. Interventional Radiologists can also localize lesions that might difficult to find in the OR. 1. Carefully select patients based on clinical and laboratory findings. 2. Choose the proper diagnostic imaging tests from US, CT, MRI, NM, and/or PET. PET and NM can also be used just prior to surgery to localize tiny abnormalities and gamma probes can be used by surgeons in the OR to assure complete removal of suspect areas. 3. Newer surgical techniques, such as endoscopy via periauricular and axillary approaches are now available for ‘scarless’ surgery. In the US some centers have a multi year experience in this, but often do less than 100 patients per year endoscopically. Laboratory testing in the OR for PTH (parathyroid hormone) decline following successful surgery and will also be reviewed. Several case studies illustrate this.

TABLE OF CONTENTS/OUTLINE

Review of Indications, Contraindications - Mostly Patient and Test Selection Choosing Between Imaging Exams for Diagnosis - US, CT, MRI, NM, PET Treatment Choices - Current Standard of Care, Open Field vs Endoscopic Surgery Follow-up Management - Biochemical and / or Imaging

NRE350

Ultrasound-guided Biopsy of the Neck Lesions: The Perspective of the Head and Neck Neuroradiologist (Station #11)

Kim Learned MD (Presenter): Nothing to Disclose, Anna Sarah Lev-Toaff MD: Nothing to Disclose, Jill Eve Langer MD: Consultant, BioClinica, Inc, Laurie A. Loevner MD: Nothing to Disclose

TEACHING POINTS

To review practical considerations for patient selection and optimizing the ultrasound-guided biopsy technique of head and neck masses. Role of preprocedural imaging, lesion localization, and differential diagnosis in selecting good candidates and ultrasound technique for obtaining tissue will be addressed.

TABLE OF CONTENTS/OUTLINE

1) Patient selection and preparation a. Review of diagnostic cross-sectional CT, MRI, PET-CT Anatomical location of mass Distance from skin surface (up to 4 cm) Differential diagnoses b. Preprocedural preparation No blood work, intravenous access 2) Selection of US transducer for high definition of biopsy area a. Linear high-frequency transducers provide optimal US imaging up to 5 cm in depth b. Small footprints, wide sector view of the curved-array transducers allow access to lesion deep to narrow acoustic window, at steep angle or uneven skin surface 3) Technique: fine needle aspiration, core needle biopsy 4) Added value of a head and neck neuroradiologist’s expertise a. Spatial relationship of the lesion and surrounding structures on neck imaging, especially in surgically-altered or irradiated neck, and applying this knowledge to real time US scanning to ensure accurate targeting for biopsy b. Differential diagnoses determine biopsy technique, need for additional laboratory testing, and followup

NRS-THB

Neuroradiology Thursday Poster Discussions

Scientific Posters

AMA PRA Category 1 Credits ™: .50
Thu, Dec 4 12:45 PM - 1:15 PM Location: NR Community, Learning Center

Sub-Events

NRS456

Cortex Volumetry and Cognition in First Episode Psychosis Patients (Station #1)
PURPOSE

to determine the relationship between cortical volumes and cognition in first episode psychosis (FEP) patients

METHOD AND MATERIALS

Twenty FEP patients were assessed with the Screen for Cognitive Impairment in Psychiatry1 (SCIP), a brief cognitive test which assesses immediate and delayed verbal memory, working memory, verbal fluency and processing speed. All participants underwent MRI scanning on a 1.5 T Siemens Avanto scanner. High resolution structural T1-weighted images were acquired. Cortical reconstruction and volumetric segmentation was performed with the Freesurfer® image analysis suite (http://surfer.nmr.mgh.harvard.edu/). Its processing includes parcellation of the cerebral cortex into units based on gyral and sulcal structure and computation of cortical thickness at each vertex on the tessellated pial surface. Pearson correlations were calculated to assess the association between the SCIP and global cortical volume and different cortical areas. Partial correlations were calculated to control for the effects of lifetime antipsychotic treatment.

RESULTS

Pearson correlations showed significant associations between working memory SCIP subtest and cortex volume (p=0.000), right and left cerebellum volume (p=0.04 and p=0.029 respectively), right and left amygda volume (p=0.03 and p=0.001 respectively), and right and left hippocampus volume (p=0.014 and p=0.031 respectively). When controlling for antipsychotic treatment, significant correlations were found between the total score of the SCIP and cortex volume (p=0.001), left and right amygdala volume (p=0.004 and p=0.001 respectively) and right hippocampus volume (p=0.031).

CONCLUSION

Global cortical volume and cerebellum, amygdala and hippocampus volumes may be related to cognitive performance in the early phases of psychosis.

CLINICAL RELEVANCE/APPLICATION

Impaired cognition can be observed in early phases of psychosis and it shows a relationship with some cortical structures volumes.
**Cerebral and Cerebellar Involvement in Patients with Friedreich Ataxia Disease: A Diffusion Tensor Imaging Study (Station #3)**

Thomas Martin  Doring  MSc (Presenter):  Nothing to Disclose , Simone Karuta :  Nothing to Disclose , Tadeu Takao Almodovar Kubo  MSc :  Nothing to Disclose , Emerson L. Gasparetto  MD :  Nothing to Disclose

**PURPOSE**

To investigate the cerebral and cerebellar white matter tracts in patients with Friedreich Ataxia (FRDA) using diffusion tensor (DT) imaging and Tract-based spatial statistics (TBSS)

**METHOD AND MATERIALS**

21 patients clinically confirmed with FRDA (mean age of onset was 13.8y, mean disease duration's time was 27.7y) and 17 healthy controls, demographically matched, underwent MRI at 1.5T. Besides clinical routine protocol a DTI sequence was applied along 30 nonlinear directions and no gap. Diffusion parameter maps (FA, MD, AD, RD) were reconstructed offline using FSL. Statistical analysis was carried out by TBSS, performing voxelwise statistical analysis (permutation based inference) in the main fiber tracts, that are common in all subjects. Significant altered regions were identified on the multiple comparison corrected significance p maps according to the JHU ICBM DTI-81 WM labels Atlas

**RESULTS**

TBSS showed multiple areas with significant FA decrease (p<0.05) in patients with FRDA: superior cerebellar peduncles, fornix, posterior thalamic radiation, forceps, inferior fronto-occipital fasciculus and inferior longitudinal fasciculus (striatum), corpus callosum, corona radiata and corticospinal tracts. High statistically significant FA reduction (p<0.01) was found in left superior cerebellar peduncle, left posterior thalamic radiation, major forceps, left inferior fronto-occipital fasciculus and corpus callosum. MD and RD values where significant increased (p<0.05) at the superior cerebellar peduncle and striatum. AD values were significantly reduced at the corticospinal tracts

**CONCLUSION**

Applying TBSS in patients with FRDA showed extensive cerebral and principally cerebellar WM involvement. The known conventional neuroimaging findings of spinal cord volume reduction, do not explain all symptoms presented in the disease. These new findings can partially explain the non-medullar symptoms

**CLINICAL RELEVANCE/APPLICATION**

The precise knowledge of brain areas that are affected in patients with Friedreichs Ataxia provides a better comprehension of the pathophysiology of the disease. Treatment strategies might be adapted to these findings

**Hand and Foot Motor Cortex Activation fMRI Assessment in Patients with Brain Tumors Adjacent to Central Sulcus (Station #7)**

Bo Jiang  MD, PhD (Presenter):  Nothing to Disclose , Jiaying Gong :  Nothing to Disclose , Ximin Pan :  Nothing to Disclose , Meiyu Hu :  Nothing to Disclose , PING XU :  Nothing to Disclose

**PURPOSE**

To assess hand and foot motor cortex mapping features in patients with brain tumors adjacent to central sulcus by using BOLD-fMRI technique.

**METHOD AND MATERIALS**

Twenty patients with brain tumors near central sulcus were obtained fMRI in 1.5 T superconduct by performing fingers-thumb tapping (FTT) and toes extension-flexion (TEF), which divided into group 1 (n=12) with impaired and group 2 (n=8) with normal limb muscle strength. Tumor-side activation degree was quantified by activated cortex volume, and graded as hypointense, intense, isointense when compared with that in healthy side. The activation degree and activation shift were compared between 2 groups and between 2 tasks (α=0.05).

**RESULTS**

1. Primary sensorimotor (SM1) activation was detected in 20 patients in FTT task. Activation distribution differed statistically between group 1 (11 hypointense, 0 intense, 1 isointense) and group 2 (2 hypointense, 1 intense, 5 isointense) (X2=9.38, P<0.005). Activation shift occurred in 10 patients in group 1 and in 4 in group 2, frequency of which differed between hypointense and none-hypointense (X2=8.80, P<0.005), but not between 2 groups (X2=1.20, P>0.25). 2. Paracentral lobule (PCL) activation was evoked in 17 patients in TEF task. No statistical difference of activation distribution existed between group 1 (8 hypointense, 1 intense, 0 isointense) and group 2 (5 hypointense, 1 intense, 2 isointense) (X2=7.46, P>0.05). No difference of hypointense activation incidence was noted in 2 groups (X2=0.037, P>0.75). Activation shift occurred in 5 in group 1 and in 2 in group 2, frequency of which showed no difference between hypointense and none-hypointense (X2=2.03, P>0.1), or between 2 groups (X2=0.615, P>0.25). 3. No difference of hypointense incidence was found between SM1 and PCL (X2=0.16, P>0.5), nor frequency of activation shift between SM1 and PCL in the 20 patients (X2=2.05, P>0.1).

**CONCLUSION**

BOLD-fMRI reveals activation pattern alterations of hand and foot motor cortex induced by the tumor near central sulcus. SM1 and PCL activation shifts imply actively protective responses to tumoral invasion. PCL seems more flexible in configuration than SM1.
CLINICAL RELEVANCE/APPLICATION

Hand and foot motor cortex mapping demonstrated by fMRI provides a guideline to pre-surgical protocol planning for the patients with tumors close to central sulcus.

NRE256

The Interface of Clinical Neurology and Neuroradiology in Classic Ischemic Stroke Syndromes: Where Do You Localize the Lesion? (Station #8)

Pavel Rodriguez MD (Presenter): Nothing to Disclose, Vivek Misra MD: Nothing to Disclose, Maria Pilar Valencia MD: Nothing to Disclose, Bundhit Tantiwongkosi MD: Nothing to Disclose

TEACHING POINTS

After reviewing this educational exhibit, the participant should be able to 1) describe the unique clinical neurological presentation of classic ischemic stroke syndromes and 2) explain their neuroanatomical localization.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Cerebral syndromes a. Clinical presentation b. Neuroimaging findings 3. Basal Ganglia syndromes a. Clinical presentation b. Neuroimaging findings 4. Thalamic syndromes a. Clinical presentation b. Neuroimaging findings 5. Brainstem syndromes a. Clinical presentation b. Neuroimaging findings Summary: The neuroanatomical localization of classic ischemic stroke syndromes is essential for the neurologist and neuroradiologist to help guide the proper ordering and interpretation of neuroimaging studies. In particular, the "gunshot" approach to neuroimaging can be avoided by understanding lesion localization. Multiple syndromes are very classic in clinical presentation and can very well predict the neuroimaging abnormality. The neuroimaging interpretation false negative rate is also likely reduced if the expected abnormal area is closely inspected especially in the hyperacute-subacute setting when CT can be equivocal. Negative diffusion weighted imaging (DWI) ischemic stroke has also been previously described in the brainstem and posterior circulation territory.

NRE226

Cerebral Microbleeds: Causes, Clinical Relevance and Imaging Approach (Station #9)

Sangam Gurudas Shet Kanekar MD (Presenter): Nothing to Disclose, David Ermak: Nothing to Disclose

TEACHING POINTS

1. To discuss in brief physics of susceptibility-weighted imaging (SWI). 2. To discuss the various causes of cerebral microbleeds (CMBs) and discuss their clinical significance.

TABLE OF CONTENTS/OUTLINE

With the development of MRI techniques (gradient-recalled echo and susceptibility-weighted sequences) exquisitely sensitive to paramagnetic blood products, microbleeds are commonly seen on routine brain MRI. The clinical significance remains elusive. We retrospectively studied MRI brain of 1200 patients from PACS system. Axial T2, T1 and SWI images were compared and then were correlated with the clinical and final diagnosis of the patient. The incidence of CMBs was highest with prior history of trauma, and intracerebral hemorrhage. Second and third most common causes were in patient with prior history of stroke/hypertensive encephalopathy, and neurodegenerative diseases such as amyloid angiopathy, Alzheimer disease. Various other causes found on our study include CADASIL, CARASIL, CMBs due to cardiac (endocarditis, myxoma and cardiac valve), Fabry's, vasculitis, post RT, moyamoya, PRES, and blood disorders. Summary: We discuss in brief the physics of SWI sequence and its role in detection of cerebral microbleeds. We give an algorithmic approach in evaluation and mapping of CMBs with respect to their clinical significance.

NRE384

Unraveling the Cerebral Venous System: A Radiologist’s Perspective (Station #10)


TEACHING POINTS

1. Present normal anatomy including variants of cerebral venous system 2. Illustrate imaging appearance of venous sinus pathologies on different imaging modalities 3. Discuss predisposing factors, pathogenesis, clinical presentation and management of dural venous thrombosis

TABLE OF CONTENTS/OUTLINE

Cerebral venous system consists of deep venous system, superficial venous system, and dural venous sinuses. Anatomical variations of these venous drainage pathways (in particular absence, hypoplasia and arachnoid granulations) are examined with emphasis on differentiating anatomic variance from pathology. For instance, differentiating sinus thrombosis from congenital hypoplasia is paramount for clinical care. The following pathologic processes are discussed in detail: sinus thrombosis, tumor invasion, trauma, carotid-cavernous fistula, vein of Galen malformation, dural AV fistula etc. A thorough understanding of cerebral sinus anatomy and its relationship to the brain and skull is important for preoperative planning. Knowledge of various pathologies affecting cerebral venous system and their characteristic imaging features is crucial for guiding treatment. Radiologist plays a vital role in providing information required by clinician. Aims/Objectives • Normal anatomy and variants • Pathology • Imaging • Clinical implications • Management • Conclusion

NRE117

Resting State fMRI: Principles, Applications and Pitfalls (Station #11)
TEACHING POINTS

Resting state functional connectivity MRI (rs-fcMRI) identifies networks of functionally connected brain regions based on temporal correlations in spontaneous low frequency fluctuations of resting-state BOLD signals. Several networks have been elucidated, including motor, language, visual, attention, executive, and default mode networks.

rs-fcMRI provides a rapid, non-invasive, task-free method of presurgically mapping eloquent cortex in patients, and has advantages and disadvantages compared to task-based fMRI. The greatest impact is in patients who cannot tolerate traditional task-based fMRI (e.g. young children, patients with developmental delay/dementia, and patients requiring anesthesia).

TABLE OF CONTENTS/OUTLINE

We provide an overview of the underlying principles, highlight the role of rs-fcMRI in neurologic disorders, discuss technical and interpretative challenges, and suggest quantitative techniques to incorporate rs-fcMRI in routine clinical practice. We review our institutional results with rs-fcMRI of patients with neurologic pathology including medically refractory epilepsy, traumatic brain injury, brain tumors and Alzheimer’s disease. Representative cases depicting the application of rs-fcMRI in comparison to conventional task-based fMRI will be presented. Technical and interpretive challenges will be illustrated.

SPSH54
Hot Topic Session: Imaging and Treatment of Neuroendocrine Tumors

Special Courses

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Thu, Dec 4 3:00 PM - 4:00 PM  Location: E353A

Participants

Moderator
Yusuf Menda MD : Research Grant, Advanced Accelerator Applications

Sub-Events

SPSH54A Radiopeptide PET Imaging of Neuroendocrine Tumors

Yusuf Menda MD (Presenter): Research Grant, Advanced Accelerator Applications

LEARNING OBJECTIVES

1) List the different Ga-68 DOTA analogs used in PET imaging of neuroendocrine tumors. 2) Compare Ga-68 DOTA labeled peptides and In-111 Octreotide in imaging of neuroendocrine tumors. 3) Understand the role of peptide PET imaging in management of neuroendocrine tumors.

