**EDE012-b**

**Pediatric Case of the Day**

*Education Exhibits*

*Location: NA*

**Participants**

Moderator  
Lynn A. Fordham MD : Nothing to Disclose  
Tae Il Han : Nothing to Disclose  
Cassandra Marie Sams MD : Nothing to Disclose  
James H. Scatliff MD : Nothing to Disclose

**TEACHING POINTS**

1) Challenge yourself with unknown pediatric cases. 2) Review test cases and similar cases. 3) Increase depth of knowledge in Pediatric Imaging.

**MSE110**

**Comprehensive Update on Imaging Features and Management of Primary and Metastatic Synovial Sarcoma**

*Education Exhibits*

*Location: MS Community, Learning Center*

**Participants**

Akshay Baheti MBBS, MD (Presenter) : Nothing to Disclose  
Sreeharsha Tirumani MBBS, MD : Nothing to Disclose  
Rani S. Sewatkar MBBS : Nothing to Disclose  
Nikhil H. Ramaiya MD : Nothing to Disclose  
Jyothi Priya Jagannathan MD : Nothing to Disclose

**TEACHING POINTS**

1. Synovial sarcoma (SS) occurs in the extremities and trunk in young adults and has indolent presentation mimicking benign tumor. 2. Extremity SS is best characterized on MRI as lobulated heterogeneously enhancing mass with characteristic imaging features such as ‘triple sign’, ‘bowl of grapes’ appearance and fluid levels. 3. Non-extremity synovial sarcomas can occur anywhere in the trunk. Intrathoracic SS is often pleural-based at presentation, and may represent a distinct entity called pleuroparenchymal syovial sarcoma (PPSS). 4. Pleural-based metastases are the most common sites of metastatic disease. 5. Synovial sarcomas are relatively sensitive to chemoradiotherapy in both neoadjuvant and adjuvant settings, and radiologists play a key role in assessing response.

**TABLE OF CONTENTS/OUTLINE**

1. Review the pathophysiology, classification, clinical features and management of synovial sarcomas 2. Illustrate the multimodality imaging features including CT, MRI, PET/CT of primary and recurrent extremity and non-extremity synovial sarcoma. 3. Discuss the prognostic implications of various radiologic findings and evaluation of treatment response after neoadjuvant therapy 4. Review the metastatic pattern of synovial sarcomas with focus on their predilection for pleural-based disease

**PDE001-b**

**Top 10 Common Pediatric Musculoskeletal Imaging Measurements: What the Orthopedic Surgeons Wants to Know**

*Education Exhibits*

*Location: S101B*

**Participants**

Mohamed A. Aggag MD (Presenter) : Nothing to Disclose  
Kelly Elizabeth Ainsworth MD : Nothing to Disclose  
Heba Takrouni MBBS : Nothing to Disclose  
Devine Peterson : Nothing to Disclose

**TEACHING POINTS**

* To familiarize the radiologist with the top musculoskeletal measurements of the lower limbs and the clinical relevance of each measurement and diseases related to abnormal measurements.  
* Radiologist will be able to perform and interpret each measurement, understand the normal and abnormal values, and have a working knowledge of the clinical relevance from an orthopedic perspective.

**TABLE OF CONTENTS/OUTLINE**

Table of content:
1. Aim of the exhibit.
2. Top 10 common lower limb measurements in pediatric MSK imaging

Pelvis and hips:
- Alpha and beta angles.
- Acetabular index.
- Femoral neck shaft.

Knee
- Tibial tuberosity trochlear groove distance.
- Patella alta and Patella baja.
- Tibio-femoral angle.

Leg/Foot
- Metaphyseal-diaphyseal angle.
- Talocalcaneal angle.
- Scanogram.
- Calcanean pitch.

3. References.

PDE002-b

Pediatric Orthopedic Hardware: Correlating Photographs and Radiographic Images to Allow for Appropriate Identification

Education Exhibits
Location: S101B

Participants
Aman Jivraj MD (Presenter): Nothing to Disclose
Ying Tang MD: Nothing to Disclose
Ron El-Hawary MD: Nothing to Disclose
Naeem Khan: Nothing to Disclose

TEACHING POINTS
1. To review commonly used pediatric orthopedic hardware, along with the correct nomenclature and common uses. 2. To correlate photographs of pediatric orthopedic hardware with their radiographic appearance, to allow for correct identification.

TABLE OF CONTENTS/OUTLINE

PDE004-b

Radiographic Appearance of Contemporary Pediatric Cardiac Assist Devices

Education Exhibits
Location: S101B

Participants
William Jefferson Rieter MD, PhD (Presenter): Nothing to Disclose
Justin J Elhoff MD: Nothing to Disclose
Paul Gene Thacker MD: Nothing to Disclose
Jeanne Griffin Hill MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: to review the utility of pediatric cardiac assist devices to describe the types of contemporary pediatric cardiac assist devices to summarize the radiologic appearance of cardiac assist devices so imagers may recognize, and accurately describe the positioning of associated cannulae. to provide multiple radiographic examples of pediatric cardiac assist devices, including variations in cannulae appearance.

TABLE OF CONTENTS/OUTLINE
Utility of cardiac assist devices Types of devices Review of radiographic findings and cannulae positioning Radiographic examples. Berlin left ventricular assist device Berlin biventricular assist devices PediMag CentriMag Heartware

PDE006-b

The Challenging Inguinal Canal Evaluation in Neonates and Children: An Update of Differential Diagnosis on Gray-scale and Color Doppler Sonography Assessment

Education Exhibits
Location: S101B

Participants
Yoshino Tamaki Sameshima MD: Nothing to Disclose
Mauricio Yamanari: Nothing to Disclose
Daniel Calich Luz MD (Presenter): Nothing to Disclose
Mariana Athaniel Silva Rodrigues MD: Nothing to Disclose
Miguel Jose Francisco Neto MD: Nothing to Disclose
TEACHING POINTS

1. This paper presents an update of the most common pathologies that may affect the inguinal canal in neonates and infants, especially those related to the closure failure of the processus vaginalis, using ultrasonography as the imaging modality of choice. 2. Depending on the degree of processus vaginalis obliteration failure, different conditions may develop, such as non-communicating and communicating hydroceles, funicular hydrocele, spermatic cord cyst, cyst of the canal of Nuck, cryptorchidism and indirect inguinal hernia, conditions that will be shown in our presentation. 3. Despite being a less common in children, we also selected a case of direct inguinal hernia. 4. In some cases, early and accurate diagnosis is urgent to avoid possible complications, for example, incarcerated or strangulated inguinal hernia, or ovary herniation into the inguinal canal.

TABLE OF CONTENTS/OUTLINE


PDE007-b

Lonely Madness: Pediatric Pelvic Masses Occurring in Association with a Congenital Solitary Kidney

Education Exhibits
Location: S101B

Participants
Patricia Trinidad Chang MD (Presenter): Nothing to Disclose
Rama S. Ayyala MD: Nothing to Disclose
Jeanne S. Chow MD: Nothing to Disclose

TEACHING POINTS

1. To review the abnormal embryologic development of the genitourinary system, which can result in unilateral renal agenesis and anomalies affecting other mesonephric duct and mullerian duct derivatives. 2. To discuss multiple cases of associated genital anomalies that can occur with a congenital solitary kidney, presenting as a pelvic mass.

TABLE OF CONTENTS/OUTLINE


PDE008-b

Intracranial Calcifications in the Pediatric Age Group: A Radiographic Review

Education Exhibits
Location: S101B

Participants
Jonathan K. Vincent MD (Presenter): Nothing to Disclose
Anthony Dinizio MD: Nothing to Disclose
Thierry Huisman MD: Nothing to Disclose
Joshua Paul Nickerson MD: Nothing to Disclose

TEACHING POINTS

This exhibit aims to: 1. Review both common and rare causes of intracranial calcification in the pediatric age group. 2. Provide a framework for creating an accurate differential diagnosis when intracranial calcifications are encountered in clinical practice.

TABLE OF CONTENTS/OUTLINE


PDE009-b

Imaging Pediatric Sub-mental Space Lesions

Education Exhibits
Location: S101B

Participants
Subramanian Subramanian MD (Presenter): Nothing to Disclose
TEACHING POINTS

1. Familiarize radiologist with normal anatomy and spectrum of lesions that can arise in submental space in pediatric patients. 2. Facilitate accurate diagnosis of submental space pathologies and thereby improve management of lesions in this area.

TABLE OF CONTENTS/OUTLINE

Submental space pathologies can be categorized as: (1) Congenital lesions: Dermoid /epidermoid cysts, vascular malformations, thyroglossal duct cysts, etc. (2) Infectious/Inflammatory lesions: Abscess or inflammatory lymphadenopathy (3) Neoplasm: Lymphoma, hemangiomas, teratomas etc. Reactive lymphadenopathy is the most common cause of submental swelling. Submental abscesses can develop secondarily to either extension of infection from lower incisor teeth or from an infected lymph node. Thyroglossal cysts are most often located posteriorly in submental space close to hyoid bone. Epidermoid cysts commonly show restricted diffusion while dermoid cysts and teratoma may show fat density and calcification. Vascular malformation usually involve multiple neck spaces. Ultrasonogram is the primary imaging modality for initial evaluation of submental lesions. CT is useful in setting of trauma or acute submental swelling. MRI is useful to further characterize the lesion and relationship of the lesion to mylohyoid muscle for presurgical planning evaluation (transoral or submental surgical approach).

PDE010-b
Whole-body MRI and Possible Role of PET/MRI in Pediatric Oncology

Education Exhibits
Location: S101B

Participants
Sergios Gatidis MD : Nothing to Disclose
Ilias Tsiflikas MD : Nothing to Disclose
Juergen F. Schaefer MD (Presenter): Nothing to Disclose

TEACHING POINTS

Whole body MRI plays an increasingly important role in the primary diagnosis and follow-up of pediatric patients with oncologic disorders. High anatomical resolution, excellent soft tissue contrast and functional imaging techniques enable accurate local staging of primary tumors as well as sensitive detection of distant metastases. However, image quality and patient compliance depend on the chosen protocol, which should be composed carefully according to the clinical question. Recently, combined simultaneous PET/MRI was introduced adding metabolic information for tumor characterization. Patient preparation and imaging protocols are of higher complexity due to tracer injection and parallel acquisition of PET and MR data. Furthermore, radiation doses should be kept to a minimum. This educational poster shall give an overview over clinical indications and technical aspects of pediatric oncologic whole body MRI and PET/MRI with respect to patient preparation, imaging protocols and specifics in image analysis.

TABLE OF CONTENTS/OUTLINE

- Clinical indications for whole body MR imaging in pediatric oncology - Differential indications for MRI and PET/MRI - Patient preparation - Choice of tracer in PET, choice of contrast agents for MRI - Composition of imaging protocols with regards to diagnostic and time efficiency - Data analysis and interpretation

PDE011-b
F18-FDG PET CT Characterization and Histopathological Correlation of Non –CNS (Central Nervous System) Neoplasms in the Pediatric Population

Education Exhibits
Location: S101B

Participants
Sajeev Rajan Ezhapilli MBBS (Presenter): Nothing to Disclose
Mary McGrath MD : Nothing to Disclose
Michele Lisi MD : Nothing to Disclose
Andrij Roman Wottonycz MD : Nothing to Disclose
Nelli Lakis MD : Nothing to Disclose
David H.I. Feiglin MD : Nothing to Disclose

TEACHING POINTS

F18-FDG PETCT allows detection of non CNS malignant tumors in the pediatric population with great accuracy and helps in initial staging and treatment planning of tumors. F18-FDG PET-CT outscores conventional imaging in detection of residual/recurrent tumor as well as lymph node and distant metastases by its ability to whole body at a single time to detect viable tumor , thus determining treatment response.

TABLE OF CONTENTS/OUTLINE

This exhibit reviews a spectrum of non CNS childhood malignancies encountered on F18-FDG PET CT examinations at our institution such as lymphoma, soft-tissue and malignant bone tumors, neuroendocrine tumors and melanoma. F18-FDG PET CT offers detection of unknown primary tumor site, malignancy within lymph nodes which do not qualify as abnormal by size criteria on CT, as well as viability within solid tumors like sarcoma which do not demonstrate uniform size reduction after chemotherapy. Furthermore, this exhibit includes histopathological correlations supplementing PET-CT findings, thus improving accuracy of diagnosis, preoperative interventions, treatment and follow-up. Occasionally, pathologies like inflammation and brown fat uptake can mimic malignancy in pediatric patients. Additional drawbacks include limited detection of lesions smaller than 5 mm, well-differentiated tumors and tumors with low metabolic activity.

PDE013-b
Sacrococcygeal Teratomas in Newborns: Let’s Talk Details
**Education Exhibits**

**Location: S101B**

- **Cum Laude**
- **Selected for RadioGraphics**

**Participants**

Hee Mang Yoon MD (Presenter): Nothing to Disclose  
Hye-Kyung Yoon MD: Nothing to Disclose  
Young Ah Cho: Nothing to Disclose  
Jin Seong Lee MD: Nothing to Disclose  
Ah Young Jung: Nothing to Disclose  
Chong Hyun Yoon: Nothing to Disclose

**TEACHING POINTS**

Sacrococcygeal teratomas are relatively common in the newborn infants detected by the tail mass itself or by prenatal screening ultrasound. The diagnosis is not difficult in many cases; however, there should be additional information on imaging studies in order to manage those infants properly. Details include classification, histology, complications such as rupture or bleeding, mass effects on the adjacent structures causing hydronephrosis, bowel obstruction, or even hip dislocations. When the tumor is too big for a baby to be delivered safely, prenatal radiofrequency ablation could be one of treatment options.

**TABLE OF CONTENTS/OUTLINE**

1. Principle of diagnostic imaging of sacrococcygeal teratoma Imaging features according to morphologic classification and pathologic types of sacrococcygeal teratoma 2. Effects on Adjacent Structures on initial presentation Bilateral or unilateral hip dislocation Obstructive hydronephrosis and hydroureter Inguinal hernia and hydrocele Hydrocolpos and colonic distension 3. Rupture Malignant transformation Other associated anomaly 4. Clinical Management Prenatal radiofrequency ablation Postnatal surgical excision Preoperative embolization

**PDE014-b**

**Neuroimaging of Cerebral Edema in Pediatric: A Pictorial Review**

**Education Exhibits**

**Location: S101B**

**Participants**

Faizah Mohd Zaki MD (Presenter): Nothing to Disclose  
Prakash Muthusami MBBS, MD: Nothing to Disclose  
Ramy Ashmawy MBBC, MSc: Nothing to Disclose  
Helen Maree Branson MBBS, FRCR: Nothing to Disclose

**TEACHING POINTS**

At the end of this exhibit, viewers will be able to: 1. understand the different types/classification of cerebral edema based on basic pathology. 2. know the different causes of cerebral edema which are often seen and more unique in children. 3. correlate the imaging characteristics for each type of cerebral edema in children on CT, conventional MRI as well as advanced MRI technique such as DWI, MRS and DTI.

**TABLE OF CONTENTS/OUTLINE**

1. Classification of cerebral edema and correlation with basic pathology. 2. Causes of cerebral edema to be discussed that are more common in children than adult include toxic-metabolic derangement, infection/inflammation, vascular, neoplastic, traumatic amongst others. 3. Certain neuroimaging features in the diagnosis of early and complication of cerebral edema in children. 4. Imaging characteristics of cerebral edema of CT and MRI findings including advanced MRI sequences such as diffusion weighted, MR spectroscopy and diffusion tensor imaging.

**PDE100**

**Atypical Vascular Rings of the Aortic Arch: Subtle Findings on CT and MRI That Lead to Definitive Diagnoses and Guide Surgical Management**

**Education Exhibits**

**Location: S101B**

**Participants**

David W. Swenson MD (Presenter): Nothing to Disclose  
Jamie Frost DO: Nothing to Disclose  
Laureen Marie Sena MD: Nothing to Disclose

**TEACHING POINTS**

Purpose: 1. Review embryology of aortic arch development. 2. Draw on examples from 137 patients over 14 years with aortic arch anomalies to highlight CT and MRI findings that will accurately classify aortic arch anomalies and vascular ring status. 3. Focus on subtle but reproducible CT and MRI findings that aid understanding atypical vascular rings and guide surgical management. Particular attention will be paid to the location and significance of Kommerell’s diverticulum, and to both direct and indirect signs of the presence of ligaments that complete atypical rings.

**TABLE OF CONTENTS/OUTLINE**

1. Edward’s Model of Arch Development 2. Imaging Examples of typical vascular rings - E.g. Double aortic arch, and right aortic arch with aberrant left subclavian 3. Focus on CT and MRI findings that confirm atypical aortic arch anatomy and vascular ring status - Double aortic arch with atretic left arch segment - Right aortic arch with aberrant left subclavian artery - Circumflex aortic arch 4. Signs of ligamentous tethering - Diverticulum of Kommerell - Mass effect and location of ductal ligament - Displacement, angulation, and/or tethering of vessels - Direct visualization of the tethering ligament on high resolution imaging - Tracheal and/or bronchial narrowing
PDE101

Breathtaking Views: Imaging Acute Airway Obstruction in Children

Education Exhibits
Location: S101B

Selected for RadioGraphics

Participants
Kathryn Darras MD (Presenter): Nothing to Disclose
Lila Yewchuk: Nothing to Disclose

TEACHING POINTS
1. To better understand normal and abnormal airway anatomy.
2. To provide an approach for evaluating acute airway obstruction in the pediatric population.
3. To discuss the pathogenesis, imaging findings, differential diagnosis and management of acute airway obstruction in children.

TABLE OF CONTENTS/OUTLINE
1. Review of upper and lower airway anatomy in children
   1.1. Illustrations
   1.2. Radiographs
2. Approach to airway obstruction
   2.1. Upper airway
      2.1.1. Acute
         2.1.1.1. Croup
         2.1.1.2. Epiglottitis
         2.1.1.3. Retropharyngeal abscess
      2.1.1.4. Foreign body
      2.1.2. Chronic
         2.1.2.1. Inflammatory (tonsilar enlargement)
         2.1.2.2. Congenital (choanal atresia)
         2.1.2.3. Neoplasms (RMS and SG hemangioma)
   2.2. Lower airway
      2.2.1. Acute
      2.2.2. Chronic
         2.2.2.1. Intrinsic
            2.2.2.1.1. Bronchial foreign body
            2.2.2.1.2. Tracheomalacia
         2.2.2.2. Extrinsic
            2.2.2.2.1. Vascular rings
            2.2.2.2.2. Extrinsic masses
3. Pearls and pitfalls in imaging the pediatric airway

PDE102

Chest Radiography Findings in Congenital Heart Disease

Education Exhibits
Location: S101B

Participants
Naim Ceylan MD, PhD (Presenter): Nothing to Disclose
Selen Bayraktaroglu: Nothing to Disclose
Petek Bayindir MD: Nothing to Disclose
Recep Savas MD: Nothing to Disclose

TEACHING POINTS
1. To classify congenital heart disease on the basis of pulmonary vascularity
2. To demonstrate characteristic radiographic findings of congenital heart diseases

TABLE OF CONTENTS/OUTLINE
Classification of congenital heart disease
Review of chest radiography findings
Sample cases
Summary

PDE103

Congenital Anomalies of the Aorta and Their Evaluation by Last Generation CT in Pediatric Patients

Education Exhibits
Location: S101B

Participants
Valeria Piagneri MD (Presenter): Nothing to Disclose
Marta Zangani: Nothing to Disclose
Daniele Della Latta PhD: Nothing to Disclose
Carla Susini: Nothing to Disclose
Alberto Clemente: Nothing to Disclose
Tommaso Trapuzzano: Nothing to Disclose
Dante Chiappino MD: Nothing to Disclose

TEACHING POINTS
- Congenital anomalies of the aorta are caused by an embryogenetic disorder and have a low incidence in general population (2/1,000 live births). They can be classified in: obstructions of the left ventricular outflow (subvalvular stenosis, valvular malformation, supravalvular stenosis like as in Williams syndrome), vascular rings (duble aortic arch, rightsided aortic arch), aortic coarctation, interrupted aortic arch and patent ductus arteriosus (see fig. from 1 to 4).
- Congenital anomalies of the aorta are often symptomatic, especially when associated with other cardio-vascular disorders, and difficult to study in new born or pediatric patients with hemodynamic and respiratory instability.
- Last generation CT (in our cases 320 slides CT) represente nowadays a non invasive technique that allows rapid imaging acquisitions, decreasing the sedation time, with a relatively good evaluation of vascular anatomy thanks to post-processing reconstructions of the angiographic images. The disadvantage of x-ray exposure can be reduced using low dose CT protocols and with modulation of radiation beam (table 1).

TABLE OF CONTENTS/OUTLINE
- A review of congenital aortic anomalies;
- Advantages of last generation CT in pediatric patients: rapid acquisition, good evaluation of vascular anatomy by post-processing reconstructions; modulations of radiation dose.
PDE104

Cystic and Cavitary Lung Diseases in Children: Radiologic Findings with Pathologic Correlation

Education Exhibits

Location: S101B

Participants

Mondher Golli MD (Presenter): Nothing to Disclose
saida Hidouri : Nothing to Disclose
Mezri Maatouk MD : Nothing to Disclose
Wald Mnine MD : Nothing to Disclose
Ahmed Zrig MD : Nothing to Disclose
Nedal Jazaerli : Nothing to Disclose
Badri Hmida : Nothing to Disclose
Abdelatif Nour : Nothing to Disclose
AbdelFatih Zakhae MD : Nothing to Disclose

TEACHING POINTS

To provide an overview of the diseases most commonly associated with Pulmonary Cystic and Cavitary Diseases (PCCD) in children. To review radiologic signs and emphasize the value of Chest CT with pathologic correlation of the PCCD.

TABLE OF CONTENTS/OUTLINE

BACKGROUND
CONGENITAL LUNG DISEASES
Congenital Lobar Emphysema
Congenital Cystic Adenomatoid Malformation
Bronchogenic Cyst
Pulmonary Sequestration
AIRWAY DISEASES
Congenital Bronchial Atresia
Bronchiectasis
Cystic Fibrosis
Interstitial emphysema
INFECTIOUS DISEASES
Bacterial Infections
Hydatidosis
Fungal Infections
PULMONARY INFARCTION
PNEUMATOCELES
PULMONARY PSEUDOCYST
CONCLUSION : Low-dose MDCT of the chest is helpful in the diagnosis and follow-up of PCCD. Identification of pathologic entities correlating with radiologic findings and clinical courses is important in the evaluation of PCCD in order to avoid unnecessary surgical procedures.

PDE105

Dynamic Volumetric Computed Tomography for Pediatric Airway Assessment: How to Get Adequate Images with Reduced Radiation Dose

Education Exhibits

Location: S101B

Cum Laude

Participants

Jyuichi Mori (Presenter): Nothing to Disclose
Yasuyoshi Ogawa RT : Nothing to Disclose
Kiyoko Tateishi : Nothing to Disclose
Atsuko Fujikawa MD : Nothing to Disclose
Brandon D. Lohman : Nothing to Disclose
Junichi Matsumoto MD : Nothing to Disclose
Hideki Shima : Nothing to Disclose
Yasuyuki Kobayashi MD, PhD : Nothing to Disclose
Tatsuo Yoshikawa : Nothing to Disclose
Yasuo Nakajima MD : Nothing to Disclose

TEACHING POINTS

Dynamic volumetric CT with wide-detector is becoming alternative examination to bronchoscopy in cases with persistent stridor or wheezing in children. The advantages of dynamic volumetric CT are rapid short examination time, no requirement of deep sedation and intubation, less need for patient cooperation, and extra-airway structure evaluation. It is essential to get adequate image quality at reduced radiation dose in dynamic volumetric CT. The teaching points of this presentation are; 1. The optimal scanning protocol of dynamic volume scan with proper radiation dose for each patient 2. Techniques to reduce various artifacts. 3. Four-dimensional reconstruction from volumetric CT data.