SPSH54B Radiopeptide Receptor Radionuclide Therapy (PRRT): Current Status and Future Opportunities in Theranostics

Richard P. Baum MD, PhD (Presenter): Stockholder, OctreoPharm Sciences GmbH Principal Investigator, AAA Research Consultant, Novartis AG Research Consultant, Ipsen SA Research Grant, ITG-Medical, Inc

LEARNING OBJECTIVES

1) Definition of THERANOSTICS, personalized and precision medicine. 2) Indications for Ga-68 somatostatin receptor [SSTR] PET/CT in neuroendocrine tumors (NET): staging, restaging, detection of unknown primary tumors. 3) Molecular imaging (quantification of receptor density by SUV measurements) for selection of NET patients for PRRT and therapy response evaluation after PRRT by Ga-68 SSTR PET/CT. 4) Indications for PRRT, methodology and clinical results (survival, PFS in patients with G1 and G2 NET). 5) Possible adverse effects of PRRT and how to reduce/avoid side effects. 6) Future developments: new peptides (e.g. SSTR antagonists, CXCR4), new indications (e.g. diagnosis and treatment of recurrent prostate cancer using Ga-68 PSMA and Lu-177 labeled PSMA ligands).

ABSTRACT

The overexpression of specific receptors on tumors enables peptide-based receptor imaging and radionuclide therapy (PRRT). 68Gallium is a generator-produced positron emitter for labeling of peptides, e.g. somatostatin analogues (SA) like DOTATOC or DOTATATE for molecular imaging of somatostatin receptors (SSTR) expressing tumors. Since 2004, we have performed over 9,500 68Ga PET/CT studies in patients with neuroendocrine tumors (NET) and have established SSTR PET/CT as the new gold standard for imaging G1 and G2 NET. The same somatostatin-binding peptides can be labeled with 177Lutetium or 90Yttrium for internal radionuclide
therapy, a form of personalized treatment (THERANOSTICS approach). Since 1999 we have treated more than 1,200 patients (>4,000 therapy cycles) using 177Lu and/or 90Y labeled peptides. A German multi-institutional registry study with prospective follow up in 450 patients indicates that PRRT is an effective therapy for patients with G1-2 neuroendocrine tumors, irrespective of previous therapies, with a survival advantage of several years compared to other therapies and only minor side effects. Median overall survival of all patients from start of treatment was 59 months. Median progression-free survival (PFS) accounted to 41 months. Median PFS for pancreatic NET was 39 mo and for small bowel NET 51 mo. Grade 3-4 nephro- or hematotoxicity were observed in only 0.2% and 2% of patients, respectively. In patients with progressive NET, personalized PRRT with lower doses of radioactivity given over a longer period of time (Bad Berka Concept) results in excellent therapeutic responses. By this approach, severe hematological and/or renal toxicity can be avoided and quality of life/clinical symptoms can be significantly improved. The concept of THERANOSTICS has now been translated to other malignancies (e.g. prostate cancer using PSMA as ligand). Current state and future perspectives of this fascinating precision treatment of malignancies will be discussed.

URL
http://www.prrtinfo.org

SESSION 3
Imaging and Therapy of Neuroendocrine Tumors with MIBG

Matthias Schmidt MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the molecular basis for imaging and therapy of neuroendocrine tumors with metaiodobenzylguanidine (MIBG). 2) To be able to define indications for imaging of neuroendocrine tumors (i.e. pheochromocytoma, paraganglioma and neuroblastoma) with MIBG and when to consider other radiopharmaceuticals. 3) Learn to read typical and difficult cases imaged with metaiodobenzylguanidine. 4) To understand the historical development of I-131-mIBG therapy and its current use in neuroendocrine tumors and high-risk neuroblastoma. 5) To address important aspects how to deliver I-131-mIBG therapy with different aspects concerning adult versus pediatric patients.
ENT Emergencies

Wendy R. K. Smoker MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize various orbital pathologies that acutely compromise vision. 2) Identify various neck infections that may compromise the airway and their extensions. 3) Understand the patterns of extension of odontogenic infections. 4) List the various intracranial complications of acute sinusitis and be able to identify.

ABSTRACT

The category of ENT emergencies encompasses a variety of pathologies, only a few of which can be addressed in the time allotted. This discussion will focus on: 1) Pathology (potentially) affecting vision acutely and including orbital infections, pseudotumor, and carotid cavernous fistulas 2) Infections that may compromise the airway including, peritonsillar, retropharyngeal, epiglottic, and parapharyngeal abscesses, Ludwig angina, Lemierre syndrome, and necrotizing fasciitis. 3) The importance of the mylohyoid line in determining whether a tooth infection will spread to the sublingual or submandibular space 4) Common complications of acute sinusitis

Non-traumatic Spine Emergencies

E. Turgut Tali MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the basic anatomic, pathologic, and physiologic principles to non-traumatic spinal emergencies, and diagnostic and therapeutic procedures. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management/safety, and cost. 4) Demonstrate understanding of the influence of socioeconomic issues on current and future practice patterns.

ABSTRACT

Nontraumatic spinal emergencies may result from a variety of causes from congenital/developmental anomalies-abnormalities, degenerative diseases, inflammation, infection, vascular, hematologic and metabolic diseases to neoplasms. Clinical findings and symptoms may be nonspecific. An optimized imaging strategy is necessary for the accurate diagnosis and treatment planning. Congenital/developmental abnormalities are not generally to present emergently. They may be unknown until an unrelated acute event occurs. Degenerative diseases and arthropathies may also cause nontraumatic emergencies, spinal cord compression can result from pannus and chronic instability of the rheumatoid arthritis. Ossification of the posterior longitudinal ligament, ossification of ligamentum flavum, synovial cysts, and epidural lipomatosis, acute disc extrusion may result in an acute neurologic deficit. Inflammations as multiple sclerosis, Guillain-Barre, infections are the main causes of the nontraumatic spinal injuries may have an indolent, latent phase prior to objective emergency findings. Vascular and hematologic disorders are present a susceptible group with respect to nontraumatic spinal emergencies. Development of symptoms of the neoplasms is usually slowly progressive, but acute presentations are not uncommon.

How to Say it: Generating High Impact H&N Reports

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: N226

Reporting Sinus Studies

Michelle A. Michel MD (Presenter): Author, Amirsys, Inc Co-editor, Amirsys, Inc Consultant, Amirsys, Inc

LEARNING OBJECTIVES

1) Understand relevant normal and variant sinonasal anatomy, patterns of inflammatory disease, and complications of acute rhinosinusitis. 2) Recognize lesions that mimic inflammatory disease and identify additional findings outside of the sinonasal cavities that may be present on imaging studies. 3) Improve your basic knowledge and skills relevant to assessing the pediatric temporal bone. 4) Apply principles of critical thinking to provide temporal bone reports that are clinically relevant and of use for parental counseling and surgical planning. 5) Understand the importance of accurately localizing the tumor to a subsite in the head and neck. 6) Apply staging details from the AJCC 7th edition to tumors that have been identified.

ABSTRACT

In order to create an accurate and clinically helpful sinonasal CT report, the radiologist must have knowledge of sinonasal anatomy and correct terminology of surgical procedures. Reports for sinus CT in the setting of inflammatory disease should include an objective description of the amount of mucosal disease in the sinuses. The drainage pathways of the sinuses should be evaluated keeping in mind patterns of inflammatory disease.
The radiologist should be familiar with the variety of orbital, bone/soft tissue, and intracranial complications of sinusitis. Whenever there is clinical suspicion of an intracranial complication of sinusitis, gadolinium-enhanced MRI of the brain is indicated. CT is often performed for the evaluation of the patient after ESS. The examination may be performed to evaluate for improvement in sinus ventilation, causes of ESS failure, or complications of surgery. Sinus CT “red flags” include odontogenic maxillary disease, isolated sphenoid sinus and olfactory recess inflammatory opacification. It is also important to review the compartments adjacent to the sinonasal cavities in search of additional findings.

**RC706B** Reporting Temporal Bone Studies
Caroline Diana Robson MBChB (Presenter): Editor with royalties, Amirsys, Inc Author with royalties, Amirsys, Inc

**LEARNING OBJECTIVES**
1) Improve your basic knowledge and skills relevant to assessing the pediatric temporal bone. 2) Apply principles of critical thinking to provide temporal bone reports that are clinically relevant and of use for parental counseling and surgical planning.

**ABSTRACT**
Reporting Temporal Bone Studies Recognize normal variants in pediatric temporal bone: Cartilaginous cochlear cleft, enlarged vestibular aqueduct mimics, SCC dehiscence mimics, foramen tympanicum, petrous apex marrow variants Congenital External and Middle Ear Problems 1. External auditory canal (EAC): Normal, stenotic (tympanic plate present/hypoplastic) or atretic (tympanic plate absent). If atretic describe atresia plate: bony (thick or thin) vs bony and membranous. Stenosis + opacification and bony erosion = keratosis obturans or cholesteatoma. 2. Mastoid pneumatization: Pneumatization (development) and aeration. 3. Middle ear space (MES): Normal, hypoplastic or absent; assess morphology; look for opacity in MES 4. Ossicles and tegment: Normal or abnormal size, shape, orientation or ossicular fusion/fixation. Tegmen integrity 5. Canal size and course: Normal or abnormal size, shape, orientation or ossicular fusion/fixation. Tegmen integrity 6. Facial nerve (CN7) canal size and course: Normal or anomalous course, normal or dehiscent, small or normal size 7. Inner ear anomalies: Inner ear + EAC/middle ear anomalies = syndromic etiology 8. Mandibular condyle size/position: Micrognathia = syndromic etiology 9. Vessels: ICA, IJV, emissary veins, MMA 10. Head and neck and brain: Incidental or related findings Congenital Inner Ear Problems 1. Vestibular aqueduct/endolymphatic sac and duct: LVA = midpoint measurement > 0.9 mm and opencrural measurement >1.9 mm. Flared LVA associated with incomplete partition (IP-II) cochlea and/or deficient modiolus. 2. Cochlea: Shape and size of turns, interscalar septum (ISS) and/or modiolus. 3. Cochlear nerve canal (CNC) and cochlear nerve: Atresia, stenotic or normal CNC. Absent, hypoplastic or normal nerve. 4. IAC and cranial nerves: Normal, wide or stenotic IAC; symmetric or asymmetric. Absent, hypoplastic or normal CNV and 8 5. Vestibule: Normal, hypoplastic or globular 6. SCC: Absent, hypoplastic, malformed or normal 7. Assess EAC, MES, vessels, HN and brain

**Active Handout**

**RC706C** Reporting Head and Neck Cancer Studies
Patricia A. Hudgins MD (Presenter): Stockholder, Amirsys, Inc

**LEARNING OBJECTIVES**
1) The significance of AJCC seventh edition and how it helps outline and direct your formal neck CT or MRI interpretation. 2) The importance of identifying the subsite of the malignancy, prior to describing the findings. 3) How to generate a value-added interpretation, so that the Tumor Board members or clinicians can triage the patient to appropriate therapy for the malignancy.

**RC711**

**Head and Neck Cancer PET Interpretation with Case Examples (An Interactive Session)**

**Refresher/Informatics**

**AMA PRA Category 1 Credits ™: 1.50**
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM  Location: S505A

**Sub-Events**

**RC711A** Practical Approach for Interpreting Head and Neck PET/CT
Rathan M. Subramaniam MD, PhD (Presenter): Speakers Bureau, Eli Lilly and Company

**LEARNING OBJECTIVES**
1) To understand the value of PET/CT in the care process of managing head and neck cancer. 2) To learn common pathways of tumor spread in head and neck. 3) To review illustrative cases and pitfalls of
**PET/CT for Head and Neck Cancer: Clinical Applications and Case Studies**

**Eric Michael Rohren, MD, PhD** (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review head and neck anatomy and physiologic sites of FDG uptake. 2) Discuss the role of FDG-PET/CT in the evaluation of patients with head and neck malignancies.

**ABSTRACT**

FDG-PET/CT provides valuable information in the assessment of the patient with cancers of the head and neck. The metabolic information determined by FDG is complimentary and additive to the anatomic information from CT, and can be used to direct surgery, plan radiation therapy, and evaluate response to systemic or localized treatment. In this presentation, the role of FDG-PET/CT in the management of head and neck cancer will be presented, using case examples to illustrate the utility of PET as well as common pitfalls.

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**Pediatric: Neuro II**

**Refresher/Informatics**

**RC713**

**Sub-Events**

**Fetal Neuro**

**Beth M. Kline-Fath, MD** (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) The participant will briefly review basic prenatal neurosonology and fetal MR imaging sequence important to identify normal and abnormal cerebral pathology. 2) Common fetal central nervous system abnormalities will be reviewed and compared to the normal fetal developmental landmarks. 3) The learner at the end of the session will be able to utilize the germinal matrix, brain parenchymal signal, sulcation and myelination to verify pathologies in the fetal brain.

**Hypoxic Ischemic Injury/Perinatal Stroke**

**Ellen Grant, MD** (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn the imaging patterns of hypoxic ischemic encephalopathy and perinatal stroke. 2) Learn the differential diagnosis for imaging patterns similar to hypoxic ischemic encephalopathy and perinatal stroke. 3) Understand the role of imaging in treatment and prognosis.

**Perinatal Brain Trauma**

**Michelle Silvera, MD** (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To become more familiar with mechanisms of injury related to parturition. 2) To better recognize birth trauma-induced imaging abnormalities of the scalp, skull, and brain in newborns. 3) To have an increased awareness of birth-related traumatic neurosurgical emergencies.

**ABSTRACT**

The incidence of birth-related neurotrauma has declined with modern advances in prenatal care and improved obstetrical techniques. Nevertheless, head injury still occurs during labor and delivery. The different types of parturitional head injury cover a wide spectrum and range from minor self-limited scalp injuries such as a caput succedaneum to life threatening intracranial posterior fossa hemorrhages requiring prompt neurosurgical intervention. Head injuries including scalp hematomas, skull fractures and types of intracranial hemorrhage will be discussed in this session as well as risk factors that predispose the neonate to birth-related trauma.
US for Thyroid Cancer: Diagnosis, Surveillance, and Treatment (How-to Workshop)

Refresher/Informatics

**US**: NNRHNOIUSNRHN

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Thu, Dec 4 4:30 PM - 6:00 PM Location: E263

Participants

Jill Eve Langer MD (Presenter): Consultant, BioClinica, Inc
Kathryn Ann Robinson MD (Presenter): Nothing to Disclose
Sheila Sheth MD (Presenter): Consultant, Star Scientific, Inc

LEARNING OBJECTIVES

1) Describe the sonographic characteristics of thyroid nodules that are suspicious for malignancy. 2) a. Discuss the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. b. Describe the indications for two new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. 3) a. Describe the technique of US-guided biopsy of thyroid nodules and cervical lymph nodes in patients who have undergone thyroidectomy for thyroid cancer. b. Discuss the rationale and method of performance of US-guided ethanol ablation of malignant cervical adenopathy in post thyroidectomy patients.

ABSTRACT

This presentation will consist of a three individual presentations. The first will review the sonographic characteristics of thyroid nodules that are suggestive of malignancy. Recommendations for selecting which thyroid nodules require ultrasound-guided biopsies which have been provided by both Radiology consensus conferences and published Endocrinology guidelines will be discussed. The second presentation will review with the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. Additionally this presentation describes the indications for two new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. The last presentation will provide a detailed description of the technique for performing ultrasound guided biopsy of thyroid nodules and cervical lymph nodes. Various methods will be discussed and required equipment outlined. Possible complications, though rare, will be described. A comparison of the typical sonographic features of normal versus abnormal lymph nodes will be presented in an effort to identify those patients in whom sonographic follow up can be used instead of biopsy. A discussion of the possible advantages of adding thyroglobulin assay to cytologic evaluation will be provided. The rationale for and technique of performing ultrasound guided ethanol ablation of malignant cervical lymph nodes in patients with thyroid cancer will be undertaken.