TABLE OF CONTENTS/OUTLINE

1. Principles of dynamic volume scan 2. How to get adequate image quality at the optimal reduced radiation dose for each patient 3. Techniques for reducing various artifacts 4. How to reconstruct 4D-CT images

PDE106

Endobronchial Tumors and Tumorlike Lesions in Children

Education Exhibits

Location: S101B
Participants
Ana Coma RT: Nothing to Disclose
Amparo Castellote MD (Presenter): Nothing to Disclose
Ignacio Delgado MD: Nothing to Disclose
Joan Carles Ferreres: Nothing to Disclose
Gabi Guillen: Nothing to Disclose
Pilar Garcia-Pensa: Nothing to Disclose

TEACHING POINTS
1.- To review clinical aspects, imaging features and pathologic findings of endobronchial tumors and tumorlike lesions in children. 2.- To discuss the differential diagnosis. 3.- To highlight the imaging clues that enable prompt diagnosis and treatment

TABLE OF CONTENTS/OUTLINE
Endobronchial lesions are rarely seen in children and may pose a diagnostic challenge. The differential diagnosis includes foreign bodies, mucus plug, infections and neoplasms. Foreign body aspiration is the most frequent pediatric cause of airway obstruction in children. In some cases, however, the classical triad of choking, coughing and wheezing is absent and many children present recurrent pneumonia, atelectasis and other complication. Most endobronchial tumors in children are malignant. Imaging plays a key role in the diagnosis. Diagnostic methods include radiography, MDCT with 2D and 3D reconstructed images, virtual bronchoscopy and MR. We will show a review of endobronchial lesions seen in our hospital in the last 15 years.

Our series includes: Endobronchial tumors Malignant: Carcinoid Mucoepidermoid carcinoma Benign: Papilloma Hamartoma Leiomyoma Teratoma Hemangioma Tumorlike lesions Foreign body Mucus plug Infectious disease (bronchial tuberculosis, fungal)

PDE107
How to Assess Visceroatrial Situs
Education Exhibits
Location: S101B

Participants
Guillaume Chassagnon (Presenter): Nothing to Disclose
Mathilde Meot: Nothing to Disclose
Elodie Carpentier: Nothing to Disclose
Dominique Sirinelli MD: Nothing to Disclose

TEACHING POINTS
- Situs solitus refers to normal viscerocidental situs, situs inversus is a fully inverted viscerocidental situs, and situs ambiguus is defined as a situs that does not correspond to either of the two previous categories. - Visceroatrial situs depends on the abdominal, the pulmonary and the atrial situs. - Abdominal situs is only dictated by the position of the liver, the stomach and the spleen. - The position of the heart and the great vessels should not be considered during assessment of viscerocidental situs. - Several conditions are associated with situs inversus and viscerocidental isomerism, including congenital heart diseases and primary ciliary dyskinesia. - Visceroatrial situs abnormalities should be systematically sought in cases of dextrocardia, asplenia, polysplenia, primary ciliary dyskinesia, atrioventricular septal defects and in case of anomalous pulmonary/systemic venous return.

TABLE OF CONTENTS/OUTLINE
- Definition of viscerocidental situs.
- How to assess abdominal situs.
- How to assess pulmonary situs.
- How to assess atrial situs.
- Assessment of viscerocidental situs: practical exercises supported by illustrated cases of viscerocidental abnormalities:
  - Situs inversus
  - Right isomerism
  - Left isomerism

PDE108
Lesion in Thymus: Imaging and Differential Considerations in Pediatric Patients
Education Exhibits
Location: S101B

Participants
Ayda A. Youssef MD (Presenter): Nothing to Disclose
Yahia Labib: Nothing to Disclose
Amal M. Refaat MD: Nothing to Disclose
Madiha Elwakil: Nothing to Disclose
Maged EL-Shafiey: Nothing to Disclose
Tarek Rafaat: Nothing to Disclose

TEACHING POINTS
The thymus is an important lymphatic organ; plays an essential vital role in the development and maturation of the immune system during childhood. - Our Objectives in this exhibit are: - To review the normal anatomy and embryology of the thymus gland. - To enumerate the differential diagnosis of the focal and diffuse lesions of thymus gland in the pediatric patient. - To illustrate the imaging features of such lesions and increase awareness and recognition of uncommon lesions.

TABLE OF CONTENTS/OUTLINE
- 1. Embryological development of the thymus gland: 2. Normal anatomy of the thymus gland throughout the different age stages of life: 3. Imaging features of the different disorders affecting the thymus at the pediatric age group: A. congenital lesions: - Congenital absence of the thymus (Di-Goarge syndrome.) B: Benign lesions including: - Thymic cyst, - Thymolipoma, - Rebound thymic hyperplasia - Ectopic parathyroid adenoma within the thymus. C: Malignant thymic lesions including: - Germ cell tumor, - Thymic lymphoma - Deposits within the thymus. In conclusion: - Lesions of the thymus, both diffuse and focal, in a pediatric patient encompass wide range of differential diagnosis; Thus the proper orientation and
accurate diagnosis help in proper treatment of these patients.

**PDE110**

**MR Angiography – Utility of Gadofosveset Trisodium (Ablavar®) in MR Angiography of Pediatric Patients**

**Education Exhibits**

**Location:** S101B

**Participants**
- Lauren Ashley May MD: Nothing to Disclose
- Prakash Mohan Masand MD: Nothing to Disclose
- Matthew R. Minor MD (Presenter): Nothing to Disclose

**TEACHING POINTS**

Pediatric vascular imaging is particularly challenging secondary to the anatomic size and unique physiology of pediatric patients. Current contrast-enhanced MR angiography techniques utilizing conventional gadolinium-based contrast agents are limited by the need to acquire images relatively quickly during the first pass of contrast material through the vessels of interest. This is to achieve adequate enhancement of vascular structures, for diagnosis, and post-processing. However, Gadofosveset trisodium (Ablavar®), a blood pool intravascular contrast agent, has proven to be excellent in this regard. This agent allows first-pass and equilibrium phase imaging of the arterial and venous structures. This exhibit reviews the added benefit of using blood pool contrast in the evaluation of various vascular anomalies, both congenital and acquired.

**TABLE OF CONTENTS/OUTLINE**

1. Physiology and Pharmacology of Gadofosveset Trisodium
   a) Indications and Usage
   b) Adverse Reactions
2. Suggested MR Imaging Protocol
   a) First pass and Equilibrium Phase Imaging (Steady state imaging)
3. Applications
   a) Congenital Heart Disease Imaging, including evaluation of Fontan baffle (post Norwood procedure)
   b) Congenital Portocaval Shunts
   c) Paget-Schroetter Syndrome
   d) Portal hypertension
   e) Klippel-Trenaunay Syndrome
   f) Vascular Malformation imaging

**PDE112**

**New Uses for Thoracic Ultrasound in the Neonatal Intensive Care Unit: Old Dog, New Tricks**

**Education Exhibits**

**Location:** S101B

**Participants**
- David T. Saul MD (Presenter): Nothing to Disclose
- Samuel Ajayi MD: Nothing to Disclose
- David Schutzman MD: Nothing to Disclose
- Mindy Meislich Horrow MD: Spouse, Director, Merck & Co, Inc

**TEACHING POINTS**

1. Neonates, especially premature, are especially sensitive to ionizing radiation
2. Small size, inability to breath-hold for chest radiographs (CXR), and lack of skeletal ossification make neonates ideal for thoracic ultrasound (US) with high-frequency probes
3. High-resolution anatomical detail of the neonatal chest is easily displayed in real time
4. In addition to established uses (e.g., pleural effusion), US has utility for evaluation during and after placement of peripherally inserted central venous catheters (PICC), umbilical arterial and venous catheters (UAC), nasogastric tubes (NGT), and endotracheal tubes (ETT)

**TABLE OF CONTENTS/OUTLINE**

1. Background on NICU CXR: Speed/reliability, average dose, # studies performed, potential risks
2. Anatomic and physiologic justification for NICU thoracic US: small size, limited depth allows high frequency (≥12 mHz) scanning. Thymic tissue and cartilaginous skeleton provide excellent acoustic windows. Real time scanning reduces issues with rotation and breathing motion.
3. How we do it: review of equipment, scanning technique, and positioning
4. US review of neonatal thoracic anatomy: mediastinum, great vessels, lungs and heart

**PDE113**

**Pediatric Coronary CT Angiography**

**Education Exhibits**

**Location:** S101B

**Participants**
- Elizabeth George MD (Presenter): Nothing to Disclose
- Kanako Kunishima Kumamaru MD, PhD: Nothing to Disclose
- Jane Newburger: Nothing to Disclose
- Frank John Rybicki MD, PhD: Research Grant, Toshiba Corporation
- Ruth M. Dunne MBBS: Nothing to Disclose
- Michael Lally Steigner MD: Speaker, Toshiba Corporation
- Ron Blankstein MD: Nothing to Disclose
- Prashant Nagpal MD: Nothing to Disclose
- Ayaz Aghayev MD: Nothing to Disclose

**TEACHING POINTS**

1. Radiologists should be familiar with the emerging role of CT angiography in coronary artery imaging in the pediatric population.
2. The indications, protocol, and findings are distinct from the adult population.
3. Comparison with other imaging modalities and clinical implications are significant to assess the risk-benefit ratio and to select the appropriate imaging modality of choice.

**TABLE OF CONTENTS/OUTLINE**

PDE114
Pre and Postnatal Images of Congenital Pulmonary Airway Malformation: Ultrasonography, Computed Tomography and Magnetic Resonance Imaging

Education Exhibits
Location: S101B

Participants
Bianca Guedes Ribeiro MD (Presenter): Nothing to Disclose
Tatiana M. Fazecas MD: Nothing to Disclose
Renata Amaral Nogueira MD: Nothing to Disclose
Taisa Davaus Gasparetto MD, PhD: Nothing to Disclose
Heron Werner MD: Nothing to Disclose
Pedro Daltro MD: Nothing to Disclose
Vitor Moreira Sardenberg MD: Nothing to Disclose

TEACHING POINTS
The CPAMs has been detected more frequently in routine prenatal ultrasound. They are a heterogeneous group of pulmonary cystic lesions that result from an abnormality in the development of airways. This study aims to review the most recent classification of CPAMs and discuss the imaging features of congenital malformations of the respiratory tract in different imaging methods: fetal US and MRI and postnatal CT. These images were analyzed retrospectively and were correlated with clinical features and the postnatal development of the disease. With advances in fetal ultrasound and MRI, chest abnormalities are increasingly being diagnosed earlier, allowing to anticipate treatment and appropriate management of patients. The postnatal evaluation of CPAMs in CT allows correct classification, thus impacting the treatment and improving the prognosis.

TABLE OF CONTENTS/OUTLINE
1- Spectrum of Congenital Lung Lesions 2- Pathophysiology of CPAMs 3- Stocker newer classification 4- Discussion and Illustration of many cases of CPAMs from our teaching file, on the obstetric US, fetal MRI and post natal CT 5- CPAMs and malignity - Pleuropulmonary Blastoma 6- Discussion and Conclusions

PDE115
Puzzling Hearts: Magnetic Resonance Imaging in Cardiac Malpositions and Heterotaxy Syndromes

Education Exhibits
Location: S101B

Participants
Carlos Marin MD (Presenter): Nothing to Disclose
Angel Lancharco MD: Nothing to Disclose
Yolanda Ruiz MD: Nothing to Disclose
Alejandro Rodriguez MD: Nothing to Disclose
Enrique Maroto: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To review the definitions of cardiac position, visceroatrial situs, heterotaxy and isomerism.
2. To describe the segmental approach to the Cardiac Magnetic Resonance (CMR) of cardiac malpositions and heterotaxy syndromes.
3. To discuss the associations between situs abnormalities and venous, ventricular, conotruncal and arterial anomalies.
4. To show the CMR protocol for a comprehensive evaluation of heterotaxy syndromes.

TABLE OF CONTENTS/OUTLINE
Cardiac malpositions are estimated to occur in 0.1/1000 live births, and heterotaxy syndromes affect 0.8% of patients with congenital heart disease. A comprehensive imaging examination is mandatory to guide the appropriate medical management and surgical correction. Systematic segmental approach must be used, including abdominal viscera, lungs, atria, ventricles and great vessels. Certain associations exist between isomerisms and cardiac segment malformations, albeit a great diversity of combinations has been reported. Treatment choices for these patients vary from medical follow up to complex surgical procedures, including systemic-to-pulmonary palliative surgery, such as Kawashima or Fontan procedure. To accomplish a comprehensive MR examination, morphologic and functional data should be included in the radiology report.

PDE116
Radiologic Approach to Respiratory Distress in Infant and Children: A Case Based Review

Education Exhibits
Location: S101B

Participants
Irene Maria Olivia Borzani MD (Presenter): Nothing to Disclose
TEACHING POINTS

The purpose of this exhibit is: 1. To review clinical presentation of the common and uncommon causes of severe respiratory symptom in children. 2. To discuss the utility of radiograph, US, CT and MRI in the assessment of respiratory distress in children and in narrowing the differential diagnoses. 3. To correlate clinical data and multimodality imaging findings to formulate the more appropriate diagnosis.

TABLE OF CONTENTS/OUTLINE

This exhibit will be displayed in a case-based format containing: • Introduction • Clinical presentation of common and uncommon disease causing respiratory distress • Comparison of pearls and pitfalls of radiograph, US, CT and MRI in investigating the pathology with particular interest in radiation protection • Presentation of multiple cases, highlighting radiological findings and comparing different imaging modalities (radiograph, US, CT, MRI) • Representative cases will include pleural empyema, pneumothorax, pulmonary AVM, broncho-esophageal fistula, pulmonary tuberculosis, airways obstruction (foreign body aspiration, retro-parapharyngeal abscess, vascular rings, endobronchial tumor), among others.

PDE117
Role of Multidetector CT Angiography (MDCTA) in the Diagnosis of Congenital and Acquired Aortic Pathology in Pediatric Patients

Education Exhibits
Location: S101B

Participants

Maria Jose Martinez-Sapina Llanas MD : Nothing to Disclose
Alba Rois Siso MD (Presenter): Nothing to Disclose
Jorge Rodriguez Antuna MD : Nothing to Disclose
Pablo Fernandez Armandariz MBBS : Nothing to Disclose
Concepcion Crespo Garcia : Nothing to Disclose
Fernando Rueda Nunez MD : Nothing to Disclose

TEACHING POINTS

To describe the semiology of different aortic pathologies in children and their findings at MDCT-Angiography. To know the indications of this technique and discuss their advantages and disadvantages in the evaluation of the aorta anomalies.

TABLE OF CONTENTS/OUTLINE

Aortic pathology in children is usually a congenital condition, and it can be an isolated anomaly or associated with Complex Congenital Heart Disease (CHD). Aortic arch anomalies with all its variants, aberrant vessel anatomy, aortic coartation, seudocoartation and aortic interruption are the most common isolated abnormalities. Acquired aortic pathology is uncommon in children, and trauma, infections, inflammatory and connective diseases can affect the aorta. The echocardiography is diagnostic for aortic valve, but it is limited to assess aortic pathology. MR angiography is a good technique, but often is not available, requires anesthesia and occasionally is contraindicated. MDCTA with axial and 2D and 3D reformatted images depicts the aorta non-invasively, fast, and in exquisite detail, establishing the primary diagnosis. MDCTA also can be used in patients with known or suspected CHD for which further imaging is needed to evaluate aortic arch and great vessels. In the postoperative of CHD, MDCTA facilitates fast and comprehensive assessment of cardiovascular structures.

PDE119
Third Generation Dual Source Scanner for Pediatric Thoracic and Cardiac CT: Technological Improvements and Challenges in Robust Protocol Design

Education Exhibits
Location: S101B

Certificate of Merit

Participants

Ronald Booij RT (Presenter): Nothing to Disclose
Marcel L. Dijkstra RT : Consultant, Siemens AG
Marcel Van Straten PhD : Research collaboration, Siemens AG
Nanko De Graaf MD : Nothing to Disclose
Mohamed Ouhlous MD, PhD : Nothing to Disclose
Gabriel P. Krestin MD, PhD : Consultant, General Electric Company Research Grant, General Electric Company Research Grant, Bayer AG Research Grant, Siemens AG Speakers Bureau Siemens AG

TEACHING POINTS

Purpose/aim: • To provide guidelines with examples from a third generation dual source CT to obtain low dose CT examinations with sufficient image quality • To learn how to optimize and utilize CT exams for pediatrics when scanning with a third generation dual source CT scanner • To understand the ways to handle intravenous contrast material injection and timing in vascular CT imaging • Demonstrate improved image quality in challenging clinical cases when using a state-of-the-art CT scanner.

TABLE OF CONTENTS/OUTLINE

Anatomy, anomalies and congenital vascular disease
• Thorax (native and contrast-enhanced)
• Cardiac

Technological improvements and accompanying challenges
• High speed scanning
• X-ray spectrum and filtration
• Iterative reconstruction technique
Scan protocol optimization
- Patient preparation
- Scan parameter optimization and radiation dose reduction
- Contrast timing and dosage
- Image reconstruction and post-processing

Clinical cases, including
- Cardiovascular anomalies
- Pulmonary vascular anomalies
- Small-airway disease
- Large-airway disease
- Role of dual source CT in surgical planning or therapy

PDE121

Unilateral Persistent Pulmonary Interstitial Emphysema: Value of Multidetecteur Computed Tomography

Education Exhibits
Location: S101B

Participants
- Mondher Golli MD (Presenter): Nothing to Disclose
- Said Hidouri: Nothing to Disclose
- Mezri Maatouk MD: Nothing to Disclose
- Ahmed Zrig MD: Nothing to Disclose
- Walid Mnari MD: Nothing to Disclose
- Badii Hmida: Nothing to Disclose
- Nedal Jazaerli: Nothing to Disclose
- Abdelatif Nouri: Nothing to Disclose
- Abdel Zakhama: Nothing to Disclose

Teaching Points
Unilateral Persistent pulmonary interstitial emphysema (PPIE) must be differentiated from congenital cystic malformation of the lung (particularly congenital lobar emphysema and cystic adenomatoid malformation). Because in the case of PPIE, conservative therapy is recommended prior to lobectomy. Multi-detector Computed Tomography (MDCT) is helpful in the diagnosis of PPIE and in determining the anatomic distribution of lobar involvement.

Table of Contents/Outline
- Background
- Epidemiology
- Clinical presentation
- Pathology: Macroscopy and histology
- Imaging: chest radiograph and MDCT
- Treatment and prognosis
- Differential diagnosis: Conclusion

PPIE should be considered in premature infants with cystic malformation of the lung, particularly congenital lobar emphysema and cystic adenomatoid malformation. Because in the case of PPIE, conservative therapy is recommended prior to lobectomy. Multi-detector Computed Tomography (MDCT) is helpful in differentiating PPIE from other lesions, such as congenital cystic adenomatoid malformation or congenital lobar emphysema. Conservative therapy is recommended. Operative treatment should be considered when the diagnosis is unclear or for progressive respiratory distress, ventilator dependence, or complications such as recurrent pneumonia or recurrent pneumothoraces.

PDE122

When Chest Radiography Is Insufficient: The Role of Cross-sectional Imaging in the Diagnosis and Management of Childhood Pneumonia

Education Exhibits
Location: S101B

Participants
- Ulysses Santos Torres MD: Nothing to Disclose
- Eduardo Portela de Oliveira: Nothing to Disclose
- Fernanda Del Campo Braojos Braga MD: Nothing to Disclose
- Maria E. Ucar MD: Nothing to Disclose
- Jose Domingo Arce MD: Nothing to Disclose
- Pedro Daltry MD (Presenter): Nothing to Disclose
- Leise Rodrigues: Nothing to Disclose
- Antonio Soares Souza MD: Nothing to Disclose

Teaching Points
Although chest radiography is the standard approach for imaging evaluation of respiratory infections in children, cross-sectional imaging is required in some specific cases, usually in the setting of suspected suppurative lung parenchymal, pleural or pericardial complications, or when ruling out a noninfectious etiology is necessary. The purposes of this education exhibit are: 1) To review the clinical usefulness of ultrasound, computed tomography and magnetic resonance imaging examinations for the assessment of complicated pneumonia in children, also discussing the implications of such methods for the management of these patients. 2) To illustrate and discuss the main imaging findings in such spectrum of complications and in cases of noninfectious diseases mimicking pneumonia on chest radiographs.

Table of Contents/Outline
- This exhibit will use a case-based approach to demonstrate characteristic US, CT and/or MRI imaging findings in a range of complicated childhood pneumonias and noninfectious pathological processes mimicking pneumonia. Representative cases will include empyemas, cavitary necrosis, lung abscesses, purulent pericarditis, pneumatoceles, bronchopleural fistulas, exogenous lipid pneumonia, airway obstruction due to foreign bodies or neoplasms, among others.

PDE123

Acquired Lesions of Fetal CNS: Prenatal MRI Role

Education Exhibits
Location: S101B
TEACHING POINTS

Acquired lesions of fetal CNS are those fetal CNS lesions caused by disruptive process, not for abnormal embryogenesis. They represent the third indication of fetal cerebral MRI after ventriculomegaly and CNS malformations. The aim of this exhibit is: To show the spectrum of fetal acquired lesions, to describe the most frequent found imaging findings and to discuss the role of prenatal MRI in the diagnosis and follow-up of these entities.

TABLE OF CONTENTS/OUTLINE
For didactic purposes, we classify acquired lesions of fetal CNS in: 1. Intracranial hemorrhage. In the fetal intracranial hemorrhage, predisposing factors are maternal trauma, fetal coagulation disorders (alloimmune thrombocytopenia) and maternal anticoagulant therapy. In this educational poster representative cases of intraventricular hemorrhage, infratentorial hemorrhage and subdural hematoma will be presented. 2. Hypoxic-ischemic injury. We will present representative cases of feto-fetal transfusion. 3. Vascular malformations. Particularly, vein Galen malformation. 4. Infections. Mainly cytomegalovirus, causing white matter lesions, microcephaly, polymicrogyria, calcifications and cerebellar hypoplasia. 5. Tumors / cysts
Participants
Beth A. Furey MD, BEng (Presenter): Nothing to Disclose
April Alexander Bailey MD: Nothing to Disclose
Jodi S Dashe MD: Nothing to Disclose
Diane Mary Twickler MD: Nothing to Disclose

TEACHING POINTS
1. To summarize indications and protocols for MR imaging evaluation of the fetal gastrointestinal tract. 2. To review T1, T2 and balanced SSFP MR appearance of normal fetal developmental GI anatomy. 3. To discuss characteristic features of common and uncommon fetal gastrointestinal pathology, correlating with MRI findings.

TABLE OF CONTENTS/OUTLINE
Drawing on experience from our institution of over 50 fetal MRI studies performed from assessment of the gastrointestinal tract, this exhibit will review MR findings of fetal GI abnormalities. A discussion of normal fetal gastrointestinal anatomy/embryology will be included, with consideration for developmental variants. Indications and protocols for fetal gastrointestinal MRI will be discussed. Common and uncommon abnormalities of the fetal gastrointestinal tract will be presented, including etiologies for obstruction, microcolon, and GI/GU communication. Examples include: a. all levels of intestinal atresia b. meconium peritonitis c. megacystis microcolon hypoperistalsis d. cloacal abnormalities Management of neonatal GI abnormalities will be reviewed, with an emphasis on the role of imaging.

PDE127
Perinatal Imaging of Developmental Malformation of the Corpus Callosum

Participants
Roberto Llorens Salvador (Presenter): Nothing to Disclose
Francisco Menor: Nothing to Disclose
Marvin Dale Nelson MD: Nothing to Disclose

TEACHING POINTS
1. To summarize indications and protocols for MR imaging evaluation of the fetal gastrointestinal tract. 2. To review T1, T2 and balanced SSFP MR appearance of normal fetal developmental GI anatomy. 3. To discuss characteristic features of common and uncommon fetal gastrointestinal pathology, correlating with MRI findings.