Multiple Sclerosis

Refresher/Informatics

MRNR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Fri, Dec 5 8:30 AM - 10:00 AM Location: E451B

Participants

Moderator
Aaron Scott Field MD, PhD: Research Consultant, BioTime, Inc

Sub-Events

**RC805A**
Clinical MS Update

Daniel Pelletier MD (Presenter): Consultant, CNS Imaging Consultant, LLC Research Grant, Biogen Idec Inc

LEARNING OBJECTIVES

1) Review the most recent MRI dissemination in space (DIS) and time (DIT) diagnostic MS criteria. 2) Review the latest disease-modifying therapeutic options and potential complications (PML). 3) Illustrate the importance of standardized MRI protocols to monitor MS patients.

**RC805B**
Advanced Imaging in MS

Aaron Scott Field MD, PhD (Presenter): Research Consultant, BioTime, Inc

LEARNING OBJECTIVES

1) Recognize the "Clinico-radiological Paradox" in MS and assess the limitations of imaging that contribute to this paradox. 2) Demonstrate how advanced MR imaging can further our understanding of the disease and help guide therapy. 3) Illustrate examples of recent efforts to be more quantitative in the imaging assessment of MS.
**Spinal Cord Demyelinating Diseases**

James G. Smirniotopoulos MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe an algorithm for evaluating myelitis. 2) Differentiate between ADEM, MS, and NMO. 3) Describe the pathology of viral myelitis.

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**Head and Neck Emergency!**

*Refresher/Informatics*

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Fri, Dec 5 8:30 AM - 10:00 AM  Location: S406B

**Sub-Events**

**RC806A**

**Adult Non-Traumatic Emergencies**

Claudia Francoise-Eve Kirsch MD (Presenter): Consultant, Informa plc

**LEARNING OBJECTIVES**

1) Review and understand the etiology of adult non-traumatic emergencies in the head and neck. 2) Review and understand the critical radiographic manifestations of adult non-traumatic emergencies, emphasizing the critical radiographic anatomical findings seen with emergent findings in the head and neck arising from either vascular, infectious, neoplastic, degenerative, inflammatory, congenital, allergic, and toxic etiologies (VINDICATE). 3) Review the radiographic features and the critical clinical implications of non-traumatic head and neck emergencies, so the radiologist is vindicated in conveying these findings to the referring clinicians leading to improved diagnostic outcomes and treatment.

**ABSTRACT**

This RSNA refresher course focuses on the adult non-traumatic emergencies in the head and neck arising from vascular, infectious, neoplastic, degenerative, inflammatory, congenital, allergic and toxic etiologies. This lecture will also focus on understanding the critical radiographic anatomical findings and clinical manifestations, allowing the radiologist to be vindicated when conveying the imaging findings to the referring clinicians.

**RC806B**

**Pediatric Non-Traumatic Emergencies**

Bernadette L. Koch MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the most common non-traumatic emergencies in imaging the pediatric head and neck. 2) Describe and understand the orbital and intracranial complications of pediatric sinusitis. 3) Identify the most common complications of middle ear and mastoid inflammatory disease. 4) Recognize the most common complications of deep neck infections in children.

**RC806C**

**Traumatic Head and Neck Emergencies**

Amy F Juliano MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the major types of orbital and facial injuries and recognize their imaging appearance. 2) Describe fractures that occur in the temporal bone and important structures that may be compromised, and correlate imaging findings with clinical presentation and symptoms. 3) Analyze laryngeal anatomy in the setting of trauma so as to be able to describe soft tissue and cartilaginous injuries.

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**RC811**

**Multi-modal Imaging Workup for Alzheimer's Disease, Parkinson's Disease, and Related Disorders: Case-based Approach**

*Refresher/Informatics*
FDG PET-CT Findings in Differential Diagnosis of Dementia


LEARNING OBJECTIVES

1) Principle of FDG-PET imaging of cerebral glucose mechanism. 2) Physiological and pathophysiological background. 3) Methodological aspects of FDG-PET imaging in the brain. 4) Differential diagnosis of non-neurodegenerative disorders leading to cognitive impairment. 5) Differential diagnosis between different forms of neurodegenerative disorders. 6) Combination of FDG-PET with other neuroimaging procedures (multimodal imaging).

Amyloid PET Findings in Alzheimer's Disease and Related Disorders

Nicholaas I. Bohnen MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss methodological aspects of fibrillary beta-amyloid PET imaging. 2) To learn about practical interpretation of fibrillary beta-amyloid PET imaging. 3) To understand the long duration of prodromal phase of amyloidopathy and its importance of correlating it with clinical symptoms when reporting on amyloid PET studies. 4) To review the presence of amyloidopathy in non-Alzheimer dementias. 5) The discuss appropriate use criteria for amyloid PET in clinical practice.

ABSTRACT

The recent developments of radioligands that visualize fibrillar B-amyloid offer a novel opportunity to study in vivo amyloid protein aggregation. [C-11]-Pittsburgh compound B (PiB) is a widely used investigational PET AB-amyloid ligand; More recently, amyloid PET has been used increasingly in clinical trials for AD therapeutics. Because the short 20-minute half-life of C-11 limits routine clinical use of PiB as a result of the need for an onsite cyclotron, amyloid-binding radiopharmaceuticals labeled with longer lived fluorine-18, with a 110-minute half-life, were developed and commercialized for wide availability. Several of such F-18 compounds, such as florbetapir, flutemetamol and florbetaben achieved approval by the U.S. Food and Drug Administration. The longer half-life of the F-18 compounds allow also more simplified delayed imaging acquisitions. Image interpretation of fibrillary B-amyloid scan will require reader's expertise to recognize the non-specific pattern of white matter radioligand uptake and to distinguish this form gray matter cortical uptake. Readers should also be aware that the build-up of the amyloid protein in Alzheimer disease may precede the clinical development of dementia with up to 15-20 years (so-called preclinical and prodromal phases). In other words, abnormal amyloid build-up can be seen in otherwise cognitive normal individuals. Therefore, scan interpretation should incorporate information of the clinical setting. Readers should also be familiar with novel definition of Alzheimer disease that now for the first time incorporate the use of imaging biomarkers, such as amyloid PET. Recently, a joint committee of the Society of Nuclear Medicine and the Alzheimers Association developed appropriate use criteria (AUC) to allow more judicious use of this new technology. Alzheimer pathology can also be seen with other dementia, such as dementia with Lewy bodies (DLB). Frontotemporal dementia is not characterized by significant amyloidopathy.

Dopamine Transporter SPECT Findings in Parkinson’s Disease and Related Disorders

Satoshi Minoshima MD, PhD (Presenter): License agreement, General Electric Company Research Grant, Koninklijke Philips Electronics NV Research Grant, Hitachi, Ltd Research Consultant, Hamamatsu Photonics KK Grant, Nihon Medi-Physics Co, Ltd Research Grant, Astellas Group Research Grant, Seattle Genetics, Inc

LEARNING OBJECTIVES

1) To describe mechanisms of dopamine transporter SPECT imaging. 2) To explain dopamine transporter SPECT procedure. 3) To discuss dopamine transporter SPECT findings in various movement disorders.

MRI Findings Commonly Seen in Dementia Patients

Yoshimi Anzai MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES
This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

Spine
RC818A
James C. Anderson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Review imaging of tumors of the spine. 2) Identify aspects of spinal tumors that affect staging, treatment and management 3) Highlight roles of various imaging modalities.

ABSTRACT
Review imaging of tumors of the spine
Review aspects of spinal tumors that affect staging, treatment and management
Review roles of various imaging modalities

Head and Neck/ENT
RC818B
Suresh K. Mukherji MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Review common head and neck tumors. 2) Identify pertinent imaging findings that show how imaging affects staging. 3) Highlight specific imaging findings that will affect staging, treatment and management.

ABSTRACT
Review common tumors of the head and neck
Review imaging findings in head and neck malignancies that specifically change staging
Review the value of imaging in directly affecting management and treatment

Brain
RC818C
Megan Kay Strother MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Identify basic anatomic, pathologic, and physiologic principles as they apply to neuro-oncologic imaging of the brain.

ABSTRACT
Five interactive neuro-oncologic cases will be presented in an interactive format. Participants will review basic knowledge and skills that are relevant to the clinical practice of neuroradiology, while evaluating the results of the latest research in neuro-oncologic imaging.

Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on Workshop)

Refresher/Informatics
RC831

A. Orlando Ortiz MD, MBA (Presenter): Nothing to Disclose
Bassem Adeeb Georgy MD, MSc (Presenter): Consultant, Johnson & Johnson Consultant, DFINE, Inc Medical Advisory Board, SpineAlign Medical, Inc Stockholder, DFINE, Inc Stockholder, SpineAlign Medical, Inc Stockholder, Spine Solutions, Inc
LEARNING OBJECTIVES

1) Describe and demonstrate methods for patient selection, evaluation and technique for Image-guided injection procedures used in spine pain management. 2) These procedures will include epidural steroid injections, nerve root blocks, facet blocks, sacroiliac joint injections, lumbar synovial cyst therapy, radiofrequency ablations. 3) Review procedural complications and how to avoid them. 4) Discuss pertinent anatomy, instruments and pharmacology. 5) These objectives will be accomplished using didactic lectures complemented by procedure videos, supervised hands on lab work with training models and round table case discussions.

ABSTRACT

Neck and back pain complaints are very common in the general population. Radiologists can contribute to the diagnosis and management in patients who are not responding to conservative management. Spine injection procedures can frequently be performed on an outpatient basis with a brief recovery phase. These procedures are performed with imaging guidance, such as a multi-directional fluoroscope or under CT guidance, in order to correctly localize the specific anatomic sites in or about the spine for diagnostic and/or therapeutic needle localization. An understanding of patient selection, indications and contraindications, are paramount to the safety and success of these procedures. The diagnostic and therapeutic potential of these procedures is also facilitated by a thorough evaluation of the spine, with respect to both anatomy and potential pathology, with cross sectional imaging techniques as well as other radiologic tests. Communication of these results between the Radiologist and the spine proceduralist will contribute to optimal patient outcomes.

SST08
Neuroradiology/Head and Neck (New Techniques in Head & Neck Imaging)

SST08-01

Novel Binominal Off-Resonant Rectangular (BORR) Pulse for MRI Retrobulbar Vessel Imaging

Yongquan Ye (Presenter): Nothing to Disclose, Zhen Wu PhD: Nothing to Disclose, E. Mark Haacke PhD: Research Grant, Biogen Idec Inc President, Magnetic Resonance Innovations, Inc

PURPOSE

Retrobulbar vessels, such as ophthalmic artery (OA) and vein (OV), central retinal artery (CRA), posterior ciliary arteries (PCA) and lacrimal artery (LA), are critical to maintain the eye's normal function. Disrupted blood flow in these vessels can lead to severe vision loss. However, these vessels are difficult to image with MRI. Here we demonstrate a novel water selective excitation method, namely Binomial Off-Resonant Rectangular (BORR) pulse, for obtaining high resolution retrobulbar vascular maps.

METHOD AND MATERIALS

Nine healthy volunteers (5 males, 31±3 y/o) were enrolled in the study with written consents. All data were collected on a Siemens 3T Verio scanner with product 32ch head coil. The BORR GRE sequence was scanned sagitally with TR/TE = 11/3ms, 0.5mm isotropic voxels; BORR pulse duration τ = 1.6ms, flip angle = 12°, and frequency offset Δf = 140Hz. This configuration gives whole brain coverage and excellent fat suppression. For comparison, 3D TOF MRA (with and without fat saturation [FS], or water excitation [WE]), 2D TOF, Linear Subtraction (LS) MRA and CE MRA were also performed. All scans were configured to have similar parameters (e.g. voxel size, bandwidth, etc.). All final results were reoriented to axial plane and processed with Maximal Intensity Projection (MIP) over a 4mm thickness.

RESULTS

As shown in the figure, the BORR pulse reliably suppresses all orbital fats, while preserving high vessel signal with sharp edges. In contrast, none of other MRA methods, including CE-MRA and LS MRA which have proven to work well for cerebral vessels, achieved similar performance in showing the vessels.

CONCLUSION

With our new BORR method, we have shown for the first time the high resolution MR images of the retrobulbar vessels, which has not been revealed by any existing MRA methods. This is because these vessels are buried in fatty tissues that show high signal in most MRA methods, and routine fat suppression or water excitation approaches also affect blood signal. The BORR method, on the other hand, has very robust and thorough fat suppression while preserving high blood signal. Therefore we have demonstrated the promising capacity for imaging retrobulbar vessels of the BORR method.

CLINICAL RELEVANCE/APPLICATION

We demonstrate a novel MRA method to reveal retrobulbar orbital vessels with high resolution, clearly revealing...
SST08-02

The Usefulness of Acoustic Structure Quantification Values in the Evaluation of Diffuse Thyroid Disease

Jisang Park MD (Presenter): Nothing to Disclose, Hyun-Sook Hong MD, PhD: Nothing to Disclose, Chul-Hee Kim: Nothing to Disclose, Kee Hyun Chang MD, PhD: Nothing to Disclose, Eun Hye Lee MD: Nothing to Disclose, Sun Hye Jeong MD: Nothing to Disclose, Aleum Lee MD: Nothing to Disclose, Heon Lee: Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of acoustic structure quantification (ASQ) for the diagnosis of diffuse thyroid disease (DTD). To identify cut-off levels of ASQ values in the differentiation of DTD and normal thyroid. To identify any difference in the subgroups of DTD between thyroid function and ASQ values.

METHOD AND MATERIALS

ASQ values were retrospectively analyzed from 439 lobes of 234 patients. The DTD group was divided into five subgroups (Hashimoto’s thyroiditis, painless thyroiditis, subacute thyroiditis, postpartum thyroiditis, and Grave’s disease). ASQ values were used to assess the echogenicity of thyroid. ASQ results included both qualitative visual results as well as quantitative results. The results are shown as occurrence in the C2m histogram (modified chi-squared distribution) with the mode, average, ratio, blue-mode, and blue-average. ROC curve analysis was performed to assess the diagnostic value of ASQ values for DTD, and cut-off values were obtained for the differentiation of DTD and normal thyroid gland function. The trends between thyroid function and ASQ values were evaluated. Concordance correlation coefficients of ASQ values were obtained.

RESULTS

The mean ASQ values in patients with DTD were significantly greater than normal thyroid (p = .000). The areas under the ROC curves for the ratio, average, blue-average, mode, and blue-mode were 0.93, 0.91, 0.90, 0.87, and 0.87, respectively. The cut-off values of the ratio, average, and blue-average in the DTD diagnosis were >0.27, >116.7, and >130.7, respectively. The sensitivity were 84.0, 85.3, and 79.1% and specificity were 96.6, 83.0, and 93.2% (ratio, average, and blue-average, respectively). A significant difference in ASQ values was found according to the hormonal status (p = .000). Trend analysis showed a quadratic trend between the hormonal status and ASQ values. The concordance correlation coefficient of obtaining ASQ values was very good.

CONCLUSION

ASQ values can provide objective and quantitative non-invasive analysis of thyroid echogenicity. ASQ value determination can be an objective guide to differentiate DTD from normal and has good diagnostic value for clinical application in the diagnosis and monitoring of DTD.

CLINICAL RELEVANCE/APPLICATION

(dealing with ultrasonography) "ASQ can provide objective and quantitative analysis of thyroid echogenicity. This exam is recommended for diagnosis and monitoring of diffuse thyroid disease."

SST08-03

Impact of Image Orientation on Measurements of Thyroid Nodule Stiffness Using Shear Wave Elastography

Manjiri K. Dighe MD (Presenter): Research Grant, General Electric Company, Jeff Thiel: Nothing to Disclose, Daniel S. Hippe MS: Research Grant, Koninklijke Philips NV Research Grant, General Electric Company

PURPOSE

To compare stiffness measurement within a thyroid nodule using Shear wave elastography (SWE) on transverse (T) and longitudinal (L) images.

METHOD AND MATERIALS

After IRB approval, elastograms were obtained by (SWE) from 77 individuals, with a total of 96 thyroid nodules. SWE data was acquired without any external compression using the Supersonics Aixplorer machine. Elastograms were acquired in the transverse (T) and longitudinal (L) orientation. 1 reader blinded to pathology results drew regions of interest (ROIs) covering the entire nodule within each image. The mean stiffness value (SV) was recorded from each ROI and averaged across each nodule for each orientation separately. Nodule SVs were compared between orientations using the Wilcoxon signed-rank test for bias and the concordance correlation coefficient (CCC) for agreement. In those with final histopathology results available, receiver operating characteristic (ROC) curve analysis and the area under the ROC curve (AUC) were used to evaluate how well SVs from each orientation could discriminate malignant and benign lesions.

RESULTS

Mean nodule SVs were 19.3 ± 15.5 kPa on T images and 22.1 ± 20.8 kPa on L images. There was a statistically significant but small bias in measurements between orientations of 2.8 kPa (p = 0.003). The SD of differences was 13 kPa and CCC = 0.74. After removing two large values, these dropped to 9.9 kPa and CCC = 0.52. In the subset of 41 nodules with histopathology available, the AUC for discriminating malignant and benign lesions was 0.76 (p = 0.002) using T images and 0.70 (p = 0.01) using L images (p = 0.28 for the difference).

CONCLUSION

There was moderate agreement in mean stiffness values measured using transverse and longitudinal orientation but only a small bias. Measurements from both orientations had similar performance in discriminating
malignant and benign lesions. Using either orientation for characterizing thyroid nodules is feasible.

**CLINICAL RELEVANCE/APPLICATION**

Similar diagnostic performance using Shearwave elastography was achievable using transverse and longitudinal orientations, which provides flexibility in imaging patients with short necks or difficulty in laying on the examination bed with an extended neck.

**SST08-04**

**Iterative Model Reconstruction Algorithm in Low kVp (80) Parotid CT Scan for Visualization of Adipose Tissue Deposition in Sjögren’s Syndrome**

Changwei Ding (Presenter): Nothing to Disclose, Xiao Mei Lu MMed: Employee, Koninklijke Philips NV, Ping Wang MD, MS: Nothing to Disclose, Qiyong Guo MD: Nothing to Disclose

**PURPOSE**

To investigate the ability of low dose parotid CT scan using an iterative model reconstruction (IMR) algorithm to detect the distinctive adipose tissue deposition in Sjögren’s syndrome.

**METHOD AND MATERIALS**

Eighteen patients with confirmed Sjögren's syndrome were scanned using a 256-slice CT for visualization of the parotid gland. This protocol was approved by hospital ethics committee and written informed consent was obtained from each patient. Among these patients, five underwent routine dose scan (120 kV and 200 mAs) and filtered back projection algorithm was used for image reconstruction (RD-FBP group), and thirteen patients under low dose scan (80 kV, 200 mAs, 71% dose reduction), and iDose4 (level 5) and IMR (level 1) algorithm was used respectively for image reconstruction (LD-iDose4 group and LD-IMR group, respectively). The image noise (measured in semispinalis capitis) was compared between RD-FBP group and LD-iDose4 and LD-IMR group. The images of LD-iDose4 group and LD-IMR group were read blinded by two experienced radiologists in consent for evaluation of the adipose tissue deposition in the parotid gland according to these features: detectability, interface contrast to parotid parenchyma, and density contrast to parotid parenchyma [1 (poor) to 5 (excellent)].

**RESULTS**

The image noise in the LD-IMR group was significantly lower than in the LD-iDose4 and RD-FBP groups (4.36±0.96, 6.92±1.11, and 5.77±1.44, respectively, P<0.05). There was no significant difference in the detectability of adipose tissue between LD-IMR and LD-iDose4 groups (P>0.05). The LD-IMR group displayed clearer boundary between adipose tissue and parotid parenchyma and offers higher density contrast than the LD-iDose4 group (P<0.05).

**CONCLUSION**

IMR algorithm reduced the noise of low dose parotid CT scan, even lower than RD-FBP, increased the interface and density contrast of adipose tissue and parotid parenchyma, so offered stronger ability to detect adipose tissue deposition in the parotid gland of patients with Sjögren's syndrome.

**CLINICAL RELEVANCE/APPLICATION**

IMR can improve the image quality of low dose CT scan, increase the contrast resolution between different tissues, and thereby enhance the ability to detect lesions.

**SST08-05**

**Single Contrast Bolus vs Radiation Dose: Can Combined Chest & Neck CT Examinations Use One Topogram?**

Jie Zhang PhD (Presenter): Nothing to Disclose, Jessica L. Cornett: Nothing to Disclose, Gerald Ball Broussard MD: Nothing to Disclose, Edward Joel Escott MD: Royalties, Thieme Medical Publishers, Inc Researcher, Athersys, Inc Grant, Athersys, Inc

**PURPOSE**

Currently we treat Computed Tomography (CT) chest and neck examinations as separate scans, using two separate topograms and dividing the contrast 60/40. Depending upon the patient's body habitus this amount of contrast for each scan may not be sufficient to opacity the vessels properly. Acquiring one topogram with the arms up then having the patient move their arms up/down during the chest/neck scan allows one bolus of contrast to be administered, but has the potential to increase radiation. The purpose of this study is to investigate the difference in patient radiation dose for combined chest and neck CT examinations when one topogram with the arms up is used, compared with two separate topograms with the arms up and down respectively.

**METHOD AND MATERIALS**

Between 2/1/2014 and 4/5/2014, patients who received a CT chest and neck examination in the same session and same CT scanner were randomly separated into two groups. One group followed the conventional two topogram scenario with proper arm positioning while the other group kept the arms up for the combined topogram. The first group received the divided 60/40 bolus contrast while the second group received only one contrast bolus. During scan acquisition for the second group the arms were positioned out of the scan field-of-view (FOV). Automatic Exposure Control (e.g., CareDose4D) remained on for CT scanning. Volume CT Dose Index (CTDIvol) for the chest and neck CT scans was recorded, respectively. Patient Body Mass Index (BMI) was also recorded.

**RESULTS**

The CTDIvol and BMI of 23 patients were collected, 11 with two separate topograms and 12 with one topogram. Our preliminary comparison shows there is no significant difference in either CTDIvol of the neck (p=0.24) or BMI (p=0.51) with either topogram technique. This may be mainly due to the use of AEC (CareDose4D) which
adjusts tube current in real time. CTDIvol of the chest was not compared since in either situation the arms are not included within the chest on the topogram.

CONCLUSION

One topogram with the arms up can be used for combined CT chest and neck examinations to allow the use of a single contrast bolus. With the appropriate use of AEC, there is no significant increase in the radiation dose to patient.

CLINICAL RELEVANCE/APPLICATION

One topogram can be used for combined chest and neck CT examinations to enable the use of a single contrast bolus without a significantly increased patient dose.

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**SST08-06**  
**Application of the Dual Energy CT Scan for Differentiation of Parathyroid Gland from Thyroid Gland Based on Enhancement Characteristics**

Laleh Daftaribesheli MD (Presenter): Nothing to Disclose, Emad Ahmadi MD: Nothing to Disclose, Omid Khalilzadeh MD, MPH: Nothing to Disclose, Rajiv Gupta PhD, MD: Nothing to Disclose

**PURPOSE**

Compared to thyroid, parathyroid is hypothesized to uptake more amounts of iodine after iodine contrast injection, and to have more rapid iodine washout in delayed images. The aim of this study was to ease the distinction of parathyroid from thyroid gland in CT images by comparing the changes of iodine content in these two glands over time after iodine contrast injection. Using dual-energy CT, we also aimed to minimize radiation exposure by eliminating the pre-contrast phase.

**METHOD AND MATERIALS**

We retrospectively studied seven CT angiograms of head and neck that had been performed for vascular assessment of patients. The imaging protocol included iodine contrast injection followed by one post-contrast dual-energy CT image and one delayed image after injection. We defined regions of interest over parathyroid and thyroid gland, computed the iodine content in these regions using dual-energy CT post-processing software, and subtracted the iodine content in delayed image from that of the post-contrast image. This iodine content change was then compared between thyroid and parathyroid glands.

**RESULTS**

Our study includes 5 males and 2 females with the mean age of 67. Our analysis showed that the iodine content decrease from post-injection to delayed image was 6.2 ± 1.8 for parathyroid gland, and it was 2.1 ± 2.1 for the thyroid gland. The figure shows the changes of iodine content over time in both parathyroid and thyroid glands, as well as the defined regions of interest for two representative cases.

**CONCLUSION**

Using a two-phase dual energy CT scan (post-contrast and delayed phase), parathyroid tissue can be distinguished from thyroid gland based on the pattern of iodine content changes between the phases.

**CLINICAL RELEVANCE/APPLICATION**

Difference between iodine content of post-contrast image and delayed post-contrast image in the parathyroid and thyroid tissue might enable clinicians to differentiate the two tissues reliably. Distinction of parathyroid from thyroid tissues in dual-energy CT images might be facilitated by superimposing computed images on the CT image that are encoded based on changes of iodine content from post-injection to delayed-phase images.

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**SST08-08**  
**Establishing Normative Values of Dual-energy CT Parameters in Head and Neck Tissues and Comparison to Benign and Malignant Tumors**

Ashok Srinivasan MD (Presenter): Author, Amirsys, Inc, Hideomi Yamauchi MD: Nothing to Disclose, Mark Alan Buehler MD: Nothing to Disclose, Matthew Spector: Nothing to Disclose, Suresh K. Mukherji MD: Nothing to Disclose, Mitchell M. Goodsitt PhD: Research collaboration, General Electric Company

**PURPOSE**

1. To establish the normal range of dual energy CT derived parameters for normal tissues in the head and neck.
2. To evaluate the differences in dual energy CT parameters amongst normal tissues, benign and malignant neoplasms.

**METHOD AND MATERIALS**

Institutional review board approval was obtained. All adult CT neck scans performed on a 64 slice GE CT (HD750, Milwaukee, WI) with dual energy CT (Gemstone spectral imaging, GSI) from November 2009 to February 2014 were included. Scans with significant artifact or poor contrast bolus were excluded. Post-processing was performed by an experienced neuroradiologist on a GE-AW workstation by placing multiple ROIs in normal tissues including the parotids, submandibular glands, floor of mouth, tongue base, lymph nodes, paraspinal muscle and in known tumor tissue (either benign or malignant). The parameters measured included HU at 70keV, effective Z and iodine-water concentrations. Mean, S.D. and range were calculated for each of these parameters within normal tissues and were then compared to the parameters measured in benign and
malignant tumors using independent samples t-test. Scatterplots of effective Z against each of the other parameters were also created to analyze if benign and malignant tissues could be reliably separated using these parameters.

RESULTS

Patients with 17 benign and 24 malignant tumors were included. The mean and SD of effective Z and iodine-water concentration (in mg/cc) in normal tissues, benign and malignant tumors are listed in Table 1. Significant differences in effective Z and iodine-water concentrations was noted between benign and malignant neoplasms (p=0.001, 0.001 respectively) and between malignant neoplasms and all normal tissues but not between benign tumors and normal tissues. The scatterplots of effective Z versus HU at 70 keV showed good separation of benign and malignant tumors.

CONCLUSION

Our study reveals that dual energy CT may help in distinguishing both benign and malignant tumors from each other, and differentiating malignant tumors from normal tissue in the head and neck.

CLINICAL RELEVANCE/APPLICATION

Dual energy CT can be an additional tool to conventional imaging in characterizing head and neck lesions.

SST08-09

Thyroid Evaluation with a Novel Microvascular Flow Technique

Priscilla Machado MD : Grant, Toshiba Corporation Equipment support, Toshiba Corporation, Sharon Rebecca Segal DO : Nothing to Disclose, Andrej Lyshchik MD, PhD : Nothing to Disclose, Flemming Forsberg PhD (Presenter): Equipment support, Toshiba Corporation Research collaboration, General Electric Company Research collaboration, Analogic Corporation Research collaboration, Toshiba Corporation Speakers Bureau, Toshiba Corporation

PURPOSE

To evaluate the flow imaging capabilities of a new prototype ultrasound (US) image processing technique (SMI; Toshiba Medical Systems, Tokyo, Japan) for depiction of microvascular flow in normal thyroid tissue and thyroid nodules compared to standard color and Power Doppler imaging (CDI and PDI).

METHOD AND MATERIALS

SMI is a novel, microvascular flow imaging mode implemented on the Aplio 500 US system (Toshiba). SMI utilizes advanced clutter suppression to extract flow signals from large to small vessels and depicts this information as a color overlay image or as a monochrome map of flow. Ten (10) healthy volunteers and 22 patients, with 25 thyroid nodules, scheduled for US guided fine needle aspiration were enrolled in this prospective study. Subjects underwent US examination consisting of grayscale US, CDI and PDI followed by color and monochrome SMI and pulsed Doppler. In the volunteers, pulsed Doppler guided by the 4 flow modes determined the lowest velocity measurable within the normal thyroid microvasculature and results were compared using a one-way ANOVA. Two radiologists independently analyzed still images and digital clips scoring overall flow detection, vessel branching details and noise on a subjective scale of 1 (worst) to 10 (best). Scores were compared (on a per nodule basis) using a non-parametric Wilcoxon signed rank test.

RESULTS

For the volunteers SMI captured microvasculature with lower velocity than CDI and PDI (2.2 ± 0.35 and 2.1 ± 0.32 cm/s vs. 2.6 ± 0.44 and 2.8 ± 0.77 cm/s; p < 0.012). In all cases SMI showed microvascular flow with significantly higher image scores and provided better depiction of the vessel branching details compared to CDI and PDI (SMI scores > 5.4 and CDI/PDI scores < 4.9; p < 0.0001). Clutter noise was significantly higher in monochrome SMI mode than in the other modes, including color SMI (monochrome SMI scores < 4.5 while others were > 6.4; p < 0.001).

CONCLUSION

The novel SMI mode consistently showed more detailed thyroid flow with smaller branches and lower velocities than CDI and PDI.

CLINICAL RELEVANCE/APPLICATION

This new flow mode may be useful for providing a better understanding of the vascularity of thyroid nodules.
Participants
Moderator
Jay J. Pillai MD : Medical Advisory Board, Prism Clinical Imaging, Inc
Moderator
Jalal Badi Andre MD : Consultant, Hobbittyview, Inc Research Grant, Koninklijke Philips NV

Sub-Events

SST09-01 Intracranial Arterial Calcifications as a Prognostic Factor for the Subsequent Occurrence of Mixed Adverse Cardiovascular Events (MACE)
Frederik Franz Strobl MD (Presenter): Nothing to Disclose, Beatrice Kuhlin: Nothing to Disclose, Fabian Bamberg MD, MPH : Speakers Bureau, Bayer AG Speakers Bureau, Siemens AG Research Grant, Bayer AG Research Grant, Siemens AG, Christopher Uebles MD : Nothing to Disclose, Maximilian F. Reiser MD : Nothing to Disclose, Tobias Saam MD : Research Grant, Diamed Medizintechnik GmbH Research Grant, Bayer AG

PURPOSE
The aim of this study was to evaluate the association of intracranial arterial calcifications (ICAC) as detected in non-contrast-enhanced CT scans of the head with the subsequent occurrence of mixed adverse cardiovascular events (MACE).