TABLE OF CONTENTS/OUTLINE
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PDE128
Post-mortem Magnetic Resonance Imaging (MRI) of the Central Nervous System (CNS) Foetuses

Participants
Laura Oleaga (Presenter): Nothing to Disclose
Carmen Sebastia Cerqueda MD: Nothing to Disclose
Amaya Sagasta: Nothing to Disclose
Alfons Nadal: Nothing to Disclose
Olga Gomez: Nothing to Disclose
Nuria Bargallo PhD: Nothing to Disclose

TEACHING POINTS
1. To summarize indications and protocols for MR imaging evaluation of the fetal gastrointestinal tract. 2. To review T1, T2 and balanced SSFP MR appearance of normal fetal developmental GI anatomy. 3. To discuss characteristic features of common and uncommon fetal gastrointestinal pathology, correlating with MRI findings.

TABLE OF CONTENTS/OUTLINE
Drawing on experience from our institution of over 50 fetal MRI studies performed from assessment of the gastrointestinal tract, this exhibit will review MR findings of fetal GI abnormalities. A discussion of normal fetal gastrointestinal anatomy/embryology will be included, with consideration for developmental variants. Indications and protocols for fetal gastrointestinal MRI will be discussed. Common and uncommon abnormalities of the fetal gastrointestinal tract will be presented, including etiologies for obstruction, microcolon, and GI/GU communication. Examples include: a. all levels of intestinal atresia b. meconium peritonitis c. megacystis microcolon hypoperistalsis d. cloacal abnormalities Management of neonatal GI abnormalities will be reviewed, with an emphasis on the role of imaging.
correlation.
We include cases of periventricular leucopathy, ventriculomegaly, periventriculitis; cystic periventricular lesions associated to
cytomegalovirus infection, haemorrhage, aqueduct stenosis due to a dysembioplastic neuroepithelial tumour (DNET) in
mesencephalon and neuronal migration disorders.
MRI provides useful morphologic information of the CNS in dead foetuses. We found a close correlation between MRI structural
findings and autopsy.
Post-mortem MRI could represent an adjunct tool in cases where autopsy cannot be performed.

PDE129
The Spectrum of Cloacal Malformations; How to Differentiate Each Entity Prenatally with Fetal MRI

Education Exhibits
Location: S101B

Participants
Kimberly Dannull MD (Presenter): Nothing to Disclose

TEACHING POINTS
1. To gain an awareness of the spectrum of cloacal malformations. 2. Understand and identify the key features which
differentiate each component of the cloacal malformation spectrum. 3. To describe the key images necessary for proper
diagnosis. 4. To briefly describe a differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Cloacal malformations are a spectrum of anatomical pelvic malformations resulting from failure of cloacal division in early
embryogenesis. Depending on the timing of the developmental arrest, a spectrum of abnormalities result, which range from
urogenital sinus to cloacal dysgenesis. With the level of detail currently provided by fetal MRI, the spectrum of cloacal
abnormalities can be confidently distinguished prenatally in order to guide postnatal therapy. The below subsets of cloacal
malformations will be presented, including the key imaging findings: 1. Urogenital sinus 2. Posterior cloaca variant 3.
Persistent/classic cloaca 4. Cloacal dysgenesis

PDE130
Ultrasound and MRI of Fetal Hepatobiliary Anomalies with Postnatal Correlation

Education Exhibits
Location: S101B

Participants
Arnold Carlson Merrow MD (Presenter): Author, Amirsys, Inc Editor, Amirsys, Inc Employee, Amirsys, Inc
Judy Hereford Squires MD : Nothing to Disclose
Maria A. Calvo-Garcia MD : Nothing to Disclose
Beth M. Kline-Fath MD : Nothing to Disclose

TEACHING POINTS
Understand advances in prenatal imaging regarding the hepatobiliary system, including review of established normal patterns
based on gestational age. Recognize prenatal sonographic and MRI findings of congenital hepatobiliary anomalies, which can
generally be divided into primary lesions (including benign and malignant hepatic tumors and hepatobiliary malformations) and
secondary manifestations of systemic problems (including transient and permanent sequelae of pregnancy-related disorders and
genetic).

TABLE OF CONTENTS/OUTLINE
Background of prenatal hepatobiliary imaging Available techniques Normal findings by gestational age Primary hepatic masses
Benign tumors Malignant tumors Cystic malformations Primary biliary malformations Choledochal cyst Gallbladder duplication
Biliary atresia Secondary hepatic parenchymal abnormalities (calcifications, edema, enlargement, multifocal masses)
Genetic/metabolic disorders Infectious disorders Metastatic disease Cardiovascular anomalies Secondary hepatic morphologic
anomalies Diaphragmatic hernia Omphalocele Situs disorders Secondary biliary anomalies Obstruction by adjacent masses
Dilation in multiple gut atresias Microgallbladder of cystic fibrosis Summary

PDE131
Vascular Anomalies: Prenatal Imaging Features with Postnatal Correlation

Education Exhibits
Location: S101B

Participants
Erica Riedesel MD (Presenter): Nothing to Disclose
Judy Ann Estroff MD : Nothing to Disclose
Ahmad Ibrahim Alomari MD : Nothing to Disclose
Harriet Joan Paltiel MD : Equipment support, Koninklijke Philips NV

TEACHING POINTS
Vascular anomalies are identified on prenatal imaging with increasing frequency. Correct identification of anomalies is essential
for appropriate prenatal parental counseling and postnatal medical management. This educational exhibit will review the imaging
findings of vascular anomalies on prenatal ultrasound and MRI with correlation to post-natal imaging findings and present case
examples seen at a tertiary care pediatrics hospital.

TABLE OF CONTENTS/OUTLINE
Vascular Anomalies International Society for the Study of Vascular Anomalies (ISSVA) Classification Scheme Vascular Tumors
Congenital Hemangioma Kaposiform Hemangioendothelioma (KHE) Vascular Malformations Capillary Malformation (CM)
Lymphatic Malformation (LM) Arteriovenous Malformation (AVM) Venous Malformation (VM) Combined Malformations and
Vascular Anomaly Syndromes Klippel-Trenaunay Syndrome (KTS) CLOVES Syndrome

PDE132

A Pictorial Stroll through the Congenital and Acquired Pathologies of the Cholangiopancreatic System in Children and Adolescents

Education Exhibits
Location: S101B

Participants
Nguyen Vu Nguyen MD (Presenter): Nothing to Disclose
Gabriela De La Vega Muns MD: Nothing to Disclose
Amber Langshaw: Nothing to Disclose
Gaurav M. Saigal MBBS: Nothing to Disclose

TEACHING POINTS

. Understand the indication and limitation of cholangiopancreatography in pediatric patients with special emphasis on Magnetic Resonance Cholangiopancreatography (MRCP) . Recognize congenital and acquired pathologies of the pancreatic and biliary system . Be familiarized with subsequent testing and treatment options for these conditions . Recognize post-operative appearance of the pancreaticobiliary system

TABLE OF CONTENTS/OUTLINE


PDE133

Contrast Enhanced Ultrasound (CEUS) in the Characterization of Pediatric Liver Lesions: Spectrum of Imaging Findings

Education Exhibits
Location: S101B

Participants
Annamaria Deganello MD (Presenter): Speaker, Bracco Group
Eleni Konstantatou MD, MSc: Nothing to Disclose
Bhavna Batohi MBBS: Nothing to Disclose
Maria E. Sellars MD, FRCR: Nothing to Disclose
Paul Singh Sidhu MRCP, FRCR: Speaker, Bracco Group Speaker, Siemens AG Speaker, Hitachi, Ltd

TEACHING POINTS

This presentation aims to exhibit the spectrum of CEUS imaging findings of common and uncommon benign pediatric focal liver lesions, with computed tomography (CT) or magnetic resonance (MR) correlation. The role of CEUS in the detection, characterization, and follow-up of these lesions in children who are investigated for acute and chronic liver disease will also be emphasized.

TABLE OF CONTENTS/OUTLINE

Primary liver tumours are rare in children, however, in our tertiary referral center for pediatric hepatobiliary disease, it is not uncommon to find a focal liver lesion in a child, and 30% of these lesions are benign. We present a pictorial review of CEUS findings in these lesions, some of which unique to the pediatric population, such as hemangioendotheliomas, some others more common in adults including hemangiomas, focal nodular hyperplasia (FNH), nodular regenerative hyperplasia (NRH) and hepatocellular adenoma; focal areas of fatty sparing or infiltration and liver abscess will also be illustrated. We will incorporate CT and MR images for correlation. Although the use of CEUS remains "off-label" in pediatrics, it holds a significant role in providing an accurate diagnosis and a minimally invasive follow-up tool in these patients, without the need for repeated ionizing radiation exposure or sedation.

PDE135

Extra-Intestinal Manifestations and Complications in Pediatric Inflammatory Bowel Disease: The Imaging Link

Education Exhibits
Location: S101B

Participants
Kamaldine Oudjhane MD, MSc (Presenter): Nothing to Disclose
Shyam Mohan MBBS, MRCP: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To recognize the different extra-intestinal manifestations and complications in children with inflammatory bowel disease. 2. To review the utility of imaging modalities in the identification and reassessment of organic findings (signs and complications) at time of diagnosis and on monitoring of the selected therapies.
TABLE OF CONTENTS/OUTLINE

1. Introduction-Classification of Extra-intestinal manifestations in children with Inflammatory Bowel Disease: a. Musculoskeletal (peripheral arthropathies, enthesopathies, axial arthropathies) b. Mucocutaneous signs (erythema nodosum, pyoderma gangrenosum) c. Hepatopancreatobiliary (Primary sclerosing cholangitis, hepatitis, pancreatitis) d. Thromboembolic disease e. Neurologic/ocular manifestations f. Bone health issues (osteoarthritis, short stature)


PDE137

Imaging Patterns of Fatty Liver in Childhood

Education Exhibits

Location: S101B

Participants

H. Nursun Ozcan MD (Presenter): Nothing to Disclose
Berna Duz MD : Nothing to Disclose
Mithat Haliloglu MD : Nothing to Disclose
Diclehan Orhan : Nothing to Disclose
Musturay Karcaaltincaba MD : Nothing to Disclose

TEACHING POINTS

Our purpose in this educational exhibit is: 1. To describe the different structural patterns of non-alcoholic fatty liver disease (NAFLD) in childhood. 2. To discuss the use of imaging modalities in NAFLD in children and address pitfalls. 3. To highlight the evidence suggesting that chemical shift gradient recalled echo MRI is more trustworthy than US for the assessment of steatosis. 4. To describe the less common imaging patterns of steatosis which include focal deposition, diffuse heterogeneous deposition and multifocal deposition as well as the most common imaging pattern, which is diffuse homogeneous fat deposition. 5. To emphasize how the imaging patterns of steatosis can mimic neoplasms, leading to confusion and unnecessary diagnostic invasive procedures. 6. To describe how location, morphologic features, contrast enhancement and mass effect of the lesion and assessment of its fat content usually permit a correct diagnosis.

TABLE OF CONTENTS/OUTLINE


PDE138

Lumps and Bumps in the Groin of Children

Education Exhibits

Location: S101B

Participants

Hee Mang Yoon MD (Presenter): Nothing to Disclose
Young Ah Cho : Nothing to Disclose
Jin Seong Lee MD : Nothing to Disclose
Ah Young Jung : Nothing to Disclose
Hye-Kyung Yoon MD : Nothing to Disclose
Chong Hyun Yoon : Nothing to Disclose

TEACHING POINTS

Pediatric inguinal swelling occurs mostly from inguinal hernias, especially in boys. However, various lesions can be found in the inguinal or groin area. Therefore, it is important to consider the different features and characteristics of masses in the inguinal or groin area to exclude other causes, such as congenital anomalies, infections, and neoplasms. Therefore, it is essential for radiologists to be familiar with imaging features of various inguinal lesions. In this exhibit, we will systematically review diverse causes of inguinal swelling in boys and girls. Multimodality imaging features and practical approach to the inguinal swelling will be presented.

TABLE OF CONTENTS/OUTLINE


PDE140

MR Urography in Pediatric Patients: Clinical and Technical Considerations

Education Exhibits

Location: S101B

Participants

Shannon L. Tocchio MD (Presenter): Nothing to Disclose
Kevin Ching MD : Nothing to Disclose
Sameh Tadros MD, MSc : Nothing to Disclose
Abhay Simha Srinivasan MD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the clinical Indications for MR urography. 2. To discuss patient preparation, how to
protocol for MR urography and the purpose of selected pulse sequences. 3. To illustrate both imaging and post-processing capabilities of MR urography vs. traditional imaging techniques used in pediatric genitourinary (GU) radiology. 4. To demonstrate the unique advantages and special considerations of MR urography in pediatric GU imaging.

TABLE OF CONTENTS/OUTLINE
Table of Contents/Outline: 1. Brief history of MR urography and current clinical indications. 2. Review of the technical considerations and important factors when implementing MR urography. 3. Case examples of MR urography and post-processing data with correlative imaging shown on conventional imaging modalities.

PDE142
MRI, MRCP and ERCP Findings in Pediatric Hepatobiliary and Pancreatic Diseases

Education Exhibits
Location: S101B

Participants
Anil G. Rao MD (Presenter): Speaker, Siemens AG
Paul Gene Thacker MD : Nothing to Disclose
Antonio J. Quiros MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To review the MRI, MRCP and ERCP imaging findings in various congenital and acquired hepatobiliary and pancreatic diseases in children To emphasize the key imaging findings To understand the etiology and pathogenesis of hepatobiliary and pancreatic diseases in children To understand the technique of performing MRI and MRCP in children for evaluation of hepatobiliary and pancreatic diseases

TABLE OF CONTENTS/OUTLINE
Technique of MRI and MRCP for evaluation of hepatobiliary and pancreatic diseases in children Etiology and pathophysiology of various congenital and acquired hepatobiliary and pancreatic diseases such as: Choledochal cysts types I-IV including choledochocele Caroli disease Primary sclerosing cholangitis Ascending cholangitis Progressive familial intrahepatic cholestasis Cholelithiasis and choledocholithiasis Biliary sludge in gall bladder and bile ducts Annular pancreas Pancreas divisum Chronic pancreatitis MRI, MRCP and ERCP findings of the various congenital and acquired hepatobiliary and pancreatic diseases listed above

PDE143
Pancreatitis in Children: They're Not Just Little Adults

Education Exhibits
Location: S101B

Participants
Brian Stewart Pugmire MD (Presenter): Nothing to Disclose
Michael Stanley Gee MD, PhD : Nothing to Disclose
Jess Kaplan MD : Nothing to Disclose
Sudha Ayyala Anupindi MD : Nothing to Disclose

TEACHING POINTS
1. Review the terminology, epidemiology, and pathophysiology of pancreatitis in children as distinguished from that in adults.
2. Review the etiologies of pancreatitis in children and appropriate work-up
3. Discuss the role of various imaging modalities in the evaluation of pediatric pancreatitis including advantages/disadvantages of each and the relevant imaging features.
4. Discuss the role of imaging in clinical management of pancreatitis using specific clinical case scenarios

TABLE OF CONTENTS/OUTLINE
1. Terminology: acute vs. acute recurrent vs. chronic pancreatitis 2. Epidemiology and pathophysiology 3. Etiologies of pancreatitis in children as compared to adults 4. Clinical presentation and initial work-up:
   - Acute vs. chronic presentation Laboratory and imaging work-up 5. Imaging of pancreatitis: pros/cons of different modalities, imaging features, and role in clinical management:
     - Ultrasound CT ERCP MRCP (including secretin MRCP) Image-guided FNA in suspected infected necrotizing pancreatitis 6. Treatment options 7. Case scenarios

PDE144
Pediatric Cystic Mass in the LUQ: The Small and Crowded Space

Education Exhibits
Location: S101B

Participants
Hee Mang Yoon MD (Presenter): Nothing to Disclose
Young Ah Cho : Nothing to Disclose
Jin Seong Lee MD : Nothing to Disclose
Ah Young Jung : Nothing to Disclose
Hye-Kyung Yoon MD : Nothing to Disclose
Chong Hyun Yoon : Nothing to Disclose

TEACHING POINTS
Cystic masses located in the left upper quadrant (LUQ) of the abdomen is not uncommon and diverse group of lesions arise from the major organs in this space; liver, pancreas, stomach, spleen, and mesentery. Diagnosis is often challenging for radiologists because of difficulty to identify precise localization of the lesion, determine the organ of origin, and characterize the specific features of various tumors. In this exhibit, we systematically describe important clues in the diagnosis and imaging features of LUQ cystic masses. Being familiar with the imaging and clinical features of various LUQ cystic masses facilitates accurate diagnosis and treatment.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
   - Anatomy of the left upper quadrant of the abdomen
   - Clues for identification of the organ of origin
     - Beak sign, Phantom organ sign, Embedded organ sign
   - Differential diagnosis of the mass according to the organ of origin
     - Tumors arising from the pancreas: Pseudocyst, Solid pseudopapillary tumor, lymphoepithelial cyst
     - Tumors arising from the stomach: Duplication cyst, Epidermoid cyst, fungal abscess, infarction, hemangioma, lymphangioma
     - Tumors arising from the mesentery: Lymphangioma, teratoma
     - Tumors arising from the liver: cyst, cystic neoplasm

2. Summary

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**PDE145**

**Percutaneous Nephrostomy Tube Placement in Children: Indications, Technique, and Measures of Success**

*Education Exhibits*

*Location: S101B*

**Participants**

- Deepti Venkatraman (Presenter): Nothing to Disclose
- Michael Stanley Gee MD, PhD: Nothing to Disclose
- Debra Ann Gervais MD: Research Grant, Covidien AG

**TEACHING POINTS**

1. Indications for percutaneous nephrostomy tube placement in infants and young children include congenital (ureteropelvic junction obstruction, primary megaureter, ureteropelvic duplication) and acquired (stones) causes of urinary tract obstruction.
2. Percutaneous nephrostomy is also indicated in children with post-operative stricture or urinary leak following urologic surgery such as pyeloplasty or ureteral reimplantation.
3. Technical considerations for nephrostomy include selection of calyceal access route, selection of image modality for guidance, utilization of one vs two stick approach, and selection of catheter size.
4. Measures of success include technical success (access and drainage of the urinary system) and clinical success (resolution of urinary obstruction or leak without need for surgical intervention).

**TABLE OF CONTENTS/OUTLINE**

1. Indications for pediatric nephrostomy tube placement.
3. Considerations in choice of access point for tube placement with respect to vascular and calyceal anatomy.
4. Indwelling nephrostomy tube management.
5. Multidisciplinary approach to congenital and acquired obstruction.

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**PDE146**

**Renal Pelvic Dilatation (RPD): Normal or Abnormal?**

*Education Exhibits*

*Location: S101B*

- Certificate of Merit

**Participants**

- Melkamu Dessie Adeb MD (Presenter): Nothing to Disclose
- Jeannie S. Chow MD: Nothing to Disclose
- Dana Spergel Schwartz MD: Nothing to Disclose
- Kassa Darge MD, PhD: Nothing to Disclose

**TEACHING POINTS**

- Discuss optimal evaluation methods for renal pelvic dilation (RPD) on postnatal imaging.
- Discuss the value of renal pelvis antero-posterior diameter (APD) in imaging evaluation of RPD.
- Discuss factors influencing evaluation of RPD.
- Discuss the role of renal pelvis APD and alternative methods such as the hydronephrosis index (HI) in evaluation of RPD and in guiding management decisions such as performing pyeloplasty.

**TABLE OF CONTENTS/OUTLINE**

1. Imaging findings in RPD
2. Sample cases from US, IVP, MRU, fMRU
3. Renal pelvis APD: is there a “cut off” between normal and obstructed? Factors affecting evaluation of RPD: Technique, Timing of examination, Hydration status, Bladder filling, Patient positioning
4. Alternative methods of RPD evaluation: Grading systems of fetal/neonatal hydronephrosis and RPD Postnatal imaging: Choice of imaging modality
5. Three factors affecting choice of imaging modality: Evaluation of morphology, Evaluation of function, Evaluation of reflux

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**PDE147**

**Retrograde Urethrography (RUG): Indications, Techniques and Outcome in Children**

*Education Exhibits*

*Location: S101B*

**Participants**

- Maria Alejandra Bedoya Velez MD (Presenter): Nothing to Disclose
- Hansal J. Otero MD: Nothing to Disclose
- Dana A. Weiss MD: Nothing to Disclose
- Kassa Darge MD, PhD: Nothing to Disclose
TEACHING POINTS

1. Retrograde urethrography (RUG) is the fluoroscopic examination of the urethra via retrograde contrast filling. It enables anatomic detail in the evaluation of the urethra in boys. There is very limited pediatric literature available on this topic, which makes its performance and interpretation challenging. 2. The principal indications of RUG are urethral trauma, stricture, rectourethral fistula, and prostatic ulcer. In urethral injuries, the contrast extravasation occurs in the extraperitoneal space if the injury is above the urogenital diaphragm; but if the injury is below the urogenital diaphragm, the contrast extravasation is within borders of dartos (Colles) fascia 3. Different modifications of the RUG technique are performed based on the clinical indication. These modifications include subsequent voiding cystourethrogram (VCUG), simultaneous VCUG, and retrograde percutaneous urethrogram.

TABLE OF CONTENTS/OUTLINE


PDE148

Role of Percutaneous Abscess Drainage in Pediatric Crohn’s Disease

Education Exhibits

Location: S101B

Participants

Brian Stewart Pugmire MD (Presenter): Nothing to Disclose
Michael Stanley Gee MD, PhD : Nothing to Disclose
Debra Ann Gervais MD : Research Grant, Covidien AG

TEACHING POINTS

1. Abscesses are a common feature of Crohn’s disease (CD) and percutaneous drainage (PD) plays an important role in their management. 2. Technical success rates with PD in pediatric patients with CD are high and PD can serve as a surgical sparing procedure allowing initiation of immunomodulatory or anti-TNF medical therapy or as a bridge to elective surgical intervention when needed. 3. There are specific considerations when performing these procedures in pediatric patients regarding sedation and radiation exposure. 4. Appropriate technique and patient selection help to ensure satisfactory outcomes.

TABLE OF CONTENTS/OUTLINE


PDE149

Study of Crohn's Disease in Pediatric Population Using Magnetic Resonance Enterography (MRE) and Ultrasound (US)

Education Exhibits

Location: S101B

Participants

Gonzalo Sanchez Jorda MD (Presenter): Nothing to Disclose
Lourdes Guillen Vargas MD : Nothing to Disclose
Cinta Sanguesa Nebot MD : Nothing to Disclose
Dolores Muro Veitia MD : Nothing to Disclose
Sara Pico Aliaga MD : Nothing to Disclose
Iciar Puchades-Roman MD : Nothing to Disclose

TEACHING POINTS

1. Describing the MRE and US indications for the study of inflammatory bowel disease and the main imaging findings. 2. To show our population group and their characteristics. 3. Current protocols for CD study by US and MR will be reviewed, along with the sequences used, included DWI, oral contrast agents and use of spasmolytic agents and their utility. 4. Current protocols for CD study by US and MR will be reviewed, along with the sequences used, included DWI, oral contrast agents and use of spasmolytic agents and their utility. 5. Pictorial review of main MRE findings in CD, and correlation with US, and other imaging techniques (CT).

TABLE OF CONTENTS/OUTLINE

• Crohn’s disease: description, pathophysiology. • To show our population group and their characteristics. • Current protocols for CD study by US and MR will be reviewed, along with the sequences used, included DWI, oral contrast agents and use of spasmolytic agents and their utility. • Pictorial review of main MRE findings in CD, and correlation with US, and other imaging techniques (CT).

PDE150

The Utility of MR Urography to Characterize Morphology and Function of Pediatric Urinary Tract Abnormalities

Education Exhibits

Location: S101B

Participants

Mathew Cherny BA, MD (Presenter): Nothing to Disclose
Mark Evan Bittman MD : Nothing to Disclose

TEACHING POINTS
MR urography's (MRU) ability to depict urinary tract morphology and renal function without ionizing radiation is a valuable tool in guiding diagnosis/management of pediatric urinary tract pathology, which traditionally requires multiple imaging modalities to evaluate. MRU utilizes heavily T2-weighted and dynamic post contrast sequences which can rapidly define the anatomy and quantify renal enhancement and excretion. Augmentation with hydration and diuretics is a useful tool to ensure uniform and timely contrast distribution for optimizing excretory phase imaging. The pediatric population presents specific challenges for MRI, notably being patient cooperation and motion sensitivity often requiring sedation.