METHOD AND MATERIALS
We included a cohort of consecutive patients with an age >60 years who underwent a non-contrast-enhanced CT scan of the head due to minor trauma or neurological disorders. Only patients without acute pathological findings in the CT scan were included. A calcified plaque score (CPS) with the range 0-4 was determined in each of the following arteries: both internal carotid arteries, both mid cerebral arteries, both vertebral arteries, basilar artery. To obtain clinical follow-up information, all patients and their general practitioners were contacted with a questionnaire and/or telephonically. Only patients in whom definite information about clinical follow-up or cause of death could be obtained were included in this study. Major cardiovascular adverse events (MACE) were defined as myocardial infarction, revascularization, stroke or death due to a cardiovascular event.

RESULTS
We included 175 patients (89 male, mean age 78.2 years). Mean follow-up time was 40.4 months, resulting in 7070 patient-years of follow-up. Overall 36 MACE occurred in the cohort during follow-up (12 myocardial infarctions or revascularizations, 6 strokes, 18 cardiovascular deaths; event rate =xx%/year). CPS was significantly higher in subjects with compared to subjects without MACE (6.8±3.5 vs. 4.5±3.4, p =5 (p

CONCLUSION
Patients with an age >60 years and a burden of intracranial artery calcification have an increased risk for the occurrence of cardio- or cerebrovascular events.

CLINICAL RELEVANCE/APPLICATION
Intracranial artery calcifications, which can be easily detected on non-contrast-enhanced CT scans of the head, might be a prognostic factor to determine the risk for a future cardio- or cerebrovascular events in older patients.

SST09-02 A New Automated Method for Magnetic Resonance Perfusion Weighted Imaging Using a Local Arterial Input Function and Contrast Agent Leakage Correction
Donald Robinson Cantrell MD, PhD (Presenter): Nothing to Disclose, Thomas Anthony Gallagher MD : Nothing to Disclose, Timothy J. Carroll PhD : Nothing to Disclose

PURPOSE
MR Perfusion Weighted Imaging (MR-PWI) supplements anatomic sequences by providing functional information regarding the hemodynamic status of the brain. Standard MR-PWI protocols employ singular value decomposition to deconvolve the arterial input function (AIF) from the relaxivity time curve. However, standard models are limited by their inability to account for differences in bolus arrival time (BAT), bolus dispersion, and contrast leakage. Local AIF techniques have addressed the problems associated with delayed BAT and bolus dispersion (Lee et al, 2010, MRM 63: 1305), but have not addressed leakage, an important hemodynamic parameter in the imaging of CNS malignancies (Boxerman et al, 2006, AJNR 27: 859). In the present work, we introduce a new fully automated local AIF perfusion technique that incorporates leakage effects, making it broadly applicable to both ischemia and malignancy.

METHOD AND MATERIALS
A per-voxel AIF was modeled with a gamma-variate function. The residue function was modeled with a mono-exponential. Leaking contrast was defined to be proportional to the cumulative integral of the intravascular concentration time curve. Parameter values were inferred with Bayesian Markov Chain Monte Carlo simulations. The automated algorithm was implemented in C/C++ and parallelized with the Message Passing Interface to execute in parallel on a user-defined number of CPUs.

RESULTS
The model was applied to a pilot series of patients with Moyamoya disease and CNS malignancy. In patients with Moyamoya disease, the MTT Derived by standard deconvolution is confounded by bolus delay. However, the local AIF technique directly accounts for delayed BAT, and the resulting MTT prolongation is reduced compared to the standard approach. In patients with glioblastoma multiforme, tumors demonstrate variable heterogeneity with some components characterized by pronounced hyperperfusion, and other components characterized by increased vascular permeability. All of these hemodynamic properties are simultaneously inferred by our new technique.
CONCLUSION

A new local AIF technique that incorporates leakage effects has been developed, and it is broadly applicable to the evaluation of both ischemia and malignancy.

CLINICAL RELEVANCE/APPLICATION

This work outlines a new local AIF technique for MR Perfusion that corrects for the effects of contrast leakage and is broadly applicable to the evaluation of both ischemia and malignancy.

SST09-03

Proof of Concept: Potential of Normal Saline (NS) as a Safe Exogenous Contrast Agent for Perfusion MRI of the Brain

Asim Zia Mian MD : Stockholder, Boston Imaging Core Lab, LLC ; Hernan Jara PhD (Presenter) : Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co ; Osamu Sakai MD, PhD : Speaker, Bracco Group Speaker, KYORIN Holdings, Inc Speaker, Eisai Co, Ltd ; Stephan W. Anderson MD : Nothing to Disclose ; Jorge A. Soto MD : Nothing to Disclose ; Alexander M. Norbash MD : Stockholder, Boston Imaging Core Laboratories, LLC Co-founder, Boston Imaging Core Laboratories, LLC

PURPOSE

Gadolinium-based contrast agents can have risks including nephrogenic systemic fibrosis, allergic reactions and limitation of use during pregnancy. Normal saline (NS) is a nontoxic sodium chloride water solution that can significantly increase the MR relaxation times of blood via hematocrit reduction. The purpose of this study was to test in-vivo the potential of NS as a safer, brain perfusion exogenous contrast agent.

METHOD AND MATERIALS

This HIPAA compliant prospective study was approved by the IRB of our hospital. MRI was performed at 1.5T (Achieva, Philips Healthcare): head array and body coil for RX/TX. Three and five patients were scanned with an IR-EPI and IR-TSE sequence, respectively. The IR pulse sequence was run during and after the NS injection for up to 5min: 100cc of NS were power injected into antecubital veins at 3-4cc/s. Images were processed with Mathcad (2001i, PTC, Needham, MA) algorithms to map maximum enhancement (maxENH), area under the curve (AUC), time-to-peak (TTP), and mean-transit-time (MTT) (Fig. 1a). These maps were used to identify visually the areas showing significant NS injection related signal. Regions of interest (ROI) were drawn in areas of high injection related effects as well as areas without these effects and graphed as a function of time.

RESULTS

NS injection-related enhancement effects were observed in all patients, particularly in highly vascular intra- and extra-cranial tissues and also in periventricular white matter. Relative signal change in cortical gray matter and periventricular white matter were observed in the 10-30% range and these enhancement effects lasted for several minutes post injection (Fig. 1b). All recruited patients completed the NS injection plus the dynamic-IR-MRI scan without any adverse effects, or expressing discomfort.

CONCLUSION

A measurable perfusion effect of up to 30% change relative to baseline has been demonstrated in-vivo in the human brain using NS as a contrast agent. The contrast mechanism is believed to be an alteration of the T1 relaxation time resulting from hematocrit reduction. To the best of our knowledge, this is the first report of the use of NS for dynamic contrast enhanced MRI.

CLINICAL RELEVANCE/APPLICATION

This demonstrates the viability of NS as a measurable, safe, practical, and inexpensive T1 contrast agent for dynamic perfusion MRI. The described methodology could be used with patients with Gd contraindications.

SST09-04

Progression of Brain Atrophy and White Matter Hyperintensities in Cerebral Small Vessel Disease. Estimates of Sample Size to Detect Treatment Effects

Philip Benjamin MBBS (Presenter) : Nothing to Disclose ; Andrew J. Lawrence : Nothing to Disclose ; Andrew Mackinnon MD, MRCP : Nothing to Disclose ; Eva Zeestraten : Nothing to Disclose

PURPOSE

Brain volume and white matter lesions have been suggested as a surrogate marker of disease progression for use in clinical trials in cerebral small vessel disease (SVD). If these MRI findings are to be used as a reliable surrogate markers in clinical trials, power calculations are required not only to determine the sample sizes needed to show therapeutic efficacy, but also to help identify the most feasible outcome measures. We used serial brain magnetic resonance imaging (MRI) to prospectively evaluate the rate of brain atrophy and white matter hyperintensity (WMH) growth in SVD and investigated the sample sizes required to demonstrate a reduction in the rate of disease progression.

METHOD AND MATERIALS

Data from the prospective SCANS study of patients with SVD was used for this analysis (n=121). SVD was defined as a clinical lacunar stroke with an anatomically corresponding MRI defined lacunar stroke as well as confluent leukoaraicitis. Multimodal MRI was performed yearly for a period of 3 years. Percentage whole brain
volume change relative to baseline was measured directly using a registration based method (SIENA). WMHs were segmented and volumes were calculated at each timepoint in individual subject space by summing binarised corrected segmentations.

RESULTS

For a 3 year trial duration the mean (SD) rate of whole brain atrophy was -1.985\%(1.958). The mean (SD) percentage growth of WMH (WMHp) was 1.912\%(1.168). Based on these figures, to detect a 25%, 20% and 15% treatment effect on brain atrophy at 80% power the minimum sample sizes required were 494 (247 in each arm), 766 (383 in each arm) and 1358 (679 in each arm) respectively. For WMH growth, the minimum sample size required to detect a 25%, 20% and 15% treatment effect at 80% power was 172 (86 in each arm), 270 (135 in each arm) and 476 (238 in each arm) respectively.

CONCLUSION

Whole brain volume change is measurable prospectively in SVD and is higher than the reported rate of atrophy in normal ageing. Whole brain volume change is therefore a feasible outcome measure for use in clinical trials in SVD although sample sizes are still moderate. Considerably smaller sample sizes are required if WMH volume is used as an outcome measure, however the impact of WMHs on cognitive impairment and disability in SVD remains uncertain.

CLINICAL RELEVANCE/APPLICATION

Markers of disease progression in cerebral small vessel disease

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**SST09-05**

**Intracranial Hypotension and Sinus Vein Thrombosis - Causal or Casual Association?**

Ruth Eliahou MD (Presenter): Nothing to Disclose, Asaf Honig MD: Nothing to Disclose, Ronen Leker MD: Consultant, MedyMatch Technology Ltd, John Moshe Gomori MD: Consultant, Medymatch Technology Ltd

**PURPOSE**

Intracranial hypotension (IH) is an increasingly recognized clinical entity with distinct clinical and imaging features. The associated venous distention and sluggish venous flow in IH has been linked to sinus vein thrombosis (SVT). Iatrogenic direct lumbar punctures (LP), spinal anesthesia (SA) or indirect punctures due to epidural anesthesia (EA) are common causes of IH. We studied the occurrence of SVT in patients post LP.

**METHOD AND MATERIALS**

We retrospectively reviewed the imaging and clinical findings of post LP patients with SVT in our institution between 2003 and 2013.

**RESULTS**

Eighty patients who presented to our institution in the past 10 years with acute sinus vein thrombosis were identified. Ten of them, all females (ages 22 -52) were found to have an LP 3-7 days before developing SVT. 8 women were post-partum with EA, and two had SA for meniscal surgery and hysterectomy. All patients had postural headaches. CT and MR scans of all ten patients were positive for SVT. In addition, five patients (50%) also showed one or more IH related MR findings: low cerebellar tonsils, decreased mamillo-pontine distance, diffuse pachymeningeal enhancement, thin bilateral subdural fluid collections. Post-partum and postoperative states are known to be hypercoagulable conditions. Subsequent coagulograms revealed underlying hypercoagulable tendencies in all ten patients.

**CONCLUSION**

Clinical and imaging data point to a direct association between IH and SVT. In post-partum women who underwent recent spinal or epidural anesthesia, with diagnosis of SVT one should look for IH. Coexistence of underlying IH may have therapeutic implications.

**CLINICAL RELEVANCE/APPLICATION**

There is a strong association between postpartum SVT and IH, caused by recent spinal anesthesia. Postpartum SVT should initiate imaging and clinical search for underlying IH.

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**SST09-06**

**Evaluation of the Atherosclerotic Wall of Intracranial Aneurysms Using Hybrid of Opposite-contrast Magnetic Resonance Angiography (HOP-MRA)**

Yuji Akiyama (Presenter): Nothing to Disclose, Toshinori Matsushige: Nothing to Disclose, Yoshiko Iwakado: Nothing to Disclose, Yoko Kaichi: Nothing to Disclose, Tokunori Kimura PhD: Nothing to Disclose, Kazuo Awai MD: Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd

**PURPOSE**

Hybrid of opposite-contrast magnetic resonance angiography (HOP-MRA) is a new technique that combines the advantages of 3D time-of-flight (TOF) MRA and flow-sensitive black-blood (FSBB) MRA. Theoretically, HOP-MRA demonstrates atherosclerotic plaques including fat as high- and the blood space as low-signal intensity areas in intracranial aneurysms. The purpose of this study was to investigate whether HOP-MRA demonstrates atherosclerotic plaques in intracranial aneurysms.

**FINANCIAL INTERESTS**

Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd
METHOD AND MATERIALS
This prospective study included 13 patients (6 men, 7 women; median age 63 years, range 24-76 years) with 15 aneurysms. The same neurosurgeon with 15 years of experience confirmed the macroscopic findings on all aneurysms. The median maximum diameter of the aneurysms was 5.1 mm (range 2.8-14.1 mm). All images were acquired on a commercially available 3T MR scanner (Vantage Titan 3T; Toshiba Medical Systems) with a 16-channel head coil. For HOP-MRA we used a 3D GRE double-echo sequence. The scan parameters were: TR, 21 ms; TE1, 3.3 ms; TE2, 13.9 ms; flow dephasing gradient (b=0.3s/mm²); flip angle, 20; field of view, 24 cm; slice thickness, 1 mm; number of partitions, 60; 192 Χ 256 matrix; and 2 NEX. We measured the relative signal intensity (RSI) of the high-intensity area to the background low-intensity area inside the aneurysm.

RESULTS
During surgery, 6 aneurysms were classified as grade A, 4 as grade B, and 5 as grade C. The mean RSI for grade A, B, and C was 4.65±1.53 (standard deviation), 1.42±0.69, and 0.93±0.16, respectively. There was a statistically significant difference between grade A and B (p=0.028, Steel-Dwass multiple comparison), grade A and C (p=0.017), and grade B and C aneurysms (p=0.038).

CONCLUSION
The relative signal intensity in intracranial aneurysms on HOP-MRA images accurately correlated with the presence and extent of atherosclerotic plaques.

SST09-07
One-step-Stroke CT Imaging – Part I: Optimization of Interleaved Acquisition of Cerebral CT Perfusion and Neck CT Angiography
Marcel Oei (Presenter): Researcher, Toshiba Corporation, Rashindra Manniesing: Research funded, Toshiba Corporation, Rieneke van den Boom MSc: Research Grant, Toshiba Corporation, Willem Jan Van der Woude: Research Grant, Toshiba Corporation, Bram Van Ginneken PhD: Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC, Frederick Jan Anton Meijer MD: Nothing to Disclose, Mathias Prokop MD, PhD: Speakers Bureau, Bayer AG, Speakers Bureau, Koninklijke Philips NV Research Grant, Toshiba Corporation

PURPOSE
One-Step-Stroke imaging is a CTP acquisition in which one volumetric scan is substituted by volumetric neck CTA, using a toggling table technique and a single dose of contrast agent (see figure). It is not clear how missing one time point of the CTP acquisition to obtain the neck CTA will affect the perfusion maps and which time point is best suited for neck CTA. We determined the optimum timing of neck CTA with the least effect on cerebral perfusion maps.

METHOD AND MATERIALS
20 consecutive patients with suspicion of ischemic stroke were scanned with a clinical CTP head protocol using a 320-row CT scanner. A neck CTA takes maximal 4s, therefore omitting one time point of the CTP with 2s scan interval is sufficient. The One-Step-Stroke protocol was simulated from the original protocol by eliminating one acquisition at various time points. The elimination of one acquisition of CTP simulates the acquisition of the neck CTA. For every patient one volumetric acquisition was deleted, starting from the bolus arrival time up to the fifth time point after the arterial peak determined from the middle cerebral artery (MCA). Corresponding perfusion maps were calculated. Percentage errors were calculated for all perfusion parameters (CBF, CBV, MTT) in basal ganglia and white matter per time point and per patient. Bolus tracking is simulated by using the enhancement curves in the MCA to derive relative thresholds (40-100HU). The relative thresholds were used to determine the time point resulting in the smallest error across all patients.

RESULTS
A volumetric CTP scan deleted 2s after reaching a threshold of 40-70HU kept the absolute percentage errors of all perfusion parameters below 10% in all patients. A relative threshold of 70HU for bolus tracking of the CTA gave the lowest absolute percentage errors for CTP parameters (mean <3.0%, maximum always <7.5%) for acquiring the neck CTA. Estimated average enhancement at CTA, measured in the MCA, was 302HU (range 198-408HU).

CONCLUSION
Our simulations suggest that the One-Step-Stroke protocol does not significantly alter absolute perfusion values and creates high enhancement in the carotids, if the neck CTA is acquired 2s after a threshold of 70HU in the MCA.

CLINICAL RELEVANCE/APPLICATION
One-step stroke imaging is a single exam sequence where the neck CTA is part of the CTP. One-Step-Stroke imaging has the potential to replace CTA and CTP which saves radiation dose and contrast agent dose.
**SST09-08**

**The Evaluation of Image Quality of Intracranial Aneurysms by Dual Energy CTA with SPS Technique as well as SAFIRE Reconstruction**

Yaying Yang (Presenter): Nothing to Disclose, Bin Yang: Nothing to Disclose, Wei Zhao: Nothing to Disclose

**PURPOSE**

To investigate the image quality (IQ) of intracranial aneurysms by dual energy CTA with selective photon shield (SPS) acquisition and SAFIRE reconstruction

**METHOD AND MATERIALS**

80 patients suspected with intracranial aneurysms were randomly assigned for CTA examinations as follows: Group 1: tube voltages 80kV/140kV, tube currents 200mAs/100mAs; SAFIRE was applied. Group 2: tube voltages 80kV/140kV, tube currents 300mAs/150mAs. The other parameters are the same. The IQ (subjective as well as objective IQ) and radiation dosage of the two groups were compared. In the meanwhile, the location, numbers and morphology of aneurysm in addition to neck display degree and neck size of the two groups were compared.

**RESULTS**

There was no significant difference on SNR between the two groups (P>0.05), however, the noise was lower in group 1 compared to group 2 (P<0.05).

**CONCLUSION**

With SPS technique in combination with SAFIRE, radiation dose could be reduced while IQ and diagnostic accuracy are increased in the detection of intracranial aneurysms by CT DE mode.

**CLINICAL RELEVANCE/APPLICATION**

Very well

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**SST09-09**

**Investigation of Accuracy of Hemodynamics and Wall Shear Stress for Intracranial Arteries Obtained from MR Fluid Dynamics (MRFD) using 3D Cine Phase-contrast MR Imaging**


**PURPOSE**

Cerebral arterial hemodynamics is thought to play an important role in aneurysmal initiation, growth and rupture. MR fluid dynamics (MRFD) using 3D cine phase-contrast MR imaging (3D cine PC MRI) would be a promising technique for assessment of hemodynamics. The purpose of our study was to validate the accuracy of hemodynamics and wall shear stress (WSS) obtained from MRFD using two phantoms.

**METHOD AND MATERIALS**

We ran blood-mimicking fluid through a 3 mm-diameter straight tube with a steady flow measuring about 2.50 ml/sec and performed 3D cine PC MRI using 3T MR system. We performed MRFD by Flova software and compared analyzed time averaged volume flow rates (VFRs) with values measured with a digital Coriolis flowmeter and also compared WSS with theoretical values. We also performed MRFD for a left internal carotid artery-posterior communicating artery aneurysm (IC-PC An) model with blood mimicking fluid for three different steady VFRs in an internal carotid artery (ICA) set at 7.99 ml/sec, 4.63 ml/sec and 2.84 ml/sec. We compared analyzed time averaged VFRs in ICA, anterior cerebral artery (ACA) and middle cerebral artery (MCA) with values measured with the flowmeters. We also compared our software-calculated velocity components and WSS with values obtained from computational fluid dynamics (CFD) and calculated correlation coefficients. We also compared MRFD and CFD streamlines.

**RESULTS**

In the straight tube phantom, relative errors of time averaged VFR and WSS were 4 % and 6 %, respectively. In the cerebral artery phantom, relative errors of time averaged VFRs in ICA, ACA and MCA were 10 %~30 %. Correlation coefficients of velocity components in ICA were 0.60~0.94 and those of WSS in ICA were 0.68~0.72. Correlation coefficients of velocity components in IC-PC An were 0.58~0.94, and that of its WSS was 0.34~0.63. Distribution of WSS and streamlines in MRFD and CFD were similar.

**CONCLUSION**

Accuracy of time averaged VFR obtained from MRFD was relatively good in this phantom study. Although accuracy of WSS obtained from MRFD was poor in IC-PC An in the model, it was good in a straight tube phantom and ICA. WSS and streamlines patterns obtained in MRFD were similar in CFD.

**CLINICAL RELEVANCE/APPLICATION**

(Dealing with MRFD using 3D cine PC MRI) Although WSS might not be accurate; VFR, distribution of WSS and...
streamlines were relatively good in MRFD in cerebral arteries.'

**SST10**

**Neuroradiology (Advances in Neuro CT Imaging)**

**Scientific Papers**

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**Fri, Dec 5 10:30 AM - 12:00 PM** **Location: N227AB**

**Participants**

**Moderator**
Pratik Mukherjee MD, PhD : Research Grant, General Electric Company Medical Advisory Board, General Electric Company
Mohannad Ibrahim MD : Nothing to Disclose

**Sub-Events**

**SST10-01**

**Reconstruction of Cerebral Angiographic Data from Time-resolved CT Perfusion Acquisitions Using Wavelet Transforms**

Lukas Havla (Presenter) : Nothing to Disclose, Kolja Thierfelder MD, MSc : Nothing to Disclose, Sebastian Ekkehard Beyer : Nothing to Disclose, Maximilian F. Reiser MD : Nothing to Disclose, Wieland H. Sommer MD : Nothing to Disclose, Olaf Dietrich PhD : Nothing to Disclose

**PURPOSE**

To evaluate a new approach for the reconstruction of high-quality 3D angiographic datasets based on the pixel-by-pixel application of wavelet transforms on CT perfusion data in the time domain.

**METHOD AND MATERIALS**

Cerebral CT perfusion data of 14 consecutive patients with suspected stroke but no ischemia on follow-up MRI and without any other pathology that could alter the cerebral hemodynamics were included in this study. All patients were examined at multi-detector CT systems acquiring 32 dynamic phases (temporal resolution: 1.5s) of 99 slices (total slab thickness 99mm) at 80kV/350mAs. Typically, 35 mL of iomeprol-350 were injected at flow rate of 4.5 mL/s. Angiographic datasets were calculated after initial rigid-body motion correction using (a) temporal maximum intensity projections (tMIP) (E.J. Smit et al. Radiology 2012) and (b) the proposed wavelet method performed with the commonly used Paul-wavelet (order 4). In the latter approach, we calculated the wavelet power spectrum of the time-attenuation curves for each pixel and displayed the maximum of this spectrum as angiographic signal intensity. Both approaches were compared with respect to the contrast-to-noise ratio (CNR) relative to surrounding tissue of 16 different vessel segments, and qualitatively using a 5pt Likert scale (0 non diagnostic, 4 excellent) with respect to image quality by two blinded and experienced readers.

**RESULTS**

The CNR for the wavelet reconstruction (580.2±474.5) was significantly higher than for the tMIP approach (60.7±31.0, Wilcoxon test p < 0.00001). Qualitatively, our new method performed significantly better than the tMIP approach with mean scores of 3.7/3.7 (reader 1/reader 2), inter-observer Cohen's κ=1 vs. tMIP scores of 2.8/2.9, κ=0.594 (p<0.001/p=0.001).

**CONCLUSION**

A ten-fold increase of contrast-to-noise ratio can be achieved for intracranial vessels by using wavelet transforms of intracranial CT perfusion datasets compared to currently used tMIP methods. The higher CNR and the resulting increase in image quality (plus method-inherent bone subtraction) are especially important for the assessment of small peripheral branches as well as for leptomeningeal collateral vessels.

**CLINICAL RELEVANCE/APPLICATION**

Using wavelet transforms, angiographic data with excellent image quality can be obtained from dynamic CT perfusion data, potentially allowing to omit a separate CT angiography examination.

**SST10-02**

**Performance of Integrated Circuit Detectors in Head CT: Objective and Subjective Image Quality in Comparison to Conventional Detector Design**

Harald Brodoefel MD (Presenter) : Nothing to Disclose, Andreas Korn : Nothing to Disclose, Benjamin Bender : Travel support, Bayer AG, Rafeeque A. Bhadelia MD : Nothing to Disclose, Peter Heiss MD : Nothing to Disclose, Ulrike Ernemann : Nothing to Disclose

**PURPOSE**

Performance of integrated circuit detectors in head computed tomography (CT) in comparison to conventional detector design.
While technical evolution of CT has primarily been oriented by improvement of speed, volume coverage and image quality, a continued rise in study numbers and heightened public awareness of radiation associated cancer risks have initiated a recent quest for significant reduction of radiation dose. A new CT detector with integrated electric components and shorter conducting pathways has recently been introduced to decrease system inherent electronic noise. The purpose of this study was to assess the potential benefit of such integrated circuit detector (ICD) in head CT by comparing objective and subjective image quality in low-dose exams with a conventional detector design (CDD).

METHOD AND MATERIALS

Using a conventional detector, reduced dose non-contrast head CT (255 mAs, effective dose 1.7 mSv) was performed in 25 consecutive patients. Following transition to ICD on the same CT scanner, 25 consecutive patients were scanned using identical imaging parameters. Data sets in both groups were reconstructed with iterative reconstruction (IR) and filtered-back-projection (FBP). Images were assessed in terms of quantitative (e.g. signal-to-noise ratio, contrast-to-noise ratio or image sharpness) and qualitative image quality (e.g. noise texture, overall image quality, artefacts).

RESULTS

Acquisition of head CT using ICD increased signal-to-noise ratio by 14% and 17% in grey (10.0±1.6 versus 11.4±2.5; p=0.02) and white matter (8.2±0.8 versus 9.6±1.5; p=0.0002). The associated improvement in contrast-to-noise ratio was 12% (2.0±0.5 versus 2.2±0.6; p=0.12). In addition, there was a 51% increase of objective image sharpness (582±85 versus 884.5±191 change in HU/Pixel; p<0.0001). Compared to standard acquisitions, subjective grading of noise as well as overall image quality scores were significantly improved with ICD (2.1±0.3 versus 1.6±0.3, p<0.0001; 2.0±0.5 versus 1.6±0.3, p=0.001). Streak artifacts in the posterior fossa were substantially reduced (2.3±0.7 versus 1.7±0.5; p=0.004).

CONCLUSION

At the same radiation level, acquisition of head CT with integrated circuit detectors achieves superior objective and subjective image quality.

CLINICAL RELEVANCE/APPLICATION

Improvement of image quality through electronic noise reduction is additive to recent benefits from iterative reconstruction algorithms and the combination of strategies has the potential for further and significant reduction of patient dose.

SST10-03

Gemstone Spectral Imaging Dual-energy CT with and without Metal Artifact Reduction Software for Dental Reconstruction Artifact

Jihoon Cha MD (Presenter): Nothing to Disclose, Hyung-Jin Kim MD: Nothing to Disclose, Sung Tae Kim MD: Nothing to Disclose, Yi Kyung Kim MD: Nothing to Disclose, Mina Song PhD: Nothing to Disclose, Pyoung Jeon: Nothing to Disclose, Keon Ha Kim: Nothing to Disclose, Hong Sik Byun MD: Nothing to Disclose

PURPOSE

To assess the usefulness of gemstone spectral imaging (GSI) dual-energy CT (DECT) utilizing metal artifact reduction software (MARs) to reduce dental reconstruction artifact

METHOD AND MATERIALS

The DECTs were performed by using fast kV-switching GSI between 80 and 140 kV in 20 patients with metallic dental prosthesis. The CT data were retro-reconstructed with/without MARs, and with synthesised monochromatic energy in the range of 40 - 140 keV. For the qualitative analysis, two radiologists evaluated 70 keV and 100 keV images with and without MARs for tongue and bilateral buccal and parotid areas by using a 4-point scale with the larger point being considered to have the better image quality. The margin and internal architecture of metallic denture were also assessed with a 3-point scale. The locations and characteristics of MARs-related artifact if any were also recorded. For the quantitative analysis, manually-drawn region of interests (ROIs) were placed in the tongue and bilateral buccal and parotid areas and the ratios of standard deviation (SD) of Hounsfield unit (HU) measured at each area were compared between with and without MARs in the range of 40 - 140 keV.

RESULTS

The GSI-MARs reconstruction markedly reduced the dental reconstruction artifacts in the buccal area (score of 1.55 without MARs vs. 3.10 with MARs for 70 keV, P<0.001, ratio of SD=56%), and the tongue (score of 1.30 without MARs vs. 2.25 with MARs for 70 keV, P<0.001, ratio of SD=38%). Parotid area did not show significant artifact reduction (score of 3.35 without MARs vs. 3.50 with MARs for 70 keV, ratio of SD=101%). The margin and internal architecture of the metal were more clearly delineated with MARs (score of 1.00 without MARs vs. 2.75 with MARs for 70 keV, P<0.001). MARs-related artifacts were most commonly occurred in the deep center of the neck, including retropharynx, pre- and paravertebral space and spinal cord. Metal artifacts were reduced slightly more in the high keV images than in the low keV images (score of 2.25 with 70 keV+MARs vs. 2.45 with 100 keV+MARs for tongue, P=0.042).

CONCLUSION

Dual-energy CT with GSI-MARs can reduce dental metal-related artifacts and improve delineation of the prosthesis and periprosthetic region.
CLINICAL RELEVANCE/APPLICATION
Dual-energy CT with GSI-MARs can reduce dental reconstruction artifacts and may improve the image quality by better delineation of the anatomic structure.

SST10-04

Growth in Ownership of CT Scanners among Otolaryngologists and Neurologists in Recent Years: How Important Is It?

David C. Levin MD (Presenter): Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC, Vijay Madan Rao MD: Nothing to Disclose, Laurence Parker PhD: Nothing to Disclose, Andrea J. Frangos MPH: Nothing to Disclose

PURPOSE
To study recent trends in acquisition of CT scanners for their offices by otolaryngologists (ENTs) and neurologists. Both specialties have become increasingly interested in acquiring their own advanced imaging equipment. This is of concern to policymakers and payers, as well as neuroradiologists, because it creates an opportunity for self-referral.

METHOD AND MATERIALS
The nationwide Medicare Part B databases for 2002-2012 were our data sources. All CPT codes for diagnostic CT were selected. Medicare’s physician specialty codes were used to identify claims submitted by ENTs and neurologists. Ownership of the units on which scans were performed was determined by tabulating global and technical component CT claims from those specialties, but excluding professional component claims. Data for other specialties were also studied.

RESULTS
In 2002, there were 8123 CT scans performed on Medicare patients on units owned by ENTs. This rose to a peak of 48,813 in 2009 (+501%), then declined to 40,121 in 2012 (-18% vs 2009). In 2002, there were 6773 Medicare CT scans performed on units owned by neurologists. This rose to a peak of 13,016 in 2009 (+92%), then declined to 7729 in 2012 (-41% vs 2009). Some of the recent declines were due to CT code bundling. Several other nonradiologic specialties performed more CTs on scanners in their offices than ENTs or neurologists. For example, 2012 CT totals for primary care physicians were 120,473; for urologists 92,375; for cardiologists 62,638; and for other internal medicine specialists 147,164. Radiologists’ total office volume in 2012 was 1,393,181.