TABLE OF CONTENTS/OUTLINE

- Discuss a spectrum of pediatric urinary tract anatomic abnormalities such as urinary tract obstruction, duplication anomalies, renal ectopia, ectopic ureters, primary megaureter, calyceal diverticulum, and ureteropelvic junction obstruction
- Appropriateness/indications of MRU in pediatric patients
- Discussion of MRU protocols, including patient preparation, sequence selection, and selection of contrast agents and diuretics
- Review of MRU clinical applications and discussion of benefits/advantages highlighting both the anatomic and functional information which influences clinical decision making

PDE151
Urethral Anatomy and Pathology in Childhood

Education Exhibits
Location: S101B

Participants
- Maria Del Pilar Sanchez-Camacho Gonzalez-Carrato MD (Presenter): Nothing to Disclose
- Purificacion Calvo Azabarte: Nothing to Disclose
- Sonia DieguezTapia MD: Nothing to Disclose
- Maria Isabel Garcia-Hidalgo MD: Nothing to Disclose
- Rosa Maria Martin-Crespo Izquierdo: Nothing to Disclose
- Lina Marcela Cruz Hernandez ARRT: Nothing to Disclose

TEACHING POINTS
1. To describe the embryology and anatomy of the male urethra.
2. To analyze the imaging techniques available for his study.
3. To review the different pathologies depending on the urethral segment.

TABLE OF CONTENTS/OUTLINE

The male urethra consists of posterior (prostatic and membranous) and anterior (bulbous and penile) portions. The most important imaging techniques for the study of urethral pathology are:
- Ultrasound: to assess the effects on bladder, ureters and kidneys
- Voiding cystourethrogram (VCUG)
- Intravenous urography
- Echo-enhanced cystosonography
- Computed tomography
- Magnetic resonance imaging

We will review the most important urethral pathology and his differential diagnosis:

**Posterior urethra:**
- Posterior urethral valves, categorized into three types according to the Young's classification
- Cecoureterocele
- Plicae colliculus
- Prostatic utricle
- Reflux into the prostatic ducts and seminal vesicles

**Anterior urethra:**
- Cobb's collar
- Anterior urethral valves
- Urethral diverticulum
- Cowper's duct cyst or syringocele
- Urethral polyp
- Urethral duplication
- Megalourethra
- Anorectal malformations
- Cloacal malformation
- Urethral fistula

PDE152
US Approach of Adnexal Torsion in Girls with Acute Pelvic Pain

Education Exhibits
Location: S101B

Participants
- Catherine Baud MD (Presenter): Nothing to Disclose
- Nancy Bechard-Sevette MD: Nothing to Disclose
- Stephanie David MD: Nothing to Disclose
- Julie Bolivar-Perrin: Nothing to Disclose
- Magali Saguintaah MD: Nothing to Disclose
- Alain Couture MD: Nothing to Disclose
- Olivier Prodhomme MD: Nothing to Disclose

TEACHING POINTS
To review how to perform color Doppler sonography (CDS) in girls with acute pelvic pain. To describe the sonographic findings of adnexal torsion. To learn to recognize the twisted vascular pedicle/tube. To provide prognostic criteria. To discuss the other causes of acute pelvic pain.

TABLE OF CONTENTS/OUTLINE

1. CDS technique: comparative study of both ovaries, vascular pedicle course analysis
2. Normal ovary torsion: enlargement, abnormal echogenicity with peripheral follicles, heterogeneity, absent or decreased blood flow
3. Ovarian cystic masses torsion: thickened, echogenic adjacent cortex with absent or decreased vascularization
4. Twisted vascular pedicle/tube detection: round mass of 10-30 mm in anteroposterior diameter adjacent to the ovary producing the nipple or the double ovary sign
5. Prognostic signs
6. Isolated tube torsion: hydrosalpinx or/and paraadnexal cyst associated with twisted vascular pedicle/tube adjacent to the uterus and/or ovary
8. Others causes of acute pelvic pain

Adnexal torsion is a rare surgical emergency requiring early diagnosis to avoid necrosis. In girls with acute pelvic pain, the twisted vascular pedicle detection can be helpful to diagnose torsion of normal ovary with mild enlargement, torsion of ovarian cystic masses and isolated tube torsion. Sonography is accurate in the differential diagnosis.
US Approach of Testicular Torsion in Children and Teenagers

Education Exhibits
Location: S101B

Participants
- Catherine Baud MD (Presenter): Nothing to Disclose
- Magali Saguintaah MD : Nothing to Disclose
- Nancy Bechard-Sevette MD : Nothing to Disclose
- Julie Bolivar-Perrin : Nothing to Disclose
- Stephanie David MD : Nothing to Disclose
- Alain Couture MD : Nothing to Disclose
- Olivier Prodhomme MD : Nothing to Disclose

TEACHING POINTS
To review how to perform color Doppler sonography (CDS) of acute scrotum To describe the sonographic findings of intravaginal torsion To learn to recognize the twisted spermatic cord To highlight the diagnostic pitfalls To provide prognostic criteria To discuss the other causes of acute scrotum

TABLE OF CONTENTS/OUTLINE
1. CDS technique: comparative study of both testes and extratesticular structures
2. Testicular signs of torsion: absent or decreased blood flow, enlargement, abnormal echogenicity, heterogeneity, abnormal location
3. Extratesticular signs: abnormal epididymal head location, extratesticular mass of 12-33 mm in anteroposterior diameter connected to the inguinal cord
4. Diagnostic Pitfalls
7. Good prognostic signs: vascularized or iso-hyperechoic testis with mild enlargement
8. Signs of necrosis: heterogeneous or avascular testis with thickened hyperemic scrotal wall
9. Negative signs of torsion in spontaneous detorsion, epididymoorchitis and appendix torsion

Intravaginal torsion is much more frequent in teenagers than in children. It is a surgical emergency requiring early diagnosis to avoid necrosis. In uncertain cases, CDS is helpful and can reduce needless surgery. Spiral twist detection is the only reliable sign of testicular torsion whatever its consequences for the testis. CDS may predict testis prognosis.

PDE154

High Resolution MR Imaging of Peripheral Nerve Injury in Children and Young Adults

Education Exhibits
Location: S101B

Participants
- Shivani Ahlawat MD (Presenter): Nothing to Disclose
- Alan Belzberg : Nothing to Disclose
- Laura Marie Fayad MD : Nothing to Disclose

TEACHING POINTS
1. Using high resolution MR imaging, normal peripheral nerve anatomy has a distinct appearance. 2. Commonly used classification schemes for peripheral nerve injury are the Seddon and Sunderland schemes, which are based on either axonal continuity and conduction or histology. 3. There are specific direct and indirect MR imaging features that can be used to identify peripheral nerve injury in children and young adults.

TABLE OF CONTENTS/OUTLINE

PDE155

High-resolution Ultrasound of the Temporomandibular Joint in Children with JIA

Education Exhibits
Location: S101B

Participants
- Irene Maria Olivia Borzani MD (Presenter): Nothing to Disclose
- Umberto Garagiola : Nothing to Disclose
- Paolo Cressoni : Nothing to Disclose
- Silvana Di Geronimo : Nothing to Disclose
- Giampietro Farronato MD, DDS : Nothing to Disclose

TEACHING POINTS
To review the clinical indications, TMJ anatomy, imaging appearance of normal and abnormal findings of temporomandibular joint ultrasound in children with JIA

TABLE OF CONTENTS/OUTLINE
Anatomy Pathophysiology Clinical Findings Imaging techniques Imaging appearance Follow-up
Inflammatory Myofibroblastic Tumors in Children: Inflammatory or Neoplastic Condition? Review of Our Experience in 15 Cases

Education Exhibits
Location: S101B

Participants
- Emilio Inarejos Clemente, MD (Presenter): Nothing to Disclose
- Lucia Riaza: Nothing to Disclose
- Monica Rebollo MD: Nothing to Disclose
- Mariona Sunol Capella: Nothing to Disclose
- Maria Teresa Maristany Daunert: Nothing to Disclose

TEACHING POINTS
1. Major radiologic features of inflammatory myofibroblastic tumors (IMT) on x-ray, CT and MR with pathologic correlation. 2. To learn how specific MR key features help to differentiate IMT from malignant tumors. 3. Highlight the main differential diagnosis, that include, amongst others, rhabdomyosarcoma and Ewing sarcoma.

TABLE OF CONTENTS/OUTLINE
1. Review of our series of 15 IMTs, highlighting the main radiographic, pathologic and cytogenetic features to ensure an accurate diagnosis. 2. MR key features to differentiate IMT from malignant tumors to avoid unnecessary aggressive treatment. 3. Differential diagnosis with corresponding imaging. 4. Treatment and prognosis based on our experience.

MR Imaging of Developmental Dysplasia of the Hip: Goals and Obstacles

Education Exhibits
Location: S101B
- Certificate of Merit
- Selected for RadioGraphics

Participants
- Daniel G. Rosenbaum MD (Presenter): Nothing to Disclose
- Eric Adam Bogner MD: Nothing to Disclose
- Douglas N. Mintz MD: Nothing to Disclose

TEACHING POINTS
1. To highlight the utility of MR imaging in the evaluation of developmental dysplasia of the hip following surgical reduction
2. To illustrate the imaging appearances of the concentrically and non-concentrically reduced hip, including obstacles to and complications of reduction

TABLE OF CONTENTS/OUTLINE
- Background and rationale for MR imaging
- Imaging technique
- Examination timing and anesthesia
- Imaging parameters
- Motion artifact/repetitive acquisition
- Image interpretation
- Concentric reduction
- Ossified vs. non-ossified capital femoral epiphyses
- Postsurgical changes with closed and open reduction
- Osteotomy hardware
- Obstacles to concentric reduction
- Inverted labrum and limbus formation
- Hypertrrophy of the ligamentum teres/tranverse acetabular ligament
- Enlarged pulvinar
- Complications
- Persistent dislocation
- Capital femoral epiphyseal contusion
- Osteonecrosis
- Contrast administration and epiphyseal perfusion
- Incidental pelvic pathology
- Clinical and imaging follow-up
- Conclusions

Pediatric Bone Tumors: the Good, the Bad, and the Ugly . . . with Particular Attention to the Bad and Ugly

Education Exhibits
Location: S101B

Participants
- David W. Swenson MD (Presenter): Nothing to Disclose
- Patricia Trinidad Chang MD: Nothing to Disclose
- Kirsten Ecklund MD: Nothing to Disclose

TEACHING POINTS
Purpose: 1. Draw on examples of 90 pediatric patients who presented over the last 15 years, and who have both pre and post chemotherapy imaging of osteosarcoma, highlighting typical imaging features at diagnosis and in response to chemotherapy. 2. Demonstrate challenging cases of osteosarcoma presenting in unusual locations and with atypical imaging appearance. 3. Discuss the differential diagnosis for atypical osteosarcomas, and present examples of imaging mimickers in the axial and appendicular skeleton. 4. Review common conundrums of treatment response imaging, and present practical problem-solving tools.

TABLE OF CONTENTS/OUTLINE
1. Osteosarcoma Basics
   - Epidemiology
   - Classic imaging
2. Osteosarcoma Imaging Evolution with Chemotherapy
   - Increased osteoid production
   - Intratralesional hemorrhage
   - Significance of increasing tumor size on therapy
3. Osteosarcoma Challenges
   - Unusual locations, including skull, jaw, spine, and pelvis
   - Atypical appearances in the appendicular skeleton
   - Differentiating growth from treatment effects
4. Osteosarcoma Mimickers and Differentiating Findings
   - Ewing's sarcoma
   - Langerhans cell histiocytosis
   - Giant cell tumor
   - Lymphoma
   - Osteoblastoma
   - Aneurysmal bone cyst
   - Chronic
PDE159


Education Exhibits
Location: S101B

Selected for RadioGraphics

Participants
Omar Adib (Presenter): Nothing to Disclose
Emeline Noizet: Nothing to Disclose
Didier Loisel MD: Nothing to Disclose
Christophe Aube MD, PhD: Speaker, Bayer AG Support, General Electric Company

TEACHING POINTS

- Cervical spine injuries in children are usually seen in the upper cervical region owing to its unique biomechanics and anatomy.
- Knowledge of the normal development and radiographic features of the pediatric cervical spine can aid in the correct interpretation of plain radiograph in the setting of trauma.
- Emergency radiologic analysis of the pediatric cervical spine can be challenging because of wide range of normal anatomic variants and changes that occur with the maturation or ossification process.
- Interpretation of a post-traumatic plain radiograph of cervical spine must be based on age of children, localisation and mechanism of the trauma.

TABLE OF CONTENTS/OUTLINE

- Several normal anatomic variants and synchondroses may be encountered on a standard cervical in children.
- Knowledge of the normal embryologic development and anatomy of the cervical spine is important to avoid mistaking synchondroses for fractures in the setting of trauma.
- Variants include, in general, pseudosubluxation C2-C3, absence of cervical lordosis, wedging of C3 vertebra, widening of the predental space and the prevertebral soft-tissue.
- This atlas provides the main signs to aid in the correct interpretation of radiographs.

PDE160

Pediatric Distal Tibial Fractures: What the Emergency Radiologist Needs to Know

Education Exhibits
Location: S101B

Participants
Christy Blaire Pomeranz MD (Presenter): Nothing to Disclose
Roger J. Bartolotta MD: Nothing to Disclose

TEACHING POINTS

Pediatric distal tibial fractures require detailed radiologic evaluation with regard to both displacement and physeal involvement in order to guide appropriate management. This exhibit enables the reader to: 1. Apply Salter-Harris fracture classification with regard to the closure pattern of the distal tibial physis 2. Understand which patients need CT in order to minimize radiation exposure 3. Review anatomic and mechanistic classifications for distal tibial fractures 4. Maximize the reporting of critical information (alignment, classification) that would alter management.

TABLE OF CONTENTS/OUTLINE


PDE161

Pediatric Elbow -The Spectrum of Normal Development, Congenital and Pathologic Findings at Imaging

Education Exhibits
Location: S101B

Participants
Adam Gehrt DO (Presenter): Nothing to Disclose
Arthur Benjamin Meyers MD: Nothing to Disclose
Kevin Paul Boyd DO: Nothing to Disclose

TEACHING POINTS

• Complex normal development at the pediatric elbow should not be confused with pathology. • The pediatric elbow is the site of a variety of common and uncommon acute injury patterns which can be identified on various imaging examinations. • Overuse injuries particularly in the young throwing athlete cause specific patterns of pathology. • A variety of other congenital, infectious and inflammatory conditions, which occur in and around the pediatric elbow, are important to recognize.
TABLE OF CONTENTS/OUTLINE
OUTLINE: Normal development • Ossification centers • Accessory Ossification centers • Trochlear pre-ossification center seen on MRI Congenital Disorders • Congenital radial head dislocation • Radioulnar synostosis • Radial dysplasia Osteochondrosis/Osteonecrosis • Panner’s disease • AVN Traumatic injuries and their complications • Fractures • Soft tissue injuries • Injuries seen in the throwing athlete Miscellaneous • Inflammatory conditions • Infection • Soft tissue masses around the elbow

PDE163
Skeletal Manifestations of Fibroblast Growth Factor Receptor (FGFR) Gene Mutations- Can We Predict Genetic Diagnosis on the Basis of Imaging?

Education Exhibits
Location: S101B
Certificate of Merit
Selected for RadioGraphics

Participants
Kiran Mahadev Sargar MBBS, MD (Presenter): Nothing to Disclose
Thomas Eugene Herman MD : Nothing to Disclose
Marilyn J. Siegel MD : Research Consultant, Siemens AG Speakers Bureau, Siemens AG

TEACHING POINTS
Fibroblast growth factor receptors (FGFR) have role in cell proliferation, growth, differentiation and migration. Genetic mutations in gene encoding FGFR types 1, 2 and 3 are responsible for specific skeletal dysplasias and craniosynostosis syndromes. Genetic diagnosis of mutations in FGFRs can be predicted based on skeletal imaging findings and appropriate genetic tests can be performed to establish the diagnosis.

TABLE OF CONTENTS/OUTLINE

PDE164
Sonography of Musculoskeletal Infections in Children

Education Exhibits
Location: S101B
Certificate of Merit

Participants
Jenny Walsh MBChB (Presenter): Nothing to Disclose
Jeannette Kraft MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To review the normal bone and joint anatomy in children and highlight differences to imaging in adults.
2. To discuss the sonographic findings associated with septic arthritis, osteomyelitis, pyomyositis and soft tissue infection in children.
3. To correlate ultrasound imaging with MRI findings.
4. To explain when further imaging with MRI is useful.

TABLE OF CONTENTS/OUTLINE
- Sonographic technique.
- Normal bone and joint anatomy in children.
- Indications for sonography.
- Review of imaging findings in septic arthritis, osteomyelitis, pyomyositis and soft tissue infection.
- Further investigations.

PDE165
The Snaps, Crackles, and Pops: Reviewing the MRI Findings and Recommended Techniques for Evaluating Pediatric Sports Injuries

Education Exhibits
Location: S101B

Participants
Thomas Michael Cullen MD (Presenter): Nothing to Disclose
Henry Chow Chow DO : Nothing to Disclose
TEACHING POINTS

Discuss the increasing prevalence of pediatric sports injuries. Present a case-based approach to understanding common mechanisms of pediatric sports injuries and their respective findings on MRI. Review recommended MRI technique and protocols for evaluating pediatric sports injuries. Highlight current clinical management strategies and the importance of early recognition of injury to avoid long-term sequela.

TABLE OF CONTENTS/OUTLINE


PDE168

Where's the Bone?: Diseases of Bone Demineralization in Children

Education Exhibits

Certificate of Merit

TABLE OF CONTENTS/OUTLINE

1. Describe the associated radiologic findings in diseases of decreased bone mineralization in children. 2. Distinguish the different diseases of decreased bone mineralization based on the imaging findings. 3. Understand the pathophysiology behind the radiologic appearance of these diseases.

PDE169

Whole Body MRI in Peripheral Nerve Sheath Tumor Syndromes: A Systematic Review

Education Exhibits

TABLE OF CONTENTS/OUTLINE

1. To review the current literature on the use of whole body magnetic resonance imaging (Wb-MRI) in patients with peripheral nerve sheath tumor syndromes, particularly neurofibromatosis types 1 and 2, and schwannomatosis 2. To emphasize differences in technical parameters offered at 1.5T and 3T. 3. To describe the utility of WB-MRI for tumor detection (assessment of disease burden), characterization of peripheral lesions, and evaluation of treatment response in patients with peripheral nerve tumor syndromes.
"Children’s Twelve": Cranial Nerves on Pediatric Brain MRI

PDE170

Education Exhibits
Location: S101B

Magna Cum Laude
Selected for RadioGraphics

Participants
Jae-Yeon Hwang MD (Presenter): Nothing to Disclose
Hye-Kyung Yoon MD: Nothing to Disclose
Jeong Hyun Lee MD, PhD: Nothing to Disclose
Hee Mang Yoon MD: Nothing to Disclose
Ah Young Jung: Nothing to Disclose
Young Ah Cho: Nothing to Disclose
Jin Seong Lee MD: Nothing to Disclose
Chong Hyun Yoon: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:
1. Review the radiological anatomy of the cranial nerves on MRI
2. To exhibit various diseases of cranial nerves in pediatric patients
3. To discuss the optimized MRI protocols for evaluating cranial nerves in pediatric patients

TABLE OF CONTENTS/OUTLINE

1. Summarized review on the cranial nerves
2. Review of the radiological anatomical, clinical considerations, and imaging issues of each cranial nerves by using 3D reformatted MR image sets; Diseases may include - Congenital: absence or dysplasia, isolated or in association with other congenital anomalies or syndromes (e.g. mid facial anomaly, Duane retraction syndrome) - Inflammatory: primary or secondary neuropathies (e.g. multiple sclerosis, Miller-Fisher syndrome) - Tumorous: primary tumor or secondary involvement by intracranial or extracranial tumors (e.g. optic glioma, leukemic infiltration) - Miscellaneous 3. Technical issues of the pediatric cranial nerve imaging - Review of the high resolution 3D MR sequences for cranial nerves - Limitations of the cranial nerve imaging in pediatric patients - Optimization of the pediatric cranial nerve imaging

Acute Cerebral Vascular Accident and Pre-wallerian Degeneration in Neonates: The Rapid Full 3 Tesla Magnetic Resonance Imaging of the Brain

PDE171

Education Exhibits
Location: S101B

Participants
Alice P. Wang: Nothing to Disclose
Adrienne Frances Thompson MD: Nothing to Disclose
Yonker Yang Wang MD (Presenter): Nothing to Disclose

TEACHING POINTS

Acute CVA in Neonates, as it has significant prognostic implications. This case-based presentation highlights the benefits of rapid 3T MRI exams in detecting neonates with acute CVA, and how to evaluate Pre-wallerian degeneration.

TABLE OF CONTENTS/OUTLINE

The benefits of 3T MRI rapid full neonatal brain imaging of 100 neonates suspected of acute CVA by intracranial US are presented. Wide range of severity of acute ischemic infarct and intraparenchymal hemorrhage cases were detected with MRI exam while neonates were monitored, without sedation. 36 cases of Pre-wallerian degeneration detected. PWD was further defined, its imaging features and prognostic implications discussed. The timeline of the imaging findings related to presentation laid out, in order to highlight the potential of earlier detection of acute CVA and PWD using 3T MRI. Early discovering of neonatal CVA, particularly PWD on MR imaging is key to determining the disease prognosis. Though effective with 1.5 T MRI, its longer acquisition time predisposes the study to motion artefact, necessitating sedation for the study. Our experience shows that MR imaging at 3T is more effective in detecting the critical result of neonatal PWD in patients presenting with acute CVA, while not using any sedation. We favor the use of 3T MRI when to minimize the risk to the neonates undergoing MR imaging.

Arterial Spin Labeling and its Application in Pediatric Neuroimaging

PDE173

Education Exhibits
Location: S101B

Certificate of Merit

Participants
David Zander MD (Presenter): Nothing to Disclose
Sanjay Padubidri Prabhu MBBS: Nothing to Disclose
Ellen Grant MD: Nothing to Disclose
Edward Yang MD, PhD: Research Consultant, CorticoMetrics LLC
Borjan Gagoski PhD: Nothing to Disclose
Richard Lee Robertson MD: Nothing to Disclose
TEACHING POINTS

1. Briefly review the concept of tissue perfusion.
2. Provide an overview of current methods of measuring cerebral perfusion, highlighting pros and cons in the pediatric population.
3. Define arterial spin labeling, illustrate labeling schemes, and describe technical aspects of performing the exam.
4. Detail the variety of arterial spin labeling applications in neuroimaging, with emphasis on unique utility within the pediatric population.

TABLE OF CONTENTS/OUTLINE

- What is perfusion, and how do we measure it?
- What is arterial spin labeling, and how do we perform it?
- Continuous ASL
- Pulsed ASL
- Pseudocontinuous ASL
- 3D ASL
- Technical aspects unique to pediatric population
- Sample cases
- Normal variants and artifacts
- Future directions/Summary

PDE174

Back to the Basics: A Review of Congenital Spine Anomalies on Ultrasound with MRI Correlation

Education Exhibits
Location: S101B

Participants
Shannon Farmakis MD (Presenter): Nothing to Disclose
Vilas Shetty MD: Nothing to Disclose
Marilyn J. Siegel MD: Research Consultant, Siemens AG; Speakers Bureau, Siemens AG

TEACHING POINTS

1. Review the indications for performing spinal sonography in neonates and young infants.
2. Review the normal anatomy of the spine on ultrasound, normal variants, and various spinal anomalies.
3. Review correlating MRI findings in spinal anomalies.

TABLE OF CONTENTS/OUTLINE

Introduction
- Indications for spine ultrasound including review of various midline skin lesions in lower back
- Multiple congenital anomalies with high association for spinal anomalies
- Review indications for recommending spine MRI following screening ultrasound

Embryology of spinal cord development
- Normal spine anatomy on ultrasound
- Normal variants on spine ultrasound with MRI correlation

Spinal anomalies on ultrasound with MRI correlation
- Summary
- Spinal ultrasonography remains the imaging gold standard in screening pediatric patients with various skin lesions in the lower back as well as in patients with multiple congenital anomalies or known spinal dysraphism. MRI imaging is the next step in evaluating spine abnormalities. This exhibit aims to review the embryology of spinal cord development, review the normal anatomy of the spine on ultrasound, and then review the appearance of various spinal anomalies on both ultrasound and MRI.

PDE175

Clinical Application of F-18 FLT PET in Pediatric Brain Tumors

Education Exhibits
Location: S101B

Participants
Yoshihiro Nishiyama MD (Presenter): Nothing to Disclose
Yuka Yamamoto MD, PhD: Nothing to Disclose

TEACHING POINTS

The nucleoside analogue 3'-deoxy-3'-18F-fluorothymidine (FLT) with PET has been introduced for imaging cell proliferation. The purpose of this exhibit is:

1. To assess the clinical value of FLT PET in pediatric patients with brain tumors.
2. To compare the uptake of C-11 methionine (MET) PET.

TABLE OF CONTENTS/OUTLINE

1. FLT PET imaging in pediatric patients with brain tumors:
   - Cerebellar astrocytoma
   - Medulloblastoma
   - Craniopharyngioma
   - Ependymoma
   - Germinoma
   - Brainstem glioma
2. Follow-up FLT PET imaging after therapy
3. Tumor recurrence vs. radiation necrosis

PDE177

Intracranial Lesions in Pediatric Patients with Sickle Cell Disease: A Review of Imaging Findings

Education Exhibits
Location: S101B

Participants
Ronald William Mercer BA (Presenter): Nothing to Disclose
Teresa Martin-Carreras BS: Nothing to Disclose
Nicholas Paul McKenna BA: Nothing to Disclose
Laura W. Bancroft MD: Royalties, Wolters Kluwer nv
Steven Anthony Messina MD: Nothing to Disclose

TEACHING POINTS

1. autopsy the concept of tissue perfusion.
2. Provide an overview of current methods of measuring cerebral perfusion, highlighting pros and cons in the pediatric population.
3. Define arterial spin labeling, illustrate labeling schemes, and describe technical aspects of performing the exam.
4. Detail the variety of arterial spin labeling applications in neuroimaging, with emphasis on unique utility within the pediatric population.

TABLE OF CONTENTS/OUTLINE

- What is perfusion, and how do we measure it?
- What is arterial spin labeling, and how do we perform it?
- Continuous ASL
- Pulsed ASL
- Pseudocontinuous ASL
- 3D ASL
- Technical aspects unique to pediatric population
- Sample cases
- Normal variants and artifacts
- Future directions/Summary
(1) Intracranial abnormalities in pediatric patients diagnosed with sickle cell disease include vascular stenosis/occlusion, moyamoya, cerebral atrophy, gliosis, non-hemorrhagic infarcts in large vascular and watershed distributions, postoperative changes after pial synangiosis, and osseous cranial abnormalities. (2) Transcranial sonography, computed tomography (CT), magnetic resonance imaging (MRI), MR angiography and conventional angiography provide valuable diagnostic information in the pre- and postoperative pediatric sickle cell patient.

TABLE OF CONTENTS/OUTLINE

- Introduction to CNS changes in pediatric patients with sickle cell disease
- Discuss common clinical indications for imaging studies in sickle cell patients ordered to assess the CNS
- Review imaging findings and discuss their prevalence in this population of patients: - Vascular stenoses, occlusion and moyamoya - Acute and chronic ischemic changes. Specifically, the common areas involved (e.g. watershed versus lacunar infarcts) - Cerebral atrophy and encephalomalacia - Postoperative changes from pial synangiosis - Osseous cranial abnormalities
- Future directions and summary

PDE178

Intracranial Pediatric Arteriovenous Malformations: A Review of AVM Grades, Treatment Modalities and Outcomes

Education Exhibits

Location: S101B

Participants

Teresa Martin-Carreras BS (Presenter): Nothing to Disclose
Ronald William Mercer BA: Nothing to Disclose
Nicholas Paul McKenna BA: Nothing to Disclose
Laura W. Bancroft MD: Royalties, Wolters Kluwer nv
Frank Helling MD: Nothing to Disclose
Steven Anthony Messina MD: Nothing to Disclose

TEACHING POINTS

(1) Discuss the clinico-radiological features in pediatric Spetzler-Martin grades I-V arteriovenous malformations.
(2) Elucidate the varying treatment modalities available for pediatric intracranial arteriovenous malformation.
(3) Discuss outcomes of single-modality, dual-modality, and triple-modality treatment approaches.

TABLE OF CONTENTS/OUTLINE

- Epidemiology and pathophysiology of arteriovenous malformations (AVMs)
- Key differences between pediatric and adult AVMs
- AVM Spetzler-Martin grading scale
- Imaging Findings - Conventional MRI/MRA - Digital Subtraction Angiography (DSA)
- Current treatment modalities for pediatric AVMs - Microsurgery, Endovascular Embolization, Radiosurgery
- Expected post-treatment findings following embolization and radiosurgery
- Treatment outcomes of pediatric AVMs - Post-procedural obliteration rates
- Future directions and summary

PDE179

Mimics in Pediatric Neuroradiology: Cases of Mistaken Identity

Education Exhibits

Location: S101B

Participants

Asha Sarma MD (Presenter): Nothing to Disclose
Narayan Viswanadhan MD: Nothing to Disclose
Sanjay Padubidri Prabhu MBBS: Nothing to Disclose
Michelle Silvera MD: Nothing to Disclose

TEACHING POINTS

Imaging mimics are not uncommon in pediatric neuroradiology. Accurate diagnosis guides optimal management. This exhibit: 1) Familiarizes the radiologist with similar appearing pediatric neuroradiological entities in order to broaden differential diagnosis, improve diagnostic accuracy, and guide optimal management 2) Teaches the radiologist to select additional imaging tests that clarify diagnosis. 3) Discusses clinical features, multimodality imaging signs, and therapeutic considerations in several challenging cases of easily mistaken entities in pediatric neuroradiology.

TABLE OF CONTENTS/OUTLINE

- Cases will be presented in quiz format. Key differential diagnostic, clinical and imaging semiology, and management considerations will be discussed each case. Case selection with mimicked entity in parentheses: Intracranial aneurysm (tumor) CNS vasculitis (tumor) Vein of Galen malformation (pial cyst) Spinal cord infarction (tumor) Tumefactive demyelination (tumor, tumoral edema) Giant tumefactive perivascular spaces (vascular lesion) Cavernoma (glioma) Callosal lipoma (ruptured dermoid) Cerebritis (glioma) Limbic encephalitis (glioma) Sphenoid bone fibrous dysplasia (sarcoma) Pyogenic abscess (centrally necrotic tumor) Racemose neurocysticercosis (ependymal cyst) Hirayama disease (epidural mass/abscess)

PDE180

MR Imaging Spectrum of Retinoblastoma

Education Exhibits

Location: S101B

Certificate of Merit

Participants

Samarjit Singh Ghuman MBBS, MD (Presenter): Nothing to Disclose
Seema Sud MBBS: Nothing to Disclose
Tarvinder Bir Singh Buxi MD: Nothing to Disclose
TEACHING POINTS
After Viewing this abstract it should be possible to describe - 1) Various MR imaging appearances and growth patterns of Retinoblastoma and associated findings in the globe such as vitreous and retinal haemorrhage/ detachment 2) Findings which indicated scleral/choroidal/optic nerve involvement and extra ocular extension 3) MR imaging in advanced tumours, including optic chiasm, meningeal and bony involvement as well as associated tumours

TABLE OF CONTENTS/OUTLINE
a) Introduction - MR imaging protocols and normal MR anatomy of the Globe, supported by diagrams and labelled scans b) Epidemiology and brief outline of MR imaging of Retinoblastoma b) Case based reviews along with Various imaging features of Retinoblastoma supported with diagrams where relevant and brief review of literature, including * Growth patterns of Retinoblastoma (Endophytic, Exophytic, Infiltrative) * Bilateral and Trilateral Retinoblastomas * Cases showing involvement of Choroid, Sclera, Anterior Chamber and Optic Nerve * Advanced tumours, including involvement of Orbit, Optic Chiasm, Leptomeningeal seeding, dural and bony metastases and post radiotherapy secondary tumour * Differential Diagnosis c) Conclusion and learning pearls

PDE181

MRI of Bone Marrow Patterns in the Developing Head and Spine

Education Exhibits
Location: S101B

Participants
Samuel Issac Frost DO (Presenter): Nothing to Disclose
Jamie R. Ledford MD : Nothing to Disclose
Teresa Gross Kelly MD : Nothing to Disclose

TEACHING POINTS
Teaching Points: i. Pattern of MRI bone marrow signal of the pediatric head and spine changes as the child develops from infancy through adolescence. ii. MRI bone marrow signal pattern of the head and spine becomes altered in select disease states that affect the marrow and cortex. iii. A systematic approach to the analysis and characterization of pediatric MRI bone marrow signal in both the normal and abnormal state can facilitate detection and diagnosis of pathology.

TABLE OF CONTENTS/OUTLINE
Table of Contents/Outline: I. Review normal pediatric bone marrow anatomy, physiology, histology and how it corresponds to MR imaging pattern in the developing head and spine. II. Review expected bone marrow changes in the pediatric head and spine from the fetus through 25 years of age. III. Provide examples of abnormal pediatric MRI bone marrow signal in the following categories of disease states: a. Trauma b. Infection c. Neoplasm d. Congenital e. Autoimmune f. Iatrogenic/treatment related

PDE182

Neuroimaging Findings in Pediatric Genetic Skeletal Disorders: A Pattern-recognition Approach

Education Exhibits
Location: S101B

Participants
Matthias W. Wagner MD (Presenter): Nothing to Disclose
Andrea Poretti MD : Nothing to Disclose
Thangamadhan Boseman MD, FRCR : Nothing to Disclose
Jane Ellen Benson MD : Nothing to Disclose
Thierry Huisman MD : Nothing to Disclose

TEACHING POINTS
Genetic skeletal disorders (GSD) are a group of disorders characterized by abnormality in growth and remodeling of cartilage and bone. Many GSD are systemic disorders with involvement of other organs including the central nervous system (CNS). CNS abnormalities have a significant impact on long-term prognosis of children with GSD and should not be missed. Early diagnosis of CNS involvement is important in the management of GSD. Here we provide a pattern-recognition approach for neuroimaging findings in GSD.

TABLE OF CONTENTS/OUTLINE
The 2010 Revision of the Nosology and Classification of Genetic Skeletal Disorders includes 456 conditions. We included all conditions (n=177) with CNS involvement. The diseases are classified based on the skeletal involvement (skull and/or trunk and/or limbs and/or acra). Skeletal involvement was defined in accordance with OMIM (Online Mendelian Inheritance of Man). The CNS involvement has been described based on an extensive literature search. Selected examples will be shown based on prevalence of the diseases and significance of the CNS involvement. Early diagnosis of CNS involvement is important in the management of GSD. Here we provide a pattern-recognition approach for neuroimaging findings in GSD.

PDE183

Neuroimaging Findings in Pediatric Patients with Hereditary Hemorrhagic Telangiectasia

Education Exhibits
Location: S101B

Participants
Faizah Mohd Zaki MD (Presenter): Nothing to Disclose
Prakash Muthusami MBBS, MD : Nothing to Disclose
Suzanne Laughlin MD : Nothing to Disclose
Felix Ratjen : Nothing to Disclose
Helen Maree Branson MBBS, FRCR : Nothing to Disclose

TEACHING POINTS
At the end of this exhibit, learner will be able to: 1. describe the typical brain findings in Hereditary Hemorrhagic Telangiectasia among pediatric population based on the different types of cerebral arterio-venous malformation (CAVM). 2. explain the use of different imaging modalities in diagnosing CAVM and their utilization in the treatment management.

TABLE OF CONTENTS/OUTLINE
1. The diagnostic criteria of HHT in pediatric population and the associated genetic mutation related to HHT. 2. The role of brain MRI screening in the detection of CAVM in HHT patients. 3. The types of CAVM that are found in HHT pediatric population ranging from developmental venous anomaly, cavernoma, arterial venous fistula and arteriovenous malformation, demonstrated by different imaging modalities including MRI, CT and angiography. 4. The intracranial complication of HHT depicted on neuroimaging.

PDE184
Pediatric Brainstem Pathologies: A Comprehensive Approach on MR Imaging
Education Exhibits
Location: S101B

Participants
Chandan Kakkar MBBS, MD (Presenter): Nothing to Disclose
Kavita Saggar MD : Nothing to Disclose
Jatinder Singh Goraya MD : Nothing to Disclose
Archana Ahluwalia MD : Nothing to Disclose
Tanica Jain MBBS : Nothing to Disclose
Siddharth Prakash : Nothing to Disclose
Sawant Singh Khela MBBS : Nothing to Disclose
Navdeep Singh MBBS, MD : Nothing to Disclose

TEACHING POINTS
To illustrate MR imaging patterns of various pathologies affecting pediatric brainstem and to develop an imaging approach to diagnosis of brainstem pathologies

TABLE OF CONTENTS/OUTLINE
To illustrate the imaging patterns of diseases with specific predilection of brainstem and typical pattern on imaging, eg. Maple syrup Urine disease, Leigh's disease, Brainstem Glioma, Osmotic myelinolysis, probable HEMS. Diseases affecting brainstem as a part of generalised CNS disease: ADEM -Isolated brainstem , Multiple sclerosis , Tubercular granulomas, Rabies encephalitis, Limbic encephalitis, Severe Hypoxic ischemic encephalopathy, Viral encephalitis Non-specific affection of the brain stem - Central tegmental hyperintensity. To discuss the various differentials and highlight the clinical and imaging points differentiating these conditions. Brainstem is a target for many pathologies having an overlapping clinical and imaging pattern. MRI plays a pivotal role in these conditions helping in arriving at specific diagnosis in a few conditions which is of prime importance in management and predicting the outcome.

PDE185
Pediatric Cochlear Implantation. Neuroimaging Evaluation in the Multidisciplinary Assesment of Children with Special Needs
Education Exhibits
Location: S101B
Certificate of Merit

Participants
Marcela De la Hoz Polo MD (Presenter): Nothing to Disclose
Monica Rebollo MD : Nothing to Disclose
Natalia Coll Alsina : Nothing to Disclose
Victor de Diego Almarza : Nothing to Disclose
Jesus Rodriguez Jorge : Nothing to Disclose
Sophia Ourani : Nothing to Disclose
Maria Antonia Claveria Puig : Nothing to Disclose

TEACHING POINTS
1.Neuroimaging preoperative assesment of the temporal bone. Anatomic factors that may make electrode insertion difficult or result in electrode malposition 2.Inner ear malformations that may occur in pediatric cochlear implantation (CI) candidates 3.Neuroimaging findings in children with sensorineural hearing loss (SNHL) and special needs 4.Review of the overall indications/contraindications for CI. New indications in children with special needs. 5.The role of the multidisciplinary team (ORL,psychologist,speech therapist,neuropediatrician,social worker, radiologist) 6.Postoperative imaging of the CI

TABLE OF CONTENTS/OUTLINE

PDE186
Pediatric Neuro-Ophthalmic Syndromes: Comprehensive Ocular and Brain Imaging
Education Exhibits
Participants
Vaishnavi Batmanabane MBBS, MS (Presenter): Nothing to Disclose
Manohar Meghraj MD : Nothing to Disclose
Prakash Muthusami MBBS, MD : Nothing to Disclose
Elise Heon MD : Nothing to Disclose

TEACHING POINTS
• The complementary role of neuro imaging (CT and MRI) and ocular imaging (optical coherence tomography - OCT and ocular ultrasonography - USG) for a comprehensive assessment of pediatric neuro-ophthalmic syndromes. • The enhanced understanding of symptomatology and pathophysiology of these syndromes provided by OCT and USG. • The limitations of these investigations in this setting.

TABLE OF CONTENTS/OUTLINE
• Pediatric neuro-opthalmic syndromes: Phenotypes and imaging characteristics - Syndromic retinal degeneration: Joubert syndrome - Developmental anomalies: CHARGE, Morning Glory, Goldenhar syndromes: Aicardi - Vascular syndromes: Sturge Weber - Phakomatoses: Tuberous sclerosis - Ocular masses: Retinoblastoma • The role of specialized ophthalmic investigations like OCT and USG - Additional information provided over CT and MRI for diagnosis and management - Clinical scenarios in which they would be relevant • Limitations

PDE187
Susceptibility-Weighted MRI in Acute Lymphocytic Leukemia: Petechial Brain Hemorrhage in the Setting of Hyperleukocytosis
Education Exhibits
Location: S101B

Participants
Michael Eric Stone MD (Presenter): Nothing to Disclose
Karyn Alayne Ledbetter MD : Nothing to Disclose
Sheena Saleem MD, MBBS : Nothing to Disclose
Deniz Altinok MD : Nothing to Disclose

TEACHING POINTS
1. Intracerebral hemorrhage is common in patients with acute leukemia accounting for approximately 20% total mortality. 2. Hyperleukocytosis is defined as a peripheral white blood cell count exceeding 100,000/ml and is not uncommon in patients presenting with acute lymphocytic leukemia (ALL). 3. Hyperleukocytosis is associated with intracranial hemorrhage, proposed to occur secondary to venous congestion due to hyperviscosity. Thrombocytopenia is a confounding factor. 4. Larger hemorrhages can be identified on CT or routine MRI sequences. Susceptibility-weighted MRI (SWI) is much more sensitive for detecting chronic petechial hemorrhage and should be considered in all ALL patients with hyperleukocytosis. 5. Imaging findings include diffuse small blooming foci on susceptibility-weighted sequences. These lesions may be faintly seen on diffusion-weighted sequences and should be scrutinized in the absence of dedicated SWI. These imaging findings will be reviewed using case based examples.

TABLE OF CONTENTS/OUTLINE
I. INTRODUCTION TO ACUTE LYMPHOCYTIC LEUKEMIA II. HYPERLEUKOCYTOSIS A. DEFINITION B. PATHOPHYSIOLOGY OF HYPERVISCOSITY III. IMAGING FINDINGS OF PETECHIAL HEMORRHAGE IN HYPERLEUKOCYTOSIS A. UTILITY OF STANDARD MRI B. UTILITY OF SUSCEPTIBILITY-WEIGHTED IMAGING IV. CASE EXAMPLES V. DIFFERENTIAL CONSIDERATIONS

PDE188
The Role of Advanced Neuroimaging Techniques in Preoperative Planning in Brainstem Expanding Lesions in Childhood
Education Exhibits
Location: S101B

Participants
Cristina Utrilla MD (Presenter): Nothing to Disclose
Arancha Royo MD : Nothing to Disclose
Fernando Carceller : Nothing to Disclose
Amelia Fernandez Zubillaga : Nothing to Disclose
Remedios Frutos MD : Nothing to Disclose
Begona Marin Aguilera : Nothing to Disclose
Alberto Alvarez Muelas MD : Nothing to Disclose
Gonzalo Garzon MD : Nothing to Disclose

TEACHING POINTS
Deciding the appropriate neurosurgical approach to a brainstem mass requires close interaction between radiologists & neurosurgeons Once an approach is decided, location of arteries & cranial nerves near the planned access point,white matter tract mapping & volumetric assessment of the tumor in relation to posterior fossa landmarks help increase the efficiency of surgery while minimizing adverse effects Advanced MR techniques allow diagnosis of focal brainstem gliomas, susceptible to surgical treatment, as well as attempt to predict tumor growth pattern and behavior Preoperative neuroimaging evaluation allows performing brainstem surgery with acceptable morbidity & mortality rates

TABLE OF CONTENTS/OUTLINE
- Cases: we reviewed 45 cases of brainstem gliomas and 1 cavernoma treated in our institution (24 surgically) - Preoperative imaging protocol: MRI (T2WI, FLAIR sequences, pre and post-gadolinium T1, DWI, MR-angiography) 20 cases also had MR-Spectroscopy and DTI) and MDCT (MPR and volumetric reconstructions) - Discussion & Conclusion: The aim of this exhibit is to describe our experience in a neuroimaging based approach selection by showing several examples of pre-surgical planning. Collaboration between surgeons and radiologists allows highly complex and risky approaches such as the Kawase triangle and the telovelar approach, with acceptable outcomes
Benign and Malignant Hepatic Liver Focal Lesions in Infant and Children

TEACHING POINTS
The aim of this exhibit is to describe the wide spectrum of benign and malignant focal liver lesions affecting infant and children, with radiological/pathological correlation in representative cases.

TABLE OF CONTENTS/OUTLINE
Imaging findings (CT, MRI, US) of benign and malignant focal lesions with radiological/pathological correlation will be described in representative cases:
- Hydatid Cyst
- Rigenerative Nodular hyperplasia
- Focal Nodular Hyperplasia
- Hepatic Adenomatosis
- Hemangiomatosis
- Hepatic Epitheloid hemangioendothelioma
- Hepatoblastoma
- Hepatocellular carcinoma
- Infantile hepatic Hemangioendothelioma
- Hepatic sarcoma
- Cholangiocarcinoma
- Post Transplant Lymphoproliferative Disease.

Biological Characterization of Neuroblastomas Using 18 F FDG PET/CT, 131 -I MIBG and Somatostatin Receptor Imaging and Its Role in Presurgical Staging and Management

TEACHING POINTS
Role of FDG PET/CECT in pre surgical staging of Neuroblastomas. Demonstrate utility of Radionuclide Imaging in treatment response assessment and dilemmas.
Explore the complex biology of Neuroblastoma using different receptor expression and its future use in therapeutics.

TABLE OF CONTENTS/OUTLINE
18 F FDG PET/CECT in neuroblastomas - As image guided risk factor in presurgical staging (INRGSS) - Comparison with 131 I MIBG and incremental value. - Complementary role in response assessment along with 131 I MIBG - Utility in Restaging
Understand complex tumor biology of Neuroblastoma - radionuclide imaging to identify expression of somatostatin, GLUT and nor epinephrine. Use of phenotype information for therapeutics in future.

Fibroblastic and Myofibroblastic Tumors of Childhood and Adolescence

TEACHING POINTS
Fibroblastic-myofibroblastic tumors account for about 12% of pediatric soft tissue tumors. Though most are benign, they can be locally aggressive and occasionally malignant. Most fibrous tumors have low signal intensity on T1 images, and variable signal on T2 weighted images depending on stage of proliferation. Diagnosis of Gardner fibroma may represent initial presentation of underlying familial adenomatous polyposis syndrome. Desmoid fibromatoses is locally aggressive neoplasm that has tendency to recur locally without evidence of metastatic spread. It has association with Gardner syndrome. Juvenile nasopharyngeal angiofibroma is a benign tumor that appears as an intensely enhancing mass along the pterygomaxillary fissure. Infantile fibrosarcoma tend to have multiple flow voids on MRI and can mimic hemangiomas and kaposiform hemangioendothelioma.

TABLE OF CONTENTS/OUTLINE
1. WHO classification of pediatric fibrous tumors - A. Pseudosarcomas (Nodular fasciitis) B. Fibromas (Gardner fibroma) C. Fibromatoses (Infantile myofibroma, Fibromatosis coli, Nasopharyngeal angiofibroma) D. Intermediate tumors (Desmoid, Inflammatory myofibroblastic tumor, Lipofibromatosis, Infantile fibrosarcoma) E. Sarcomas (Low grade fibromyxoid sarcoma) 2. We will discuss clinical, pathologic and imaging features of these common pediatric fibrous tumors.
From ACS to AVN: A Comprehensive Guide to the Systemic Imaging Characteristics and Radiologic Management of Sickle Cell Disease

**Education Exhibits**

**Location:** S101B

**Certificate of Merit**

**Participants**
- Thomas Michael Cullen MD (Presenter): Nothing to Disclose
- Steven M. Bernstein MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to: Discuss the etiology and pathophysiology of sickle cell disease. Review the characteristic and uncommon findings sickle cell disease on MRI, CT, ultrasound, radiograph, and scintigraphy. Discuss the complications of the disease and the radiologist's role in minimizing morbidity and mortality. Highlight the current recommendations for imaging sickle cell patients in the acute and clinical setting, with a discussion of research regarding the use of intravenous contrast in these patients.