CONCLUSION
During the previous decade, ENTs were more aggressive than neurologists in acquiring CT scanners for their offices. Medicare CT scans on in-office units owned by ENTs grew 501% from 2002-2009. Growth among neurologists was considerably less (92%). Volumes of CTs done on in-office units owned by the 2 specialties declined after 2009, but the decline was proportionately less among ENTs (18% vs 41% for neurologists). In spite of the growth of in-office CT ownership by the 2 specialties after 2002, their total volumes were small compared with those among several other clinical specialties and among radiologists. It does not appear that they will threaten the role of neuroradiologists in the near future.

CLINICAL RELEVANCE/APPLICATION
not applicable.

SST10-05

Low-Tube-Voltage 80-kVp Head and Neck CT in Routine Clinical Practice: Evaluation of Diagnostic Accuracy and Interobserver Agreement

Julian Lukas Wichmann MD (Presenter): Nothing to Disclose, Johannes Kraft: Nothing to Disclose, Eva-Maria Noske: Nothing to Disclose, Iris Burck MD: Nothing to Disclose, Jan-Erik Scholtz: Nothing to Disclose, Claudia Freisleben: Nothing to Disclose, Jens Wagenblast MD: Nothing to Disclose, Josef Matthias Kerl MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Ralf W. Bauer MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Boris Bodelle MD: Nothing to Disclose, Claudia Frellesen: Nothing to Disclose, Thomas Lehnert MD: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose, Boris Schulz MD: Nothing to Disclose

PURPOSE
To evaluate a low-tube-voltage 80-kVp computed tomography (CT) technique for head and neck imaging in routine clinical practice regarding its effects on diagnostic accuracy and interobserver agreement.

METHOD AND MATERIALS
This retrospective study was approved by the institutional review board, and the requirement to obtain informed consent was waived. Three radiologists individually analyzed exclusively the 80-kVp scans of 170 patients with a variety of pathologies who had undergone head and neck dual-energy CT. Reviewers were unblinded only to the clinical indication for CT, but otherwise blinded to any other information or image data, and were asked to state a single final relevant diagnosis. Results were compared with the ultimate diagnosis in the medical record charts, histopathology results, or CT reports based on standard blended 120 kVp image series. Diagnoses were grouped as squamous cell carcinoma (SCC) associated (n=110, presence / absence of primary / recurrent SCC or metastatic lymph nodes), lymphoma-associated (n=40, presence / absence of...
primary / recurrent lymphoma), and benign (n=20, e.g. abscess, sialolithiasis). Sensitivity, specificity, positive and negative predictive values (PPV, NPV) were calculated. Interobserver agreement was evaluated using intraclass correlation coefficients (ICC).

RESULTS
The overall sensitivity, specificity, PPV and NPV were 94.8%, 93.0%, 95.9%, and 91.1%, respectively. Further divided grouped results were also consistently high for SCC-associated (94.8%, 89.1%, 94.3%, 90.1%), lymphoma-associated (95.0%, 100.0%, 100.0%, 95.2%) and benign (94.3%, 93.3%, 98.2%, 85.7%) diagnoses. Global interobserver agreement was almost perfect (ICC, 0.82; 95% confidence intervals: 0.76-0.86). The calculated average dose-length-product was reduced by 48% with 80-kVp acquisition compared to the cumulative dose from the standard dual-energy scan (135.3 mGy•cm vs. 282.2 mGy•cm, P<0.001).

CONCLUSION
Low-tube-voltage 80-kVp head and neck CT provides sufficient image quality with high diagnostic accuracy and interobserver agreement in routine clinical practice especially for follow-up imaging of SCC or lymphoma and has the potential to significantly decrease radiation exposure.

CLINICAL RELEVANCE/APPLICATION
Low-tube-voltage 80-kVp CT acquisition provides diagnostic image quality for head and neck imaging in routine clinical practice with a significant reduction of radiation exposure.

SST10-06
Comparison of Knowledge-based Iterative Model, Hybrid Iterative and Filtered Back Projection Reconstruction Techniques in Brain CT: Impact of Thin Slice Imaging


PURPOSE
Image noise is a serious problem in brain CT because of the requirements for contrast resolution. Previous report suggested that the recent introduced knowledge-based iterative model reconstruction (IMR) is able to reduce image noise, offer accurate CT attenuation, and enable improvement in low-contrast detectability. The purpose of this study was to evaluate the usefulness of IMR in brain CT especially with thin slice images.

METHOD AND MATERIALS
This prospective study received institutional review board approval; prior informed consent to participate was obtained from all patients. This study enrolled 34 patients who underwent brain CT. We reconstructed axial images with filtered back projection (FBP), hybrid-iterative reconstruction (HIR) and knowledge-based-IMR with 1 and 5 mm slice thickness. We compared the CT number, image noise, contrast, and contrast noise ratio (CNR) between the thalamus and the internal capsule and the rate of increase of image noise in 1 mm thickness images from 5 mm thickness images between the reconstruction methods with the Holm test. Two independent readers assessed image contrast, image noise, image sharpness and the overall image quality of the 1 mm thickness images with each reconstruction technique on a 4-point scale.

RESULTS
There were significant differences in the CT numbers between IMR and the other reconstruction techniques (p<0.01). The image noise was significantly lower with knowledge-based-IMR (2.4 HU ± 0.3) compared to FBP (4.9 HU ± 0.5) and HIR (4.1 HU ± 0.4) (p<0.01). The contrast and the CNR between the thalamus and the internal capsule were significantly higher with IMR (5.1 HU ± 1.6; 2.2±0.8) relative to FBP (4.8 HU ±1.7; 1.0±0.4) and HIR (4.8 HU ±1.7; 1.2±0.4) (p<0.01). The rate of increase in noise in 1 mm thickness images was significantly lower with IMR (70.7% ± 32.6) compared to FBP (130.1% ± 31.9) and HIR (129.6% ± 35.2) (p<0.01). The visual scores in image contrast, image noise and overall image quality with knowledge-based-IMR were significantly higher than that with other reconstruction images (p<0.05).

CONCLUSION
IMR offers significant noise reduction, higher contrast and CNR in brain CT especially with thin slice images compared to FBP and HIR.

CLINICAL RELEVANCE/APPLICATION
IMR might offer higher image quality compared to FBP and hybrid-IR in brain CT especially for thin slice imaging.

SST10-07
Diagnostic Performance of Cone Beam Computed Tomography and MDCT in Diagnostic Imaging of the Midface: A Comparative Study on Phantoms and Cadaver Head Scans

Simon Veldhoen MD (Presenter): Nothing to Disclose, Maximillian Scholchen : Nothing to Disclose, Henning Hanken : Nothing to Disclose, Clarissa Precht : Nothing to Disclose, Frank Oliver Gerhard Henes MD : Nothing to Disclose, Gerhard Schön : Nothing to Disclose, Hans Dieter Nagel : Consultant, Koninklijke Philips NV, Max Heiland MD : Nothing to Disclose, Gerhard B. Adam MD : Nothing to Disclose
PURPOSE

As an overlap of cone beam computed tomography (CBCT) and MDCT use for imaging in midfacial trauma can be observed, purpose of the study is to compare a state-of-the-art CBCT device and a 256-MDCT for imaging of the midface.

METHOD AND MATERIALS

A CBCT device (3D Accuitomo, Morita) and a 256-MDCT (Brilliance iCT, Philips) were compared based on scans of 25 cadaver heads and phantoms. Scan protocols at three dose levels were generated (standard-dose, CTDIvol=24mGy; reduced-dose, CTDIvol=9mGy; low-dose, CTDIvol=4mGy). MDCT images were reconstructed using filtered back projection (FBP) and iterative reconstruction (IR) (iDose4™, Philips Healthcare). Spatial resolution was assessed using a phantom (Catphan™ 500, The Phantom Laboratory). Objective image noise (OIN) was measured and four readers evaluated the subjective quality of the blinded images separately.

RESULTS

Using low-dose settings, spatial resolution of CBCT and MDCT was equal (10 identifiable line pairs (lp) per cm). At reduced- and standard-dose, CBCT was superior with 11/13 lp/cm compared to 10/11 lp/cm in MDCT. Concerning cadaver head scans, OIN was higher in FBP-MDCT images when compared to CBCT (standard dose, 33 vs. 82HU; reduced-dose, 47 vs. 135HU; low-dose, 71 vs. 196HU). Iterative reconstruction was able to lower the OIN of MDCT images but except standard-dose they remained higher than in CBCT (standard-dose, 40HU; reduced-dose, 93HU; low-dose, 132HU). Subjective image quality was comparable at standard-dose (CBCT 3.5 vs. MDCT 3.7). CBCT was superior at reduced- and low-dose settings (CBCT, 3.3/3.0 vs. MDCT 2.9/2.3). At low-dose settings, MDCT images were of limited diagnostic quality. Image acquisition and reconstruction times were markedly higher for the CBCT device.

CONCLUSION

CBCT imaging provided better objective and subjective image quality at low-dose settings, when compared to MDCT whereas spatial resolution was equal. Similar performance was observed at higher exposure settings but CBCT then provided better spatial resolution. Modern CBCT devices seem to make use of noise-reduction techniques similar to IR as very low image noise and long reconstruction times were observed.

CLINICAL RELEVANCE/APPLICATION

Due to the high resolution, dental imaging is the specific strength of CBCT. Long image reconstruction times and the inferiority in soft-tissue assessment are main limitations of CBCT use in midfacial trauma. Therefore, MDCT should be preferred for this purpose.

SST10-08

Spectral CT Imaging for the Differentiation between Primary Lymphoma and Meningiomas

Qiang Ma (Presenter): Nothing to Disclose, Xiang Ren: Nothing to Disclose, Xuejun Ping: Nothing to Disclose, Najia Liu: Nothing to Disclose, Zhiyuan Zhang: Nothing to Disclose

PURPOSE

To evaluate the clinical value of dual energy spectral CT imaging in differentiating primary central nervous system lymphomas (PCNSL) from meningiomas.

METHOD AND MATERIALS

We retrospectively reviewed 23 patients with histologically proven primary intracranial solid tumors (16 meningiomas and 7 PCNSL) who underwent un-enhanced dual energy spectral CT scans. Patients were divided into 2 disease groups (meningiomas and lymphomas) and analyzed using GSI viewer software. Monochromatic images and material decomposition images with blood-fat as base material pairs were reconstructed. Spectral CT parameters such as the slope of spectral HU curve, effective-Z, and fat and blood concentrations were obtained for the tumors as well as normal brain tissues. Independent-samples t test was performed on these values between the two disease groups and matching tests were performed between tumors and normal brain tissues.

RESULTS

The slope and effective-Z values were (0.64±0.16, 7.99±0.09) for the meningiomas and (0.44±0.02, 7.81±0.04) for PCNSL. There was significant difference between them (p<0.001). The CT values at 40keV were 81.68±14.05HU and 56.39±6.26HU for meningiomas and PCNSL, respectively, with significant difference (p<0.001). The blood and fat concentrations (in mg/ml) for meningiomas (1227.94±87.76 and -180.35±85.38, respectively) were also significantly different from those for PCNSL (1077.93±21.97 and -26.41±26.68, respectively) (p<0.001). The matching t test indicated that there were significant differences for the blood and fat concentration values between the meningiomas and normal brain tissues, and between PCNSL and normal brain tissues (p<0.001).

CONCLUSION

Meningiomas and PCNSL had distinctively different characteristics in spectral CT imaging. Parameters obtained by spectral CT imaging, such as effective-Z and blood and fat concentrations, may provide additional and valuable information than conventional CT for the differential diagnosis between meningiomas and PCNSL.
Dual energy spectral CT imaging may provide additional information than conventional CT for the differential diagnosis between primary lymphoma and meningiomas.

The Value of Dual Energy Spectral CT in Differentiating Benign and Malignant Meningiomas

**Songhong Yue** (Presenter): Nothing to Disclose, **Junlin Zhou**: Nothing to Disclose

**PURPOSE**

To evaluate the value of dual energy spectral CT (DEsCT) in differentiating benign and malignant meningiomas.

**METHOD AND MATERIALS**

Twenty-three patients with meningiomas underwent head CT scan with dual energy spectral mode (Discovery CT 750HD, GE healthcare), all cases were proved by pathological findings. The patients included 16 cases of grade I meningioma (benign group) and 7 cases of grade 2 or grade 3 (malignant group). For each patient, 40keV-140keV monochromatic images (interval of 10kev) and iodine/water based material decomposition images were reconstructed. The CT value, iodine and water concentration of meningiomas during both phases were measured. The slope K of spectral HU curve was calculated according to the formula: K=(CT40keV-CT90keV)/40-90, student T test was performed for data comparison.

**RESULTS**

**CONCLUSION**

The benign and the malignant meningiomas have distinct characteristics findings on dual energy spectral CT, and the spectral HU curve can be used to differentiate the benign the malignant meningiomas.

**CLINICAL RELEVANCE/APPLICATION**

To evaluate the value of dual energy spectral CT (DEsCT) in differentiating benign and malignant meningiomas.

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**SST12**

*Pediatrics (Neuroimaging II: Epilepsy and Neuro-oncology)*

***Scientific Papers***

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

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**Participants**

Moderator  **Jeremy York Jones** MD: Nothing to Disclose
Moderator  **Susan Palasis** MD: Nothing to Disclose

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**Sub-Events**

**SST12-01**

**Evaluation of Thalamic Abnormalities in Children with Epilepsy and Continuous Spike-wave during Slow-wave-Sleep (CSWS) Using FDG Brain PET**

**Ajay Kumar** MD, PhD (Presenter): Nothing to Disclose, **Rajkumar Agarwal** MBBS: Nothing to Disclose, **Vijay Narayan Tiwari** MD, PhD: Nothing to Disclose, **Harry T. Chugani** MD: Nothing to Disclose

**PURPOSE**

Thalamic injury has been implicated in the development of continuous spike-wave during slow-wave-sleep (CSWS) in children with epilepsy, which is associated with poor neuro-cognitive outcome. We studied thalamic abnormalities in children with CSWS using FDG-PET imaging.

**METHOD AND MATERIALS**

Twenty patients (11 females; mean age: 8.6 years) with epilepsy and CSWS (excluding Landau-Kleffner syndrome), underwent FDG-PET. Thalamic glucose metabolism, represented by standardized uptake value normalized to whole brain (NSUV), and its asymmetry [absolute asymmetry index (AAI)]:|(Right-Left)|*200/(Right+Left)| was calculated. These values were compared with those from 10 normal healthy controls (5 females; mean age: 11.1 years).

**RESULTS**
Thalamic glucose metabolism was abnormal in 17 patients (85%). Significant thalamic asymmetry (AAI=5.5-31.5% (0.8-3.3% in controls); p=0.004) was seen in 9 children. 5/9 children had unilateral [increased (n=2) or decreased (n=3)] and 4/9 had bilateral [increased (n=1) or decreased (n=3)] thalamic abnormality. Thalamic NSUV was decreased (n=7) or increased (n=1) bilaterally in 8 children without any asymmetry. MRI was abnormal in two patients, showing unilateral thalamic atrophy, consistent with severely decreased glucose metabolism. Epilepsy surgery was performed in 6 patients with Engel class-I outcome seen in 3/4 patients with unilateral and 2/2 with bilateral decreased thalamic NSUV. Thalamic metabolism was found to be lower on the side of cortical resection in all children.

CONCLUSION

Thalamic abnormalities, both uni- and bilateral, are seen in patients with CSWS. FDG-PET is a sensitive and quantifiable modality to detect these changes compared to MRI which is mostly normal. Successful epilepsy surgery is possible in these cases.

CLINICAL RELEVANCE/APPLICATION

Our findings provide further insight into the pathogenetic mechanism behind continuous spike-wave during slow-wave-sleep (CSWS) in children with epilepsy.