**TABLE OF CONTENTS/OUTLINE**

- The genetics and pathophysiology of sickle cell disease (SCD).
- Case-based review of the systemic findings of SCD: Musculoskeletal: bone infarcts, marrow repopulation, osteomyelitis, osteonecrosis, septic arthritis.
- Abdominal: splenic infarct, cortical nephrocalcinosis.
- Chest: cardiomegaly, mosaic attenuation of lung parenchyma, ground glass opacities related to reperfusion of infarcted lung, osseous changes.
- Discussion of the complications and natural progression of the disease.
- Review current recommendations for imaging sickle cell patients in the acute and clinical setting, including the use of intravenous contrast.

Imaging in Paediatric Renal Tumors: How Can a Radiologist Contribute in Effective Management?

**Education Exhibits**

**Location:** S101B

**Participants**
- Seema Ashish Kembhavi MD, DMRD (Presenter): Nothing to Disclose
- Sajid Qureshi MS: Nothing to Disclose
- Girish Chinnaswamy: Nothing to Disclose
- Siddhartha Laskar MD: Nothing to Disclose
- Mukta Ramadwar: Nothing to Disclose
- Sneha Ashok Shah: Nothing to Disclose

**TEACHING POINTS**

- Atypical imaging features that can point to a non-Wilms' tumor diagnosis
- Pros and cons of National Wilms' Tumor Study (NWTS) and International Society of Paediatric Oncology (SIOP) approach
- Using imaging for selecting patients: can we get the best of both worlds?

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
   - Wilms' Tumor (WT) and other renal tumors
2. Diagnosis
   - Intra-renal versus extra-renal mass
   - Intra-renal mass: Pointers towards non-WT
   - Morphologic features of WT
   - Loco-regional spread along known pathways of spread
3. Staging of WT
   - NWTS and SIOP
   - Pictorial depiction for easy understanding
4. Comparison of NWTS and SIOP
   - NWTS and SIOP approach: what are they?
   - Pros and cons of both
   - Randomized Comparison of both: UKW3 trial
5. Biopsy of renal mass
   - Is it needed?
   - Is it safe?
   - Yields and Complications
6. How to use imaging for better selection of patients?
   - Inoperable ones for NWTS
   - Identifying ones at increased risk for tumor spillage
   - Identifying ones which are likely to be benefitted by pre-operative chemotherapy

Imaging of Early and Late Effects of Cancer Therapy in Children

**Education Exhibits**

**Location:** S101B

**Certificate of Merit**

**Participants**
- Govind Babusing Chavhan MD (Presenter): Nothing to Disclose
- Paul S. Babyn MD: Nothing to Disclose
- Paul Nathan MD, FRCP: Nothing to Disclose
- Sue Creviston Kaste DO: Nothing to Disclose

**TEACHING POINTS**

1. Effects of cancer therapy in children can be seen in early survival period or later in life in almost all organ systems of the body.
2. Many of these conditions are evaluated by imaging and some are diagnosed based on characteristic imaging features.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Common therapy options in childhood cancers
Early (during therapy) and late (after end of therapy) effects of cancer therapy
Therapy related conditions with illustration of imaging features in various systems:
- Endocrine system- Hypothyroidism, Growth Hormone deficiency, short stature BMD deficits, delayed bone age
- Pulmonary- Interstitial lung disease, parenchymal alterations, fibrosis, scarring, volume loss
- Hepatobiliary- Focal nodular hyperplasia, cholelithiasis, fibrosis, iron deposition
- Genitourinary- Renal atrophy, hemorrhagic cystitis, acquired vaginal occlusion
- MSK- Osteonecrosis, GCSF related marrow changes, marrow conversion, osteoporosis bone mineral density deficits, scoliosis, myositis, osteochondromas, radiation osteitis, premature phyeal closure, asymmetric phyeal closure, marrow fibrosis, post XRT growth disturbances, asymmetric growth
- Multisystem- GVHD, PTLD, Secondary malignancies

Summary and Teaching points
References

PDE197

Pediatric Lymphomas: Update on Imaging Findings

Education Exhibits
Location: S101B

Participants
Maria Virginia Trujillo Ariza MD (Presenter): Nothing to Disclose
Annelies Coessens MD : Nothing to Disclose
Maria Cruz Agetos Casais MD : Nothing to Disclose
Andres Lopez Carballera MD : Nothing to Disclose
Mercedes Linares Paz MD : Nothing to Disclose
Julia Cortez Hernandez MD : Nothing to Disclose

TEACHING POINTS
• To review the epidemiology and presentation of Hodgkin’s lymphoma (HL) and non-Hodgkin’s lymphoma in the pediatric age population.
• To describe the anatomopathological classification of HL and NHL.
• To describe the utility of the different imaging techniques (x-ray, US, TC, MRI and PET) in the diagnosis and follow-up of these patients.
• To review the principal imaging findings on pediatric’s HL and NHL and summarize some of the main treatment complications.
• To analyze the main criteria for the evaluation of therapeutic response.

TABLE OF CONTENTS/OUTLINE
• Epidemiology and presentation of HL and NHL
• Anatomopathological classification of HL and NHL.
• Utility of imaging techniques: x-ray, US, TC, MRI and PET.
• Imaging findings for: initial diagnose and treatment complications
• Therapeutic response.

PDE199

The Role of MIBG SPECT/CT in Neuroblastoma: A Pictorial Review

Education Exhibits
Location: S101B

Participants
Olivia Carney FFR(RCSI) (Presenter): Nothing to Disclose
Lorenzo Biassoni MBBS : Nothing to Disclose
Marina Easty FRCP : Nothing to Disclose

TEACHING POINTS
Neuroblastoma is the third commonest childhood tumour after leukaemia and brain malignancies. I-123-labelled MIBG scintigraphy is considered the best diagnostic technique for evaluation of disease activity at presentation and at follow-up with a reported sensitivity of 93% and specificity of almost 100%. Interpretation of CT and MRI after surgery or radiotherapy can be challenging but integration with MIBG SPECT enables a direct correlation of anatomic information and functional information resulting in better localization and definition of scintigraphic findings. Objectives of this pictorial review: To review the contribution of MIBG SPECT/CT in diagnosis of Neuroblastoma. To illustrate the diagnostic usefulness of MIBG SPECT/CT in the assessment of Neuroblastoma post treatment including improved disease localization and identification of metastatic disease.

TABLE OF CONTENTS/OUTLINE
Outline: MIBG SPECT/CT plays a useful role in the diagnosis and follow-up of Neuroblastoma. It improves image interpretation and therefore assists in future treatment planning. This pictorial review includes cases demonstrating the benefits of MIBG SPECT/CT including: Accurate anatomic localization of the pathologic site. Detection of metastatic disease. Differentiating postsurgical changes from recurrent disease. Early detection of disease relapse.

PDE200

Whole-body Magnetic Resonance Imaging of Neuroblastoma to Reduce Radiation Exposure: Effectiveness for Follow-up, Re-staging and Evaluation of Disease Response to Therapy

Education Exhibits
Location: S101B

Participants
Mototaka Miyake MD (Presenter): Nothing to Disclose
Yoshiaki Watanabe MD : Nothing to Disclose
Masakatsu Tsurusaki MD, PhD : Nothing to Disclose
Kazuro Sugimura MD, PhD : Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group
Yasuki Arai : Nothing to Disclose

TEACHING POINTS
Neuroblastoma (NB) requires multimodal diagnostic imaging methods including radiography, CT, metaiodobenzylguanidine (MIBG) scintigraphy, and bone scintigraphy, FDG-PET, and MRI. Whole-body MRI (WB-MRI) which enables both local staging and detection of metastatic spread in one approach is useful to minimize radiation exposure during the sequential evaluation of younger patients. This exhibit will show the usefulness and the limitation of WB-MRI for follow-up, re-staging and evaluation of disease response to therapy of NB.

**TABLE OF CONTENTS/OUTLINE**

1. Quick Review of the clinical and the multimodal imaging manifestations of neuroblastoma with emphasis on WB-MRI. 2. Introduction of management strategies for follow-up, re-staging and evaluation of disease response to NB. 3. MR imaging techniques to improve quality and consistency in evaluation. The transversal 2D sequential scan including STIR, T2WI, DWI, pre-contrast DIXON and post-contrast DIXON and the high-resolution 3D scan, both of which can be obtained exactly at isocenter, provide seamless images without the boundary artifacts and the distortion. The total scan time of all the sequences is ranging from 45 min to 60 min. 4. Case-based review of recurrence, metastatic disease, treatment response and post-therapeutic surveillance. 5. Pitfalls and limitations of WB-MRI.

**PDE201**

**Child Abuse Injuries: Spectrum of Imaging Findings**

*Education Exhibits*

*Location: S101B*

**Participants**

- Alba Lucia Reyes Ortiz MD (Presenter): Nothing to Disclose
- Maria Isabel Garcia-Hidalgo MD: Nothing to Disclose
- Purificacion Calvo: Nothing to Disclose
- Sonia DieguezTapia MD: Nothing to Disclose
- Lina Marcela Cruz Hernandez ARRT: Nothing to Disclose
- Maria TERESA Herrera Lopez MD: Nothing to Disclose

**TEACHING POINTS**

Child abuse or nonaccidental trauma (NAT) is a fairly common condition. Its diagnosis is a challenge, however it is imperative that this diagnosis be made to prevent further physical, mental, and emotional harm to the affected children. The radiologist plays a fundamental role in order to document the abuse. The purpose of this paper is to review the clinical and radiologic spectrum of child abuse signs, through the description, analysis of the mechanism and classification of radiological findings of inflicted lesions, by implementing schemes applied to real cases of our hospital, because the key to diagnosing child abuse early is to know and recognize its radiological signs and to keep a high clinical suspicion.

**TABLE OF CONTENTS/OUTLINE**

- Background.
- Review of the image appearance in the findings of child abuse with a systematic approach to interpretation.
- Description of the skeletal injuries in extremities, spine, scapula, and rib cage, as well as head injuries.
- Medical illustrations - CT, X-Rays and MRI images from cases of our hospital.

**PDE202**

**Do We Need All the Radiographs in a Skeletal Survey for Suspected Non Accidental Injury? Experience from a Paediatric Tertiary Referral Centre and Up to Date Literature Review**

*Education Exhibits*

*Location: S101B*

**Participants**

- Walid Al-Deeb MBBS, MRCP (Presenter): Nothing to Disclose
- Joanne Warner MBChB, MRCS: Nothing to Disclose
- Farhat Bano: Nothing to Disclose
- Caren Landes: Nothing to Disclose

**TEACHING POINTS**

1. To gain awareness of the current Non-Accidental Injury skeletal survey guidelines and potential anticipated changes.
2. To beware of pitfalls in Non-Accidental Injury skeletal survey assessment, particularly pertaining to the spinal region.
3. An invaluable imaging review of the classical injuries seen in child abuse.

**TABLE OF CONTENTS/OUTLINE**

- Current UK and US skeletal survey guidelines in suspected non accidental injury. Elaborate on contemporary discussions relating to the exclusion of certain radiographs from the skeletal survey with reference to the current literature.
- Analysis of 189 skeletal surveys reviewed by a Paediatric Radiologist with extensive experience as an expert witness in child protection proceedings. Common fractures encountered (Table 1) Pitfalls of spinal imaging (Figure 1) Charts comparing which view the fracture was commonly seen in (for ribs and skull) (Figure 2) How our data compares with current literature. - Images of some of the fractures from our cases as an essential refresher of the more typical injuries seen in child abuse. (Figure 4) Discuss the need for an updated template in light of our findings and the published literature, with reference to the ALARA principle to obviate exposure to unnecessary ionising radiation.

**PDE203**

**Get a Handle on Handlebar Injuries: Multimodality Assessment of Common and Uncommon Handlebar Injuries in Pediatric Patients**

*Education Exhibits*

*Location: S101B*

**Participants**

- Nourolhoda Birouti MD (Presenter): Nothing to Disclose
- Benjamin Teichman Addicott MD, MS: Nothing to Disclose
TEACHING POINTS

1. To review the mechanism responsible for abdominal handlebar injuries. 2. To illustrate handlebar injuries resulting in visceral, intestinal, soft tissue, and vascular trauma. 3. To illustrate how imaging contributes to diagnosis and management of handlebar injuries.

TABLE OF CONTENTS/OUTLINE

- Introduction/explanation of mechanism behind handlebar injuries
- Visceral injury
- Intestinal injury
- Soft tissue injury
- Vascular injury
- Conclusion

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PDE204

Novel and Unique Applications of Contrast Enhanced Ultrasound (CEUS) as a Bedside Problem-solving Tool in the Management of the Acute Pediatric Patient

Education Exhibits
Location: S101B
Certificate of Merit

Participants
- Annamaria Deganello MD (Presenter): Speaker, Bracco Group
- Eleni Konstantatou MD, MSc: Nothing to Disclose
- Anu Obaro MBBS: Nothing to Disclose
- Maria E. Sellars MD, FRCR: Nothing to Disclose
- Paul Singh Sidhu MRCP, FRCR: Speaker, Bracco Group Speaker, Siemens AG Speaker, Hitachi, Ltd

TEACHING POINTS

We illustrate the benefits of bedside use of CEUS in a variety of acute pediatric medical problems, in which it contributes to achieve immediate effective patient management, without recourse to CT and MR imaging, eliminating radiation exposure and the need for sedation.

TABLE OF CONTENTS/OUTLINE

- CEUS is a rapid, safe, radiation-free and accurate technique that, despite remaining "off-label" in the context of pediatric imaging, proves to be extremely beneficial for this group of patients, and has an expanding role in children with the desire to reduce radiation exposure. This pictorial review illustrates a variety of unusual cases where CEUS was tremendously effective in the immediate diagnosis of abnormalities and in the acute management of pediatric patients. CEUS imaging findings of complicated pneumonias, biliary complications of liver transplant and inflammatory bowel disease are described. We also display examples of intra-cavitary use of CEUS, a novel application of this method, with diluted microbubbles being injected through thoracic and biliary catheters, which allows exact localization of the drains and accurate measurement and detection of complications of drained fluid collections or bile ducts.

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PDE205

Surviving to Pediatric Diseases: New Faces of Disease in Adults (Long Term Complications and New Ones)

Education Exhibits
Location: S101B

Participants
- Maria Pardo-Antunez (Presenter): Nothing to Disclose
- Xavier Merino-Casabiel MD: Nothing to Disclose
- Ana Coma RT: Nothing to Disclose
- Victor Sanchez Pineda MD: Nothing to Disclose
- Sergi Quiroga MD: Nothing to Disclose
- Rosa Dominguez-Oronoz MD: Nothing to Disclose

TEACHING POINTS

Review the complications that may arise in adults from therapy and long-term survival of pediatric diseases. Describe the spectrum of radiological findings, with an emphasis in MRI and CT.

TABLE OF CONTENTS/OUTLINE

- Therapeutic advances in the treatment of a wide range of pediatric diseases have improved the prognosis of life. The rate of long-term survival of these patients, which may be almost normal, has also increased the risk of developing other complications of their underlying disease or long-term complications related to treatment. It can be a challenge for radiologist identify them for not being aware. We illustrate these "new faces of disease" with examples of emerging complications of diseases secondary to survival rate improvement (Cystic fibrosis and Distal intestinal obstruction syndrome) or long-term complications related to the treatment that the no pediatric radiologist is not aware (Repaired congenital heart disease and liver cirrhosis and/or tumors, Radiotheraphy or grow-hormone replacemet and vascular diseases, Radiotheraphy or immunosupressor treatments and secondary neoplasm). In conclusion, radiologists should be familiar with the long-term consequences of therapy or unusual presentation of some diseases because the long-term prospects of survival associated with these diseases.
PDE206

The “DWIBSlight” Saga: Breaking Dawn - Shedding Light on DWIBS Imaging in Pediatric Patients

Education Exhibits
Location: S101B

Certificate of Merit

Participants
Monica Epelman MD (Presenter): Nothing to Disclose
Carolina V. Guimaraes MD: Nothing to Disclose
David Dinan MD: Nothing to Disclose
Craig M. Johnson DO: Nothing to Disclose
Lane F. Donnelly MD: Author with royalties, Reed Elsevier Author with royalties, Amirsys, Inc

TEACHING POINTS
- To identify indications for DWIBS imaging in children
- To review normal DWIBS appearances in different body regions and understand imaging pitfalls
- To illustrate examples of pathological conditions

TABLE OF CONTENTS/OUTLINE
DWIBS, diffusion-weighted whole body imaging with background body signal suppression, is a free-breathing, fast MRI sequence that does not require contrast. It is based on the detection of random Brownian motion of water over very small distances. DWIBS is an alternative to PET imaging in pediatric patients due to the lack of radiation. Technical aspects of DWIBS and the current role of the method in pediatric imaging will be presented.

1. Background
2. Normal appearances
3. Pitfalls
4. Abnormal examples in oncology imaging
5. Abnormal examples in other entities
6. Summary

PDE207

Utility of 18F-FDG PET/CT in the Pediatric Patient: Imaging Review of Common and Rare Non-malignant Causes of Fever of Unknown Origin in the Pediatric Patient

Education Exhibits
Location: S101B

Participants
Kelly C. Borden (Presenter): Nothing to Disclose
Phillip Jahyung Koo MD: Advisory Board, Bayer AG Research Consultant, Dendreon Corporation Speaker, Dendreon Corporation Consultant, Eli Lilly and Company Consultant, General Electric Company
Jennifer Jinyang Kwak MD: Nothing to Disclose
Brian M. Bagrosky MD, MS: Research Consultant, Eli Lilly and Company

TEACHING POINTS
- Understand the utility of 18F-FDG PET/CT in the workup of fever of unknown origin (FUO) in the pediatric population.
- Discuss important differences in the 18F-FDG PET/CT protocol for the pediatric patient from the adult patient.
- Recognize the normal biodistribution of 18F-FDG in the pediatric patient.
- Identify both common and rare non-malignant etiologies of FUO in the pediatric population.
- Describe imaging pearls and potential imaging pitfalls in the work up of pediatric FUO with 18F-FDG PET/CT

TABLE OF CONTENTS/OUTLINE
Review of the pediatric 18F-FDG PET/CT protocol - Patient preparation - Radiopharmaceutical dosing - PET/CT scanning protocols - Radiation dose comparisons - Normal physiologic and pathophysiologic FDG biodistribution in the healthy and septic pediatric patient, respectively - Imaging examples of non-malignant etiologies of FUO by organ system with discussion of imaging pearls and potential imaging pitfalls - Central nervous system - Parietal lobe abscess, meningitis - Pulmonary - Pneumonia with loculated pleural effusion - Gastrointestinal - C. Difficile colitis - Genitourinary - Pyelonephritis, Pyonephrosis with obstructing staghorn calculus, tubo-ovarian abscess - Lymphatic/Hematological - Kikuchi’s disease, deep venous thrombosis - Musculoskeletal - CRMO, osteomyelitis

PDE209

Optimal Use of the Automatic Tube Current Modulation (ATCM) at Pediatric CT

Education Exhibits
Location: S101B

Participants
Takanori Masuda (Presenter): Nothing to Disclose
Yoshinori Funama PhD: Nothing to Disclose
Naoyuki Imada: Nothing to Disclose
Takayuki Oku: Nothing to Disclose
Masao Kiguchi RT: Nothing to Disclose
Kazuo Awai MD: Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIIICHI SANKYO Group Research Grant, Eisai Co, Ltd
TEACHING POINTS

The purpose of this educational exhibit is to: 1. Help you understand the ATCM technique 2. Describe methods for effective use of the ATCM for the child patient 3. Propose the optimal scan protocol to reduce radiation dose for the child

TABLE OF CONTENTS/OUTLINE

- Easy explanation of the ATCM for pediatric CT examinations
- Patient factors - subject size - breathing effect
- Technical factors - setting noise index - helical pitch - tube voltage - X-ray filter-such as bow-tie filter - image filter-such as adaptive noise reduction filters
- Our proposed scan protocol for achieving optimal image quality and radiation dose reduction

PDE211

The Pros and Cons of Using Low kVp in CT Imaging

Education Exhibits
Location: S101B

Participants
Jianying Li (Presenter): Employee, General Electric Company
Xiaolei Tong: Employee, General Electric Company
Yun Shen PhD: Employee, General Electric Company

TEACHING POINTS

1) To illustrate the limitations of using fixed tube voltage at 120kVp or 140kVp in CT imaging, especially for pediatric patients
2) To illustrate the advantages and disadvantages of using low kVp in CT imaging
3) To demonstrate strategies of selecting the kVp based on patient size and clinical tasks

TABLE OF CONTENTS/OUTLINE

1) Standard CT imaging and its limitations - fixed tube voltage at 120kVp or 140kVp with mA modulation - potentially higher contrast medium (CM) dose for adequate enhancement, especially in venography - potentially higher radiation dose for adequate contrast-noise-ratio (CNR) 2) Pros and cons of using low kVp - contrast improvement with low kVp in contrast enhanced CT scans - lower dose efficiency and higher image noise with increased patient size at low kVp - The use of iterative reconstruction (IR) for noise reduction 3) Optimal strategies using these technologies - patient size and clinical task-dependent low kVp selection - balancing noise and CNR based on clinical tasks - proper IR strength for further reducing noise

VSPD11

Pediatric Series: Neuro

Series Courses

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Participants
Moderator
Richard Lee Robertson MD: Nothing to Disclose
Moderator
Marvin Dale Nelson MD: Nothing to Disclose

Sub-Events

VSPD11-01  Congenital Spinal Anomalies
Erin Simon Schwartz MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the relevant developmental embryology and an easily implemented clinico-radiological classification system for improvement in the understanding and diagnosis of congenital spinal anomalies

ABSTRACT

Disruption of the process of neurulation of the developing spinal cord and its surroundings results in an array of dysmorphology. An understanding of the embryological processes, and the variety of appearances that result when they occur abnormally, will allow the radiologist to more confidently and accurately diagnose spinal dysraphism. Clinico-radiological classification systems will be reviewed in detail, with specific case examples from both pre- and postnatal imaging.

VSPD11-02  Improving Fractional Anisotropy Measurements and Gray Matter/White Matter Differentiation in DTI of the Pediatric Spinal Cord Using Rigid Body Motion Correction
Devon M. Middleton: Nothing to Disclose, Scott Hunter Faro MD (Presenter): Nothing to Disclose, Mary Jane Mulcahey: Nothing to Disclose, Feroze B. Mohamed PhD: Nothing to Disclose

PURPOSE

Disruption of the process of neurulation of the developing spinal cord and its surroundings results in an array of dysmorphology. An understanding of the embryological processes, and the variety of appearances that result when they occur abnormally, will allow the radiologist to more confidently and accurately diagnose spinal dysraphism. Clinico-radiological classification systems will be reviewed in detail, with specific case examples from both pre- and postnatal imaging.
Spinal cord diffusion tensor imaging (DTI) is a relatively new field of research that may lead to better understanding of physiologic changes in many spinal cord pathologies. Physiological motion can create problems in DTI of the spinal cord. Spinal cord DTI is complicated by oscillation and pulsation of the cord, and by noise introduced by cardiac and respiratory motion. If motion is not corrected for, results of DTI analysis are impacted, including, false decrease in white matter fractional anisotropy (FA), poor delineation of the cord/CSF interface, and poor gray/white matter differentiation. The purpose of this work was to show efficacy of rigid 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 added 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 for both corrected and uncorrected images.

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, 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 - 4years) 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 extended 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.

VSPD11-05

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 the 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.

VSPD11-07

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 controls. 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 Wisnouski 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, Philip 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<0.5). 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, glutamine 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 is 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.

**PDS-SUA**

**Pediatric Sunday Poster Discussions**

**Scientific Posters**

**PDS212**

**Osteochondral Lesions of the Femoral Cartilage follow a Distinctive Pattern: Comparison of MR findings with Split Line Maps of the Knee Joint (Station #1)**

Anna L. Falkowski (Presenter): Nothing to Disclose, Carlo Camathias: Nothing to Disclose, Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc Olaf Magerkurth MD: Nothing to Disclose

**PURPOSE**

To characterize MR findings of osteochondral lesions in the knee joint with regard to location, size, shape, orientation of the axes and compare these findings with a split line map of the distal femoral cartilage.