Relation to Cortical Blood Flow and Electrographic Activity in Childhood-onset Seizures: Correlation between MRI-SWI and EEG


PURPOSE

To evaluate the relationship between cortical perfusion or venous flow and electrographic activity in the children with seizure using susceptibility weighted imaging (SWI) and electroencephalography (EEG).

METHOD AND MATERIALS

Children presenting with seizures who underwent MRI-SWI and EEG within 24 hours of seizure onset were retrospectively reviewed. The localized area of increased cortical venous flow (SWI+) was assessed using SWI while the abnormal activities such as slowing or epileptiform discharges (EEG+) were investigated on EEG recordings. We defined three groups of patients according to the correlation between MRI-SWI and EEG: (A) no increased venous flow and no abnormal discharges, (B) discordant finding between the SWI+ and EEG+ area, (C) concordant finding between the SWI+ and EEG+ area.

RESULTS

We identified 297 children (194 in group-A, 76 in group-B, and 27 in group-C). The mean age among the three groups was similar (group-A: 3.8±4.6, group-B: 5.0±4.5, group-C: 4.6±4.8 years). The greatest difference among these groups was in seizure frequency and underlying disease. Multiple seizures were revealed more frequently in group-C (12/27, 44.4%) than in group-A (47/194, 24.2%, p=0.026) or group-B (18/76, 23.7%, p=0.041). The incidence of newly-diagnosed epilepsy was significantly higher in group-C (14/27, 51.9%) than in group-A (59/194, 30.4%, p=0.026) or group-B (22/76, 28.9%, p=0.032). By contrast, there were no significant differences in the previous seizure history, seizure types or duration among the three groups.

CONCLUSION

Seizures with concordant findings between increased venous flow on MRI-SWI and abnormal electrographic activities are more likely to more frequent or real epileptic seizures.

CLINICAL RELEVANCE/APPLICATION

Susceptibility-Weighted image is well represented cortical venous flow in children with seizure and helpful to show the change of cortical blood flow in frequent seizure.

Independent Contribution of Individual White Matter Pathways to Language Function in a Cohort of Pediatric Epilepsy Patients

Johanna Monsalves MD (Presenter): Nothing to Disclose, Michael John Paldino MD : Nothing to Disclose, Wei Zhang PhD : Nothing to Disclose, Lynn Chapieski PhD : Nothing to Disclose

PURPOSE

Patients with epilepsy are at high risk for language and other cognitive impairment. Several white matter pathways have been implicated in such dysfunction. However, great potential exists to detect indirect associations between a proposed biomarker and a particular cognitive function, particularly in populations whose cerebral connectivity and brain function are both extensively abnormal. The goal of this study was to measure the independent contribution of well-described white matter pathways to language function in a cohort of pediatric patients with epilepsy.

METHOD AND MATERIALS

Patients were retrospectively identified from an existing database of pediatric epilepsy patients with the following inclusion criteria: 1. Diffusion tensor imaging acquired at 3 Tesla; 2. Language function measured by
a neuropsychologist. The following tracts were analyzed: corpus callosum, corticospinal tracts (CSP), inferior longitudinal fasciculi (ILF), inferior fronto-occipital fasciculi (IFOF), uncinate fasciculi (UF), and arcuate fasciculi (AF). Mean diffusivity (ADC), axial diffusivity (e1), and fractional anisotropy (FA) were calculated for each tract. A machine learning algorithm (random forest) measured the independent contribution of metrics from each tract to the clinical phenotype. In other words, the importance of each tract was measured after adjusting for the contribution of all other tracts.

RESULTS
Twenty patients met criteria (age: 4-18 years). All tracts were identified in all patients except the AF, which was not identified on the right in 8 patients and not identified on the left in 1 subject. Metrics related only to the left UF, IFOF, and AF were independently associated with the clinical phenotype (Figure 1). In addition, the machine learning algorithm was highly accurate in predicting the individual patient language scores on the basis of tract metrics.

CONCLUSION
Quantitative metrics derived from the left uncinate, inferior fronto-occipital, and arcuate fasciculi were independently associated with language function.

CLINICAL RELEVANCE/APPLICATION
Our findings highlight the importance of these three association pathways in human language function.

SST12-04

The Utility of MR Spectroscopy (MRS) for the Evaluation of Seizure in Pediatric Patients

Marisa K. Blitstein MD (Presenter): Nothing to Disclose, Sandra Rincon MD: Nothing to Disclose, Paul Albert Caruso MD: Nothing to Disclose, Ramon Gilberto Gonzalez MD, PhD: Nothing to Disclose, Ronald Thibert: Nothing to Disclose, Eva-Maria Ratai PhD: Nothing to Disclose

PURPOSE
To determine the utility of MR Spectroscopy (MRS) for evaluation of seizure in the pediatric patient: does MRS add information to the MRI?

METHOD AND MATERIALS
A search was performed to identify patients <18 years old with both MRI and MRS for evaluation of seizure between 1/1/2011 and 12/31/2012. This search yielded 165 cases. 7 were discarded because the MRS was nondiagnostic, leaving 158 cases (146 patients). Chart review was performed to determine if the patient had a relevant diagnosis known at the time of imaging. We defined relevant diagnosis as a diagnosis related to seizure AND known to exhibit structural MRI features. MRI, MRS, and original radiology report were reviewed by 2 neuroradiologists and an MR physicist, to determine whether MRS was normal or abnormal, and whether MRS added information not provided by MRI.

RESULTS
MRS yielded additional information for 34% (53/158) of cases. In the largest subset, 10/53 cases, MRS was useful for distinguishing dysplasia from neoplasm. Of all cases, 46/158 had a known relevant diagnosis and 112/158 had no known relevant diagnosis at the time of imaging. Of cases with a known diagnosis, MRS yielded additional information in 54% (25/46), the largest number of which was for a diagnosis of hypoxic-ischemic injury (HII) (8/25) or perinatal infection (4/25). Of cases without known diagnosis, MRS yielded additional information in 25% (28/112); the largest number were for cases with a focal lesion where differentiation between neoplasm and dysplasia was helpful (7/28), and for cases where MRS abnormalities prompted a metabolic or genetic workup (6/28).

CONCLUSION
In our series, MRS provided additional information in 34% of pediatric patients with seizures, and was particularly helpful for distinguishing dysplasia from neoplasm. Furthermore, it was most helpful in patients with a known diagnosis vs patients without a diagnosis at the time of imaging. Of known diagnoses, it was most helpful differentiating dysplasia versus neoplasm, and was also helpful in prompting additional metabolic or genetic workup.

CLINICAL RELEVANCE/APPLICATION
In select pediatric patients evaluated for seizure, MRS can add information that is not provided by MRI.

SST12-05

Automated Processing of Dynamic Contrast Enhanced (DCE) T1 Permeability Perfusion: Advanced Pharmacokinetic Metrics in Pediatric Brain Tumors

Sridhar Vajapeyam PhD (Presenter): Nothing to Disclose, Kelsey Ricci MA: Nothing to Disclose, Naira Muradyan PhD: Employee, iCAD, Inc, Mark Kieran: Nothing to Disclose, Tina Young Poussaint MD: Nothing to Disclose

PURPOSE
To study the efficacy and feasibility of automated dynamic contrast enhanced T1 permeability perfusion imaging and advanced imaging metrics in children with suspected pediatric brain tumors.
METHOD AND MATERIALS
T1 permeability imaging was performed using T1 mapping with flip angles of 2, 5, 10 and 15°, followed by DCE with 0.1 mmol/kg bw of Gd-based bolus. Data were processed prospectively using automated iCAD OmniLook software (iCAD Inc., Nashua, NH) to generate advanced pharmacokinetic parameters using the Tofts 2-compartment model, allowing voxel-wise calculation of Ktrans (transfer constant from the blood plasma into the extracellular extravascular space, EES), Kep (rate constant from EES back into blood plasma), ve (extravascular extracellular volume fraction), vp (fractional plasma volume) and T1 values.

RESULTS
There were 11 patients, ages 2.6-17 years, mean 10.3 years. New diagnoses included medulloblastoma(2), ependymoma(1), anaplastic ependymoma(1), sarcoma(1), atypical hemangioma(1), pilocytic astrocytoma(1), low grade glioma(2), tumefactive demyelination (initially thought to be tumor-1), and the followup case included recurrent pilocytic astrocytoma(1). 4 patients had supratentorial lesions and the remaining 7 were infratentorial. Pharmacokinetic parameters measured for the cohort were as follows: Ktrans=2.306 ± 4.341(1/min), Kep=10.979 ± 14.292(1/min), ve=0.189 ± 0.082, vp=0.047 ± 0.035 and T1=2.961 ± 0.693sec., with higher permeability values for high grade tumors compared with low grade tumors.

CONCLUSION
Automated processing of DCE brain permeability perfusion data in children is feasible and provides valuable additional pharmacokinetic metrics useful for assessing tumor grade and ultimately response to therapy.

CLINICAL RELEVANCE/APPLICATION
Advanced DCE T1 perfusion pharmacokinetic metrics help in pediatric brain tumor characterization.

SST12-06

Resting State fMRI as a Predictor of Vision Loss in Patients with Neurofibromatosis Type 1 (NF1)-associated Optic Pathway Gliomas

Noushin Yahyavi-Firouz-Abadi MD (Presenter): Nothing to Disclose, Jerrel Rutlin : Nothing to Disclose, James Hoekel : Nothing to Disclose, Robert C. McKinstry MD, PhD : Travel support, Siemens AG Speaker, Siemens AG, Joshua S. Shimony MD, PhD : Nothing to Disclose, David Gutmann MD, PhD : Nothing to Disclose

PURPOSE
Optic pathway Glioma (OPG) occurs in 15-20% of children with neurofibromatosis type 1 (NF1) and may result in vision loss in as many as 50% of patients. To date, no radiologic finding or other reliable factor has been identified to predict NF1-OPG vision loss or to determine which patients will require treatment. The purpose of this study was to investigate the utility of resting state fMRI (rsfMRI) as a potential marker for vision loss in a cohort of children with NF1-OPG.

METHOD AND MATERIALS
Ophthalmologic evaluations and concurrent rsfMRI measurements were performed in 26 patients with NF1-OPG (9 with progressive and 17 with stable disease), some of which underwent as many as 4 paired MRI-ophthalmology exams. The intra- and inter-connectivity of five resting state networks were evaluated in the following systems: default-mode network (DMN), dorsal attention network (DAN), control (CTL), salience (SAL) and sensory-motor network (SMN). Visual acuity was measured by the logarithm of the minimal angle of resolution (logMAR).

RESULTS
Evaluation of the rsfMRI demonstrates a correlation between increased intra-network connectivity of SAL (p

CONCLUSION
In a small cohort of patients with NF1-OPG, we demonstrated that functional connectivity measures derived from rsfMRI correlate with vision loss. A prospective study in a larger cohort with longer follow-up is needed to evaluate whether rsfMRI can be a used as a reliable predictor of vision loss and a marker for early treatment in this population.

CLINICAL RELEVANCE/APPLICATION
Our preliminary results indicate that functional connectivity as measured using rsfMRI may be useful as a marker of vision loss in children with NF1-OPG.

SST12-07

Retinoblastoma Nerve Optic Invasion: How Color Doppler Can Improve Diagnosis Better than MRI

Osmar Cassio Saito MD, PhD (Presenter): Nothing to Disclose, Maria Cristina Chammas MD : Nothing to Disclose, Maria Teresa Bonanomi PhD, MD : Nothing to Disclose, Giovanni Guido Cerri MD, PhD : Nothing to Disclose

PURPOSE
(1) We intend to review the retinoblastoma main findings by means of ultrasound and MRI; (2) to compare imaging findings (ultrasound and MRI) and anatomopathological findings after enucleation; (3) to evaluate which method can detect best the optical nerve invasion.

METHOD AND MATERIALS
18 monocular retinoblastoma tumors were evaluated by means of ultrasound with color Doppler and MRI at Clinicas Hospital of University of São Paulo. The mean age were 24 month year old. All patients underwent ultrasound examination with 16 MHz probe Toshiba applio 500 GE MRI 1,5 tesla. All patients underwent general anestheisa before MRI and Ultrasound. Color Doppler evaluated the arterial systolic velocity and vein velocity inside optic nerve in the normal and tumor eye. We also calculated IP and RI in the central retina artery and vein. All tumors were evaluated by T1, T2 with gadolinium injection.

RESULTS

All 18 patients had monocular retinoblastoma were enucleated and anatomopathogical study were made in order to detect optic nerve invasion. 11 patients had optic nerve invasion (61%); 4 patients had optic nerve invasion detected by MRI (retrobulbar enhancement and optic nerve thickening (36 %); 9 had increased velocity vein (81%); Central retina arterial velocity and central retina vein velocity were higher in tumor than in normal eyes.

CONCLUSION

Retinoblastoma eyes have faster flow; Lower PI is related to nerve optic invasion.

CLINICAL RELEVANCE/APPLICATION

Retinoblastoma is a highly malignant ocular neoplasm that shows a tendency to optic nerve invasion which implies in a poorer prognosis for the patient. The diagnosis of nerve invasion at presentation is important for prognostic and management. Retinoblastoma invasion of the optic nerve may not be detected by MRI. Due to the scant space inside lamina cribrosa to harbor artery, vein and tumor cells, it seems logical to study blood flow in retinoblastoma, aiming to detect nerve invasion.

MRI Characteristics of Ependymoblastoma: Results from 22 Centrally Reviewed Cases

Johannes Nowak MD (Presenter): Nothing to Disclose, Carolin Seidel: Nothing to Disclose, Frank Berg: Nothing to Disclose, Torsten Pietsch: Nothing to Disclose, Carsten Friedrich: Nothing to Disclose, Katja von Hoff: Nothing to Disclose, Stefan Rutkowski: Nothing to Disclose, Monika Warmuth-Metz: Nothing to Disclose

PURPOSE

Ependymoblastoma (EBL) is a malignant, embryonal central nervous system (CNS) tumor of early childhood with a dismal prognosis. Categorized by the WHO as a subgroup of CNS-PNET (primitive neuroectodermal tumor), EBL is histologically defined by “ependymoblastic rosettes”. Due to its rarity, little is known about specific MRI characteristics of EBL. We first systematically analyze and discuss MRI features of EBL in a series of 22 consecutive patients.

METHOD AND MATERIALS

All 22 EBL cases within this study were centrally reviewed for histopathology, MRI findings, and multimodal therapy. Patients were diagnosed between 2002 and 2013. For systematic analysis of initial MRI scans at diagnosis, we evaluated 25 standardized criteria for reference image evaluation of pediatric brain tumors. Image reading was performed by two neuroradiologists in consensus.

RESULTS

EBL are large tumors with well-defined tumor margins and iso- to hyperintense signal on T2WI. The majority of EBL were located supratentorially (16/22 patients), whereas 4 tumors were found infratentorially and 2 tumors occurred in the brainstem. Tumors showed diffusion restriction in all cases where DWI was provided. Surrounding edema was present in 9%, and cysts could be found in 50% of the EBL cases. Contrast enhancement was variable, with a tendency to mild or moderate enhancement. Subarachnoid spread is common in EBL, but can be absent initially. There was a male preponderance (1.75:1 ratio) for EBL in our cohort. Mean age at diagnosis was 2.1 years.

CONCLUSION

Imaging appearance of EBL seems to share features with other pediatric embryonal CNS tumors. However, future studies are needed to systematically compare MRI findings of EBL with other CNS-PNET and ependymoma, in order to delineate imaging criteria that might help distinguish these pediatric brain tumor entities. Since there is still an ongoing debate about the exact histopathological definition of EBL among neuropathologists, we contribute to this discussion with the first systematic analysis of imaging characteristics of EBL.

CLINICAL RELEVANCE/APPLICATION

With this study, we add the largest case collection to the very limited published database of MRI findings in EBL, together with epidemiological data.