**METHOD AND MATERIALS**

IRB approval was obtained. Patients with acute OCDs were included. The following measurements and observations were obtained: location, depth, shape and size of the OCD. Lesions with a ratio of short axis / long axis <0.6 were considered as oval and over 0.6 as round lesions. Orientation of the long and short axes were compared to a split line map. Interreader Agreement was tested with a paired two tailed t-test.

**RESULTS**

56 patients were included in the study. 17 OCDs were located in the medial central portion of the medial femoral condyle joint surface (R13, Fig.1). The location of the other lesions were: 4 in R1, 1 in R4 and R7, 4 in R10, 6 in R11, 1 in R12, 5 in R14, 8 in R17, 4 in R19, and 1 in R20. Orientation of the long axis correlated with the split line map. In regions R10-R12, lesions were round, whereas they were oval in R4, R7 and R13-R20. Testing for interreader agreement showed no significant difference and a good correlation (p=0.067, r=0.7100).

**CONCLUSION**

In this study shape of osteochondral lesions in the knee joint do follow split line maps representing the layered structure of the cartilage. We assume that paying attention to orientation of autologous chondral grafts might increase stability a the recipient site and improve outcome.

**CLINICAL RELEVANCE/APPLICATION**

The majority of osteochondral defects (OCD) in the knee joint occur in the femoral cartilage. According to the International Cartilage Repair society (ICRS) OCDs should be characterized by location (Fig. 1B), size, depth and involvement of the underlying bone. According to histological and biomechanical studies the cartilage is not an amorphous mass covering the epiphysis, but consists of a layered matrix orientated to tensile forces during motion of the joint. This layering is supposed to increase stability of the cartilage. We observed that osteochondral lesions are oval in shape and that the long axis may correlate with split lines maps (Fig. 1A) of the femoral cartilage. This might imply that in autologous chondral grafting paying attention to orientation of chondral plugs at the donor and recipient site might improve the outcome.

**PDS213**

**Reading Networks in Children with Dyslexia Compared to Children with Ocular Motility Disturbances Revealed by fMRI (Station #2)**

Ibone Saralegui MD (Presenter): Nothing to Disclose, Begona Garcia-Zapirain MD: Nothing to Disclose, Begona Fernandez-Ruanova: Nothing to Disclose, Alejandro Basterra: Nothing to Disclose, Jose Maria Ontanon MD: Nothing to Disclose, Ricardo Martinez MD: Nothing to Disclose

**PURPOSE**

To analyze the neural network while reading in a group of dyslexic children and to compare it that in two other groups, one of children with normal development and the other of children with monocular vision secondary to ocular motility disorders, to assess whether dyslexic readers share neuronal patterns with children with ocular motility disorders; if, in contrast, there are differences in their language networks, ocular motility disorders should not be considered a cause of dyslexia.
METHOD AND MATERIALS

We conducted a comprehensive fMRI study including three different cognitive tasks, two lexical decision tasks and a semantic categorization task, in order to explore the two main routes of reading, phonological and orthographic. We studied the brain activation pattern while reading in the most eloquent cortical areas from the two reading routes, and the strength of their association with reading scores in 66 Spanish children aged 9-12 years divided into three groups: typically developing readers (controls) (TDR), dyslexic readers (DXR) and readers with monocular vision due to ocular motility disorders (MVR).

We used a non-parametric K Test for comparisons between the three groups, followed by a post hoc MW test for comparisons between pairs of groups.

RESULTS

For the three paradigms, the pattern of activation while reading in MVRs seems different from that in DXRs but be similar to that in TDRs. In relation to the two paradigms designed to explore the phonological route, DXR tended to hypoactivate the posterior region of the VWFA (Visual Word Form Area): (p = .001, K-W test), DXRs vs TDRs (p = .002, M-W test); and vs MVRs (p = .002, M-W test); as well as the left Wernicke's area, and both the Broca's areas. In the paradigm linked to the orthographic route, the semantic categorization task, DXR hypoactivated the left Wernicke's area: MVRs vs DXRs (p = .016, M-W test); and both triangular regions of both Broca's areas, and they seemed to compensate by activating the Wernicke's area of the contralateral hemisphere: (p = .005, K-W test), DXR vs TDRs (p = .002, M-W test).

CONCLUSION

According to our results, Spanish DXR do not have the same brain network for reading as MVR. Ocular motility disorders would not be a causal factor for dyslexia.

CLINICAL RELEVANCE/APPLICATION

fMRI might help to distinguish the underlying mechanisms of dyslexia and its relation with visual impairment, with beneficial consequences for its diagnosis and treatment.

PDS214

Addition of High Resolution Balanced Fast Field Echo Sequence of Lumbosacral Spine Increases Reviewer Confidence and Agreement among Reviewers in Evaluation of Spinal Drop Metastases in Children with Brain Tumors (Station #3)

Korgun Koral MD (Presenter): Nothing to Disclose , Nabila Choudhury MD : Nothing to Disclose , Lynn Gargan PhD : Nothing to Disclose , Song Zhang PhD : Nothing to Disclose , Timothy Nicholas Booth MD : Nothing to Disclose

PURPOSE

To test whether addition of a balanced fast field echo (BFFE) sequence increases confidence of diagnosis and inter-observer agreement in diagnosis of spinal drop metastases in children with brain tumors.

METHOD AND MATERIALS

Institutional review board approval was obtained for this retrospective HIPAA compliant study. Query of the Neuro-Oncology database from 3/2010 through 3/2013 yielded 42 patients (113 examinations) who underwent MRI for evaluation of spinal drop metastasis using a protocol with both gadolinium enhanced (sagittal and axial) T1W spin echo (SE) sequences and sagittal BFFE sequence of the lumbosacral spine. Two pediatric neuroradiologists with 12 and 16 years' experience independently reviewed the de-identified studies that were presented randomly. Three sessions, at least 15 days apart, were conducted with each reviewer. At each session, only the T1W SE sequences, only the BFFE sequence and combined T1W SE and BFFE sets were reviewed. The reviewers recorded the presence or absence of the drop metastases and their confidence levels (3= highly confident, 2= moderately confident, 1= not confident). The degree of agreement between the reviewers was assessed for each dataset. Whether the addition of BFFE to T1W SE sequence influenced the diagnosis and confidence level was analyzed.

RESULTS

Kendall’s coefficient of concordance (0.85) was greater for the combined data set than it was for T1W SE and BFFE sequences, 0.73 and 0.80, respectively. Addition of BFFE resulted in a change in diagnosis of drop metastasis from negative to positive in 9.7% and 7.1% of examinations and from positive to negative in 7.1% and 1.7% of examinations for the reviewers, respectively. The diagnoses changed in 13.7% of observations when both reviewers' evaluations were combined (31/226).

CONCLUSION

Addition of high resolution BFFE sequence to gadolinium enhanced T1W SE sequence increases the confidence and agreement among reviewers. A significant percentage of diagnoses changed with inclusion of BFFE sequence in the imaging protocol.

CLINICAL RELEVANCE/APPLICATION

Accurate detection of spinal drop metastases determines the delivery and dose of spinal radiation in children with brain tumors. Demonstration of clinical utility characterized by increased rates of agreement and confidence of an additional sequence is important in justifying the additional scanning time (on the order of 4-5 minutes).
Alterations of the Regional Low-frequency Fluctuation and Peculiarities of the Brain Metabolism in Autistic Children: fMRI and In-vivo 1H MRS Study (Station #4)

Zina Z. Rozhkova PhD, DSc (Presenter): Nothing to Disclose, Oleksii Omelchenko: Nothing to Disclose

PURPOSE

We propose amplitude of low-frequency fluctuations ALFF, and values of the fractional ALFF (fALFF), and also the ratios of the main cerebral metabolites for the characteristics of functional and metabolic abnormalities of autism.

METHOD AND MATERIALS

26 children are examined by fMRI and 1HMRS using 1.5T Signa EXCITE HD (GE). All subjects are divided into two groups. The 1st group (NG) consists of 8 healthy children (3-16yo). The 2nd group (PG) includes 18 (3-14yo) autistic children. For all subjects T2*W-GE-EPI (TR/TE=3000/71ms) were obtained. Single, and group ICA analysis using MELODIC were carried out. The frequency fluctuations of the BOLD signal in the range 0.0024-0.167 were measured. ALFF and fALFF were calculated using REST software, and analyzed in two different frequency bands (slow-5:0.01-0.027Hz, slow-4:0.027-0.073Hz). To detect the differences of ALFF and fALFF in two groups for all voxels in the gray matter (GM) the GLM was applied. 1H spectra are recorded with STEAM:TR/TE=1500/144ms in both hemispheres in the white and gray matter (WM, GM).

RESULTS

In PG decreasing ALFF of both frequency bands and fALFF of slow-5 band, including left inferior/middle/superior temporal gyrus, left inferior parietal gyrus, left supramarginal gyrus, left angular gyrus, left fusiform gyrus, left middle occipital gyrus are found. In PG in slow-4 band fALFF decreased in right inferior/middle/superior temporal gyrus, right supramarginal gyrus, right angular gyrus, right fusiform gyrus, and right lateral cerebellum. In contrast, ALFF of slow-5 band increased in bilateral brainstem, cerebellar vermis, media cerebellum, and left parahippocampal gyrus. Frequency-specific ALFF/fALFF abnormalities in PG are associated with deficit of social cognition. In PG decrease of NAA/Cr, increase of Cho/Cr, and mIns/Cr in anterior cingulate and left striatum in comparison with NG are obtained. In WM in the NG in the age 3-6y the Glu/Cr increase rapidly from (0.23+-0.02), reach maximum in 6y (0.34+-0.02), and thereafter decreased moderately to adults level (0.30+-0.02) for the age 8y. In GM in the NG in the age 3-6y the Glu/Cr (0.28+-0.02) increase rapidly before values (0.36+-0.03), characteristic for adult level.

CONCLUSION

fMRI and MRS gives us a possibility for monitoring of the brain functional development in the norm and under pathology.

CLINICAL RELEVANCE/APPLICATION

We combined these methods to understanding of the mechanisms of autism formation.

MRI of Fetal Congenital Diaphragmatic Hernias: Liver and Lung Volume Index of Neonatal Survival (Station #5)

Beth A. Furey MD, BEng (Presenter): Nothing to Disclose, April Alexander Bailey MD: Nothing to Disclose, Kevin Worley MD: Nothing to Disclose, Patricia Santiago-Munoz MD: Nothing to Disclose, Jodi S Dashe MD: Nothing to Disclose, Diane Mary Twickler MD: Nothing to Disclose

PURPOSE

To evaluate the percentage of fetal lung and liver occupied in the thorax with MRI as predictors of survival in fetuses with congenital diaphragmatic hernias (CDH).

METHOD AND MATERIALS

A retrospective review of fetuses with the diagnosis of isolated CDH referred for fetal MR from July 2001 to December 2013 was performed. Observed lung volume and intrathoracic liver ("liver-up") volume to expected lung volume ratios were calculated using region of interest (ROI) measurements, and compared to neonatal survival. Data stratified for gestational age (GA) at the time of MR examination (≤ 28 weeks vs. > 28 weeks) was also compared. Wilcoxon rank sum tests were used for individual significance of lung volume and liver-up ratios in determining neonatal survival. Logistic regression was used for predicting neonatal survival.

RESULTS

To date, 48 MR examinations of fetuses with isolated CDH who had neonatal outcomes available have been included. Newborns who survived the neonatal period had significantly larger observed to expected lung volume ratios [median 0.25 (Q1 = 0.17, Q3 = 0.42) vs. 0.13 (Q1 = 0.10, Q3 = 0.20), p=0.0004] and smaller liver-up to lung volume ratios [median 0.08 (Q1 = 0, Q3 = 0.16) vs. 0.27 (Q1 = 0.19, Q3 = 0.41), p=0.0002] than the non-survivors. Measurements of observed to expected lung volume ratios obtained at a GA of ≤ 28 weeks were less predictive [median 0.42 (Q1 = 0.17, Q3 = 0.43) vs. 0.16 (Q1 = 0.10, Q3 = 0.27), p=0.0474] than GA > 28 weeks [median 0.25 (Q1 = 0.17, Q3 = 0.33) vs. 0.13 (Q1 = 0.08, Q3 = 0.16), p=0.0031]; measurements of liver-up to expected lung volume ratio obtained at a GA of ≤ 28 weeks were also less predictive [median 0.11 (Q1 = 0, Q3 = 0.16) vs. 0.22 (Q1 = 0.16, Q3 = 0.35), p=0.0356] compared to GA > 28 weeks [median 0.05 (Q1 = 0, Q3 = 0.16) vs. 0.35 (Q1 = 0.20, Q3 = 0.43), p=0.0004]. Both remained statistically significant. A logistic regression analysis was generated for survival with area under the curve (AUC) based on both MR volumes and GA = 0.9304 [95% CI: 0.8654, 0.9954].
volumes and GA = 0.9304 [95% CI: 0.8654, 0.9954].

**CONCLUSION**

The fetal MR combination of liver-up and lung volume ratios in conjunction with gestational age at the time of study can assign an index which may be helpful in predicting survival of fetuses with CDH.

**CLINICAL RELEVANCE/APPLICATION**

Accurate prediction of survival in fetuses with CDH by MR measurements of lung and liver-up volumes is important for antenatal parental counseling and decisions for neonatal care.

**PDE166**

**Tumor-like Musculoskeletal Lesions in Children and Young Adults: MR Appearance of Multifocal Diseases (Station #6)**

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

**TEACHING POINTS**

The purpose of this exhibit is to:

1) Demonstrate an extensive collection of osseous tumors and tumor-like conditions in pediatric and young adult patients that present in a multifocal, diffuse, or poorly defined manner.

2) Discuss MR findings in both malignant and non-malignant conditions.

3) Illustrate key clinical and pathopysiologic principles that aid in diagnosis and prognostication.

**TABLE OF CONTENTS/OUTLINE**

*Nonmalignant*
- Inherited anemias (sickle cell disease, thalassemia, sideroblastic anemia)
- Bone infarction
- Serous atrophy of malnutrition (anorexia nervosa)
- Gaucher disease
- Osteomyelitis
- Hypervitaminosis A and D
- Fluorosis
- Lead toxicity
- Glycogen Storage Disease type 1A and 1B
- Langerhans Cell Histiocytosis/Eosinophilic Granuloma
- Radiation Injury
- Multiple enchondromatosis (Ollier disease, Maffucci syndrome)
- Fibrous dysplasia (polyostotic, McCune Albright)
- Multiple Osteochondromas
- Reflex Sympathetic Dystrophy

*Malignant*
- Leukemia
- Metastatic disease
- Lymphoma

**PDE189**

**What a Radiologist Should Knows about Pediatric Ocular Ultrasound (Station #7)**

Ana Maria Vargas Diaz MD (Presenter): Nothing to Disclose, Diana Garcia Casado: Nothing to Disclose, Gloria Gomez Mardones: Nothing to Disclose, Arturo Rodriguez Minguez: Nothing to Disclose

**TEACHING POINTS**

Review the congenital and acquired ocular pathology that may involve the pediatric orbit.

Review ocular sonography performed in our center, select the most representative images and illustrate the characteristic radiological images.

**TABLE OF CONTENTS/OUTLINE**

Ultrasound is the technique of choice for evaluating orbital pathology in children in the initial study of a wide spectrum of diseases and an additional tool for the ophthalmoscopic assessment

Orbital pathology is divided into:

- Congenital: Persistent hyperplastic primary vitreous, congenital cataracts, coloboma, drusen, coats disease and congenital microphthalmos.

- Acquired: Traumatism and tumors.

Ocular sonography is able to demonstrate the morphology of the lesions, solid or cystic nature or the presence of calcification, hemorrhage, retinal/choroid detachment and foreign bodies.

The study was performed placing the transducer directly on the eyelids after applying gel on them. Ocular assessment begins with the identification of the anatomical characteristics and must continue with the specific characteristics and structural abnormalities.

The indications of the ocular ultrasound are: Opacity of the ocular media, marked pupillary miosis, visible mass on clinical examination, retinal/choroid detachment, trauma, foreign body and clinical suspicion of congenital microphthalmia
Initial Application of Diffusional Kurtosis Imaging (DKI) in Brain Development of Preterm Infants and Evaluation of DKI in Hypoxic-ischemic Encephalopathy (Station #1)

Jingjing Shi (Presenter): Nothing to Disclose, Jian Wang: Nothing to Disclose, Wenzhen Zhu MD, PhD: Nothing to Disclose

PURPOSE

To observe correlations of DKI parameters with the postmenstrual age (PMA), and compare these parameters between preterm infants at term equivalent age (TEA) and term infants.

METHOD AND MATERIALS

Conventional magnetic resonance imaging and DKI were performed in 33 preterm infants (18 preterm infants at term-equivalent age) and 7 term controls. Among them, 25 preterm infants (15 infants before TEA, 10 at TEA) and all the term controls had normal brain MRI performance and normal physical and neurologic examination, while the left 8 infants had typical MRI performance of hypoxic-ischemic injury. Consent forms were obtained prior to the study. The values of MK (mean kurtosis), K// (axial kurtosis) and K? (radial kurtosis) from the lentiform nucleus (LN), the ventrolateral thalamus (VLM), the posterior limb of internal capsule (PLIC), the corona radiate (CR), the frontal, parietal, occipital and temporal white matter (FWM, PWM, OWM, TWM correspondingly) on both hemi-cerebrum were obtained.

RESULTS

Different levels of correlations existed between PMA and the values of MK, K//, K? from the selected ROIs. The MK values from the PLIC, CR, LN of both sides showed high correlation with PMA (r>0.6). In addition, K? values from the left PLIC, K// values from the right OWM were significantly different between the preterm infants at TEA and the term controls.

CONCLUSION

The DKI-derived measures at both white matter and grey matter showed high correlation with the postmenstrual age. MK, K//, K? values could be useful to differentiate the preterm infants group from the term infants group.

CLINICAL RELEVANCE/APPLICATION

DKI is a promising tool to observe brain development of preterm infants and detect the abnormality of HIE.

Changes in Structural Connectivity Across a High School Football Season (Station #3)

Samuel Joseph Kuzminski MD (Presenter): Nothing to Disclose, Michael D. Clark: Nothing to Disclose, Melissa A. Fraser MS: Nothing to Disclose, Jeffrey William Prescott MD, PhD: Nothing to Disclose, Chunlei Liu PhD: Nothing to Disclose, Kevin Guskiewicz: Nothing to Disclose, Jeffrey Robert Petrella MD: Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited

PURPOSE

Magnetic resonance diffusion tensor imaging (DTI) has emerged at the forefront of sports-related neurotrauma research. DTI can detect subclinical alterations in the white matter tracts related to contact sport exposure. Structural brain connectivity is a method that investigates white matter tract associations between different regions of the brain utilizing DTI. The primary purpose of this pilot study was to investigate structural connectivity alterations over the course of a high school football season. Our secondary purpose was to correlate these changes to cumulative head impact exposure as measured by helmet accelerometers.

METHOD AND MATERIALS

Pre- and postseason MRI scans were obtained on 12 varsity high school football players. Graph theory metrics of cortical organization were subsequently calculated from DTI data. Accelerometer data was collected throughout the season using the Head Impact Telemetry System (HITS). DTI measures were correlated to HITS measures using general linear regression. The pre- to post-season DTI measures were compared using paired samples t-tests. Our a priori α was set at 0.05.

RESULTS

Significant changes from pre- to post-season measures were observed for global network node strength and local efficiency, with trend-level changes observed for clustering coefficient (Table 1). Changes in DTI measures were not significantly correlated to the helmet accelerometer measures.

CONCLUSION

The results from our preliminary study show changes in global white-matter structural connectivity across a single season of high school football. These changes are not explained by cumulative measures of head impact exposure.
impacts. It is unclear if these alterations are related to brain network reorganization in response to repetitive trauma or expected brain development. Our preliminary analyses are limited by small sample size, lack of a control group, and coarse resolution of our network analyses. A larger cohort with an age-matched non-contact sport control group is needed to verify these findings. Determining the biomechanical correlates of head impacts to neuroanatomical changes may inform equipment design, coaching practices, and rule development to improve the overall safety of youth football.

**CLINICAL RELEVANCE/APPLICATION**

Repetitive asymptomatic head trauma may lead to structural connectivity changes in high school football players.

**Added Value of a Combination of Susceptibility Weighted Imaging (SWI) and 3D Arterial Spin-labeling (ASL) in Diagnosis and Prognosis of Neonatal Encephalopathy (Station #4)**

Yang Liu MD (Presenter): Nothing to Disclose, Huimao Zhang: Nothing to Disclose, Qiang Wang: Nothing to Disclose, Zhiheng Zhang: Nothing to Disclose, Zhuo Wang: Nothing to Disclose, Meng Wang: Nothing to Disclose

**PURPOSE**

To investigate the contribution of a combined SWI and 3D ASL MRI to the diagnosis and prognosis of neonatal encephalopathy, through an exploration of the correspondence of the obtained cerebral blood flow (CBF) and R2* mappings, and the reconstructed 3D cerebral vasculature to the physiopathological findings of neonatal brain.

**METHOD AND MATERIALS**

17 neonates (preterm in 10 and term in 7) with clinically confirmed neonatal encephalopathy were recruited in this prospectively study with the permission of neonates’ parents and the approval of ethics committee of our hospital. All the neonates underwent MRI exam on a 3.0T scanner (MR750, GE, Waukesha) with the protocol including the conventional MRI, ESWAN and 3D ASL. From the obtained R2* and CBF mappings, the R2* and CBF values of 9 cerebral regions of interest (ROIs) were blindly measured by 2 experienced radiologists. Paired-Samples T Test and Independe-Samples T Test was performed to analyze differences intragroup and among groups with p<0.05 considered significantly different.

**RESULTS**

From the reconstructed 3D vasculature map, medullary veins dilation was observed at different degrees for all the neonates, with 4 preterm in micro-bleeding. The R2* values at the micro-bleeding regions were significantly higher than other ROIs. Compared with the white matter of frontal lobe and centrum semiovale, thalamus had a slightly higher R2* values in all neonates, however with significant difference (p<0.05). The CBF maps revealed hyperperfusion in gray matter of frontal lobe and thalamus, while hypoperfusion in white matter of frontal lobe and parietal gray matter. For the term neonates, the CBF values of thalamus were significantly higher than white matter and parietal gray matter. In preterm group, the CBF values of thalamus were significant higher than that of white matter and parietal gray matter (P<0.05). [What is the difference between the term and preterm]No significant difference of the R2* and CBF values was observed between the term and preterm infants in all the ROIs (p>0.05).

**CONCLUSION**

On neonatal encephalopathy, the R2* and CBF values exhibited different manners at different cerebral locations, partially reflecting the physiopathological features of local brain tissues.

**CLINICAL RELEVANCE/APPLICATION**

The combination of SWI and 3DASL, with R2* and CBF mappings obtained, showed more details in evaluation of neonatal brain with/without diseases.

**Prenatal MR Imaging in Congenital Diaphragmatic Hernia: Separate Evaluation of the Ipsi- and Contralateral MR Fetal Lung Volume (Station #5)**

Claudia Hagelstein MD (Presenter): Nothing to Disclose, Stefan Burger-Scheidlin: Nothing to Disclose, Meike Weidner: Nothing to Disclose, Thomas Schaible: Nothing to Disclose, Christel Weiss: Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Wolfgang Neff MD, PhD: Nothing to Disclose

**PURPOSE**

To separately evaluate the ipsi- and contralateral observed-to-expected MR fetal lung volume (o/e MR-FLV) in fetuses with congenital diaphragmatic hernia (CDH) and to assess the prognostic accuracy of the o/e MR-FLV regarding neonatal survival, extracorporeal membrane oxygenation (ECMO) requirement and development of a chronic lung disease (CLD).

**METHOD AND MATERIALS**

Using T2-weighted HASTE imaging, the o/e MR-FLV ipsi- and contralateral to the diaphragmatic defect was separately calculated and evaluated in 107 fetuses with isolated CDH between 20 and 39 weeks gestation. To assess the prognostic value of the o/e MR-FLV for association with neonatal survival, ECMO requirement, and development of CLD receiver operating characteristics (ROC) analysis and logistic regression analysis were performed.
RESULTS

Total o/e MR-FLV of both lungs in fetuses with a left-sided CDH (n=97) was 31.9±13.7% and 22.8±7.4 in patients with a right-sided CDH (n=10; p=0.004). Fetuses with a right-sided CDH showed a significantly lower o/e MR-FLV of the ipsilateral lung (4.8±2.9%) when compared to the contralateral o/e MR-FLV in fetuses with a left-sided hernia (9.4±10.0%; p=0.001). Regarding the contralateral o/e MR-FLV, there was no statistically significant difference between left-sided (49.2±18.8%) and right-sided hernias (45.7±15.0%; p=0.573). Total and contralateral o/e MR-FLV revealed significant differences regarding neonatal survival (total p<0.001; contralateral p<0.001), ECMO requirement (total p=0.001; contralateral p<0.001), and development of CLD (total p=0.001; contralateral p<0.001). Compared to the total o/e MR-FLV, the contralateral o/e MR-FLV showed a slightly higher prognostic accuracy regarding survival (AUC=0.859 vs. 0.825) and development of CLD (AUC=0.734 vs. 0.732) and a very similar prognostic accuracy regarding ECMO requirement (AUC=0.805 vs. 0.826).

CONCLUSION

Both lungs, ipsi- and contralateral to the diaphragmatic defect in patients with CDH showed a reduced fetal lung volume as compared to healthy controls. Beside the total o/e MR-FLV, the contralateral o/e MR-FLV is a highly reliable prenatal predictor for neonatal outcome.

CLINICAL RELEVANCE/APPLICATION

Separate evaluation of the ipsi- and contralateral o/e MR-FLV has the potential to improve prenatal prediction of neonatal survival, ECMO requirement and development of CLD in CDH patients.

PDE210

Submillisievert Pediatric CT Made Easy: CT Applications Using Iterative Reconstruction Algorithms from Major Vendors (Station #6)


TEACHING POINTS

To assess the feasibility of submillisievert radiation doses in pediatric CT examinations, To educate the audience regarding currently available iterative reconstruction (IR) algorithms across all major vendors and their different settings which can be used to achieve submillisievert dose, To illustrate multiple CT applications using different IR techniques and protocols in pediatric settings.

TABLE OF CONTENTS/OUTLINE

Discuss and educate radiologists about size-specific, indication-based, and body-region based CT protocols in pediatric imaging to achieve submillisievert radiation dose. Describe currently available iterative reconstruction algorithms and their settings from major vendors: image-based: SafeCT, hybrid-based: ADMIRE, AIDR3D, ASIR, iDose, IRIS, SAFIRE), knowledge-based (IMR) and model-based (VEO) that can be used in submillisievert pediatric CT. Illustration of examples from our institution for pediatric CT applications (for chest, cardiac, head, abdomen-pelvis, spine, and extremities regions) at submillisievert radiation dose. Diagnostic image quality, noise and radiation dose implications in submillisievert pediatric CT based on our institutional experience.

PDE176

Differential Diagnosis of Cerebellar Atrophy in Childhood: A Pattern-recognition Approach (Station #7)

Matthias W. Wagner MD: Nothing to Disclose, Eugen Boltshauser MD: Nothing to Disclose, Thangamadhan Bosemani MD, FRCR (Presenter): Nothing to Disclose, Thierry Huisman MD: Nothing to Disclose, Andrea Poretti MD: Nothing to Disclose

TEACHING POINTS

Cerebellar atrophy (CA) implies loss of cerebellar parenchyma and is a nonspecific pediatric neuroimaging finding. In the majority of cases, the vermis is more affected compared to the cerebellar hemispheres. Involvement of the brainstem as a small pons is unusual and occurs in prenatally acquired CA, neurodegenerative diseases with prenatal onset (as pontocerebellar hypoplasias) or CA as a sequela of extreme prematurity. CA may result from genetic or metabolic diseases or be acquired. In pediatric CA, neuroimaging findings are rarely diagnostic. In the majority of cases, a neuroimaging pattern-recognition approach is helpful in the evaluation of children with CA to narrow the list of differential diagnoses, plan targeted additional investigations and interpret their results.

TABLE OF CONTENTS/OUTLINE

The literature was reviewed for etiologies of pediatric CA. A pattern-recognition approach is suggested for hereditary CA considering "pure" (isolated) CA and CA "plus" (associated with other neuroimaging findings such as hypomyelination, progressive infra- or supratentorial white matter abnormalities, involvement of basal ganglia, T2-hypointense cerebellar cortex). Additionally, checklists are provided for postnatally acquired CA, unilateral CA and pediatric diseases with ataxia as a symptom without CA on neuroimaging.
**Fetal Imaging at 3T**

**Teresa Victoria MD, PhD (Presenter):** Nothing to Disclose

**LEARNING OBJECTIVES**

1) To compare and contrast fetal imaging at 1.5 and 3Tesla. 2) To discuss artifacts encountered while imaging the fetus at 3T. 3) To discuss safety concerns associated with scanning the fetus at higher magnetic strength.

**ABSTRACT**

Several attempts have been made in the past at imaging the fetus at 3T as part of the continuous search for increased image signal and better anatomic delineation of the developing fetus. Until now, imaging of the fetus at 3T has been disappointing, with numerous artifacts impeding image analysis. Improved technology now allows imaging of the fetus at greater magnetic strength, while still encountering some hurdles in the shape of imaging artifacts. In this course we present the preliminary experience of evaluating the developing fetus at 3T, discuss several artifacts encountered and techniques to decrease them, as well as safety concerns associated with scanning the fetus at higher magnetic strength.

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**Fetal Cardiac MRI and Left Ventricular Function Assessment Using a New Gating Strategy Based on Doppler Ultrasound: Preliminary Results**

**Fabian Kording (Presenter):** Nothing to Disclose, Jin Yamamura MD: Nothing to Disclose, Chressen Catharina Remus MD: Nothing to Disclose, Manuela Tavares de Sousa: Nothing to Disclose, Friedrich Uberle: Nothing to Disclose, Gerhard B. Adam MD: Nothing to Disclose, Bjoern Schoennagel MD: Nothing to Disclose

**PURPOSE**

The commonly used method to evaluate the fetal heart is echocardiography (ECG). However, the detection of congenital heart diseases by ECG varies from 45% to 74% and an alternative imaging modality would be desirable. Fetal cardiac magnetic resonance imaging (MRI) has the potential to visualize anatomy and to assess functional parameters of the fetal heart but was up to now not feasible due to a missing gating strategy. The purpose of this study was to perform fetal cardiac MRI using a newly developed Doppler ultrasound sensor (DUS) for external fetal cardiac gating in a human fetus for the first time.

**METHOD AND MATERIALS**

One pregnant volunteer (gestation week 34) was examined at 1.5 T to evaluate the DUS gating method for fetal cine MRI. To obtain a gating signal from the fetal heart, an MRI compatible ultrasound transducer of a cardiotocogram was employed for cardiac triggering. DUS signals from the CTG were transferred to LabView with a data acquisition card. Trigger signals were processed based on a newly developed algorithm and transmitted to the physiologic unit of the MRI for cardiac gating. Retrospective cine imaging was then performed in four-chamber, long-axis and short-axis view. Left ventricular function parameters were assessed by cardiac cine MRI and compared to parameters obtained from consecutively performed standard ECG.

**RESULTS**

Cardiac gating signals from the fetus could be reliably detected. No artefacts and interferences were observed, resulting in very good image quality. The synchronous contraction of the ventricles was clearly visualized from the apex to the base with an average R-R interval of 464 ± 94 ms. End-systolic and end-diastolic volumes calculated from cine cardiac MRI and ECG were 0.58 ml / 0.62 ml and 3.17 ml / 3.22 ml, yielding stroke volumes of 2.60 ml / 2.59 ml with an ejection fraction of 80 % / 81 % and cardiac output of 334 ml/min / 335 ml/min.

**CONCLUSION**

For the first time, cine cardiac MRI could be performed in a human fetus using a newly developed DUS device and dedicated software for fetal cardiac triggering. Fetal cardiac functional parameters revealed high agreement...
in comparison with standard fetal echocardiography.

**CLINICAL RELEVANCE/APPLICATION**

Fetal cardiac MRI has the high potential to detect cardiovascular malformations and to evaluate fetal cardiac function and, hence, may be important to overcome the limitations of echocardiography.

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**VSPD12-03 In Utero Tractography of Ganglionic Eminence Pseudofibers**

Christian Mitter MD (Presenter): Nothing to Disclose, Daniela Prayer MD: Nothing to Disclose, Peter Christian Brugger MD, PhD: Nothing to Disclose, Gregor Kasprian MD: Nothing to Disclose

**PURPOSE**

The ganglionic eminence (GE) is a transient structure of the developing fetal brain located adjacent to the lateral ventricle, and contains the proliferative zone for developing GABAergic basal ganglia projection neurons and cortical interneurons. Due to its highly anisotropic organisation the GE can be visualized and investigated by diffusion tensor imaging. We used in utero DTI-based tractography to identify the normal 3D imaging patterns of this structure in the developing fetal brain during the second trimester in vivo.

**METHOD AND MATERIALS**

Preselected non-motion degraded in utero DTI examinations of 13 unsedated fetuses (21 - 27 gestational weeks, GW) without gross cerebral malformations were included. Orthogonal axial diffusion tensor sequences (16 directions, reconstructed voxel size 0.94mmx0.94mmx3mm, b-values of 0s/mm2 and 700s/mm2) were performed using a 1.5T superconducting MR unit. Color coded FA maps were geometrically coregistered with multiplanar T2-weighted MR sequences. The GE was anatomically defined using a multiple ROI approach and visualized using a FACT algorithm.

**RESULTS**

Three-dimensional visualization of anisotropic diffusion within the GE by in utero tractography resulted in multiple "pseudofiber" tracts with a C-shaped course along the wall of the lateral ventricle. Pseudofibers showed an anterior-posterior orientation along the body of the lateral ventricle and a superior-inferior orientation in front of the trigone. Coregistered T2w sequences confirmed the location to be within the strongly hypointense cell rich proliferative layers of the GE. Overall, in utero tractography of the GE was successful in 10/13 subjects in both hemispheres and in 3/13 subjects in only the right hemisphere.

**CONCLUSION**

This study demonstrates the potential of DTI-based in utero tractography to visualize the three-dimensional anisotropic organization of the GE in the developing fetal brain in vivo as early as 21 GW. Anisotropic diffusion within the GE may be related to tangential migration of developing neurons in this region. In utero tractography of GE pseudofibers may be useful for a more detailed assessment of this transient fetal structure in both normal development and fetal brain pathologies.

**CLINICAL RELEVANCE/APPLICATION**

Due to its important role in the production of GABAergic neurons, a more detailed assessment of the GE in utero may be useful in a range of neurodevelopmental disorders, including epilepsy.

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**VSPD12-04 DTI-based in Utero Tractography of Association Fiber Tracts in the Developing Fetal Brain**

Christian Mitter MD (Presenter): Nothing to Disclose, Daniela Prayer MD: Nothing to Disclose, Peter Christian Brugger MD, PhD: Nothing to Disclose, Gregor Kasprian MD: Nothing to Disclose

**PURPOSE**

Association fibers connect different cortical areas in the same hemisphere and constitute an important anatomical substrate for a diverse range of higher cognitive functions. They already have been extensively investigated in vivo in adults and children as well as postmortem in human fetal brains. In the present study fetal MRI and DTI-based tractography was used to visualize major association fiber tracts (uncinate fasciculus - UF, inferior fronto-occipital fasciculus - IFOF, inferior longitudinal fasciculus - ILF and cingulum) and the fornix in the living fetal brain in utero.

**METHOD AND MATERIALS**

24 non-motion degraded DTI examinations of living unsedated fetuses (20-34 gestational weeks - GW) without gross cerebral abnormalities were included in the study. Orthogonal axial DTI sequences (16 directions, reconstructed voxel size 0.94/0.94/3mm, b values of 0 and 700 sec/mm2) were performed using a 1.5T MR unit. Association fiber tracts were anatomically defined using multiple ROI approach and calculated using a deterministic linear tracking algorithm.

**RESULTS**

In utero tractography of UF and IFOF was possible as early as 20 GW. UF was found in 24/24 (100%) subjects and IFOF in 21/24 (87.5%) subjects. Visualization of the ILF was possible in only 6/24 (25.0%) subjects, most of them aged 30 GW or older. Tractography of cingulum and fornix was successful from 27 GW on in 9/24
(37.5%) and 8/24 (33.3%) of subjects respectively. Statistically significant differences in mean FA-value were found between left and right IFOF and between UF and IFOF of the right hemisphere.

CONCLUSION

Provided optimal imaging conditions DTI-based tractography can be used to visualize the morphological appearance of major association fiber tracts in the developing fetal brain in utero. Identifiable fiber tracts include the UF and the IFOF as early as 20 GW, and the ILF, the cingulum and the fornix in older fetuses. Quantitative analysis of diffusion parameters provides preliminary evidence for hemispheric asymmetry and structural differences between association fiber tracts.

CLINICAL RELEVANCE/APPLICATION

The possibility to non-invasively investigate association fiber tracts in utero with DTI-based tractography may be useful for a more precise evaluation of intraterine white matter damage.

VSPD12-05 Magnetic Resonance Imaging Based Ratio of Fetal Lung Volume to Fetal Body Volume as a New Prognostic Marker for the Development of Chronic Lung Disease in Congenital Diaphragmatic Hernia

Meike Weidner (Presenter): Nothing to Disclose, Melissa Winkler: Nothing to Disclose, Claudia Hagelstein MD: Nothing to Disclose, Christel Weiss: Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Thomas Schäible: Nothing to Disclose, Wolfgang Neff MD, PhD: Nothing to Disclose

PURPOSE

Most prenatal prognostic parameters in congenital diaphragmatic hernia (CDH) refer to a healthy control group. The prenatally measured MR based ratio of fetal lung volume to fetal body volume (FLV/FBV) can be calculated individually. This study investigated the prognostic value of this ratio with regard to the development of chronic lung disease (CLD).

METHOD AND MATERIALS

MRI was performed in 132 fetuses with diagnosed CDH. Both FLV and FBV were measured and used to calculate the ratio of FLV/FBV. CLD was diagnosed if oxygen was required at postpartum day 28. Logistic regression analysis was used to model the dependence of CLD on the ratio. Prognostic accuracy was evaluated by applying the area under the curve (AUC) in receiver operating characteristics (ROC) analysis.

RESULTS

61 of 132 children (46%) developed CLD postnatally. Neonates who developed a CLD showed prenatally a significantly reduced ratio (FLV/FBV) of 0.011±0.005 in comparison to children without the diagnosis of CLD (0.014±0.005; p=0.0008). A higher ratio of FLV to FBV was associated with a reduced probability of CLD-development. In ROC-analysis, the AUC in this context was 0.743.

CONCLUSION

The MRI based ratio (FLV/FBV) is a prenatal predictor for the development of CLD in children with CLD. It is calculated individually and therefore independent of a control group.

CLINICAL RELEVANCE/APPLICATION

The individually calculated ratio of FLV to FBV is able to predict the probability of CLD-development prenatally. Its independency of a control group may be an advantage in particular in growth restricted children.

VSPD12-06 Prenatal/Postnatal Correlation of Congenital Lung Lesions

Christopher Ian Cassady MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the various and different types of congenital lung malformations. 2) Perceive their differentiating fetal imaging features and those of mimics. 3) Understand the implications of differentiating lung malformations. 4) Understand the strategies for management of CLMs in the fetus and neonate.

ABSTRACT

Congenital lung malformations are a heterogeneous group of non-malignant lesions that are not uncommonly seen on fetal ultrasound as echogenic or cystic masses in the chest. These are invariably referred to as ‘CCAM’s (congenital cystadenomatoid malformation), but the pathology is much broader than just CCAM. Recent (Langston, 2003) pathologic review has proposed a unifying theory for the development of all of these lesions from early obstruction of the airway. We will discuss this pathologic approach to fetal lesions and show imaging correlates that can aid in differentiating types of lesions. We will discuss how differentiation prior to birth may be helpful; although these lesions are technically benign, certain lesions can cause in utero demise. We will discuss imaging strategies for both fetal and neonatal treatment planning of these lesions, and their differentiation from lesions that might mimic CLMs, including rare neoplasms. Neonatal correlation of fetal images will be included as appropriate.

VSPD12-07 Prenatal ADC Value Evaluation of the Fetal Brain in Monochorionic Twins with TTTS, and the Influence of Fetal Demise of One Fetus on the Surviving Sibling
Twin-to-Twin Transfusion Syndrome (TTTS) is a chronic hemodynamic disequilibrium affecting 10-15% of all monochorionic pregnancies. Modern treatments have dramatically decreased the mortality rate from TTTS, and in the same time focused great attention to the still significant morbidity, primarily neurocognitive morbidity. TTTS pregnancies are extensively monitored with ultrasound and post-natal neurological exams; however, fetal magnetic resonance imaging (MRI) and Diffusion-weighted imaging (DWI) are not yet commonly used, despite evidence that MRI can detect changes that are not apparent on prenatal ultrasound. In this study we have set off to assess the ADC changes in the brains of fetuses in pregnancies complicated with TTTS.

METHOD AND MATERIALS
We have evaluated 53 DWI scans of fetuses afflicted by TTTS and 46 DWI scans of healthy singleton fetuses, in all of which ADC values from 8 regions of interest (ROIs) - frontal, parietal, temporal, occipital, basal ganglia, thalamus, pons and cerebellum, were plotted and compared using parametric and non-parametric tests.

RESULTS
We have found no significant differences in ADC values between the two groups, in any of the ROIs. Also, no significant differences were found in ADC values in any ROI between fetuses with or without co-twin demise. A non-parametric test comparing healthy controls to TTTS afflicted fetuses with and without pathological radiological findings have demonstrated significant difference between the three subgroups in the Basal ganglia (BG) ROI and Pons ROI. Comparison between the control group and the radiological pathology positive subgroup, using Mann-Whitney U Test, indicated a significant increase in ADC in the Pons ROI.

CONCLUSION
We observed that commonly used treatments for TTTS, do not evoke a significant changes in the diffusion of the fetal brain, even after a co-twin demise. Our data suggests the need for further investigation as to the meaning of pathological findings in fetal MRI scans and their correlations to neurocognitive injury in TTTS.

CLINICAL RELEVANCE/APPLICATION
This study is the first using fetal brain DWI to assess neurological changes caused by TTTS. We hope it will lead to improved pre-natal evaluation and treatment choices as well as post-natal care.
PURPOSE

T1 Rho and T2 mapping of articular cartilage has been shown to be more sensitive for chondral injuries compared with conventional anatomic MR sequences. The purpose of this study is to validate if the presence of a large joint effusion affects T2 or T1 Rho cartilage mapping values in children when proton density weighted fat saturated MR sequences are otherwise normal.

METHOD AND MATERIALS

We performed a prospective study of children between 0-18 years who underwent MRI of the knee from 12/13-3/14 at our institution. MRI exams were performed on a 3T Philips unit with a dedicated knee coil and axial T1rho and T2 mapping axial sequences were added at the end of a standard sports knee protocol which includes multiplanar T2 and PDW sequences. Patients were included in the study provided that the anatomic sequences showed no evidence of chondral injury or subchondral marrow edema and a joint effusion was subjectively identified on MR. A control population was similarly generated but without evidence of a joint effusion. Region of interest T2 and T1rho maps were obtained in identical locations in the medial and lateral patellar facet and values for a total of 4 individual cartilage sampling points for each study and control patient. Values were generated and statistically compared between study and control population.

RESULTS

Seventeen children with joint effusion (12 female, 5 male, average age 15.1) and 10 without joint effusion (6 female, 4 male, average age 14.9) were included in the study. In the study population, T2 and T1rho values of the 68 cartilage sampling points were 33.12 +/- 4.98 msec and 47.16 msec +/-8.97, respectively. In the control population, T2 and T1rho values of the 40 cartilage sampling points were 33.83 +/-4.91 msec and 51.28 +/-9.67 msec, respectively. Both study and control population T1rho and T2 values were within the normal expected range. There was no difference in T1rho (P=0.130) and T2 mapping values (P=0.614) between the study and control populations.

CONCLUSION

Although T2 mapping values of cartilage are affected by relative water content compared with T1rho values, neither of these parameters appear to be adulterated when assessing cartilage when there is subjective presence of a joint effusion.

CLINICAL RELEVANCE/APPLICATION

Subjective presence of a joint effusion does not affect T1rho and T2 mapping values when anatomic T2 and PDW MRI sequences are normal.

Analysis of Risk Factors for Ultrasonographic Graf Type 2a Hips in Developmental Dysplasia: A Hospital-based Case-control Study with a Screening Program

Burcu Sahin MD (Presenter): Nothing to Disclose, Elif Aktas MD: Nothing to Disclose, Hidir Kaygusuz: Nothing to Disclose, Cengiz Tuncay: Nothing to Disclose, Bilgin Kadri Aribas MD: Nothing to Disclose

PURPOSE

Ultrasonographic Graf type 2a hips are considered as "physiologically immature". There is very scarce information in the literature about the risk factors for specifically these Graf type 2a immature hips. Hence, the purpose of this case-control study was to examine the association between ultrasonographic Graf type 2a hips and maternal and infant risk factors of the newborns who were screened for the developmental hip dysplasia.

METHOD AND MATERIALS

In a one-year period, 679 infants were screened for developmental dysplasia by ultrasonography using Graf's method. As an inclusion criterion, only Graf type 1 and type 2a's were accepted. Overall, 619 infants (321 boys, 298 girls, mean age: 6.3 weeks) were eligible. A total of 60 cases (17 boys, 43 girls) with ultrasonographic Graf type 2a(+) and (-) hips and 559 controls (304 boys, 255 girls) with ultrasonographic Graf type 1 mature hips were recruited. Sociodemographic status of the infants, including gestational age, birth weights and associated congenital anomalies, maternal characteristics and, if any, the degree of consanguinity, were recorded. A backward stepwise logistic regression model was used to evaluate the relationship between idiopathic Graf type 2a hips and maternal and infant risk factors of the newborns who were screened for the developmental hip dysplasia.

RESULTS

Among maternal and infant characteristics, significant risk factors for Graf type 2a hips in the regression analysis were gestational age (>42 weeks, adjusted OR: 2.321), birth weight (>3500 gr, adjusted OR: 3.274) and gender (girls adjusted OR: 2.741). Congenital anomalies, multiple pregnancy and family history - although accepted as risk factors for developmental dysplasia - had no relation with Graf type 2a immature hips.

CONCLUSION

In conclusion, girls born after 42 weeks of gestation with an over 3500 grams of weight had a more than twice the risk for a physiologically immature Graf type 2a hips. To obtain more accurate results, a population-based screening study with an increased number of cases and controls should be performed in future studies.

CLINICAL RELEVANCE/APPLICATION

For ultrasonographic screening of developmental hip dysplasia, we recommend that gender, birth weight and
gestational age should be questioned in order to be alert for Graf type 2a hips.

**VSPD21-04**  
**DCE-MRI Curve Shape Patterns in Active and Inactive Juvenile Idiopathic Arthritis Patients Using a Pixel-by-Pixel Time-intensity Curve Shape Analysis Method**

Robert Hemke MD, PhD (Presenter): Nothing to Disclose, Cristina Lavini DPhil: Nothing to Disclose, Charlotte M. Nusman MSc: Nothing to Disclose, J. Merlijn van den Berg: Nothing to Disclose, Koert M. Dolman: Nothing to Disclose, Marion Van Rossum MD, PhD: Nothing to Disclose, Taco Kuijpers MD, PhD: Nothing to Disclose, Mario Maas MD, PhD: Nothing to Disclose

**PURPOSE**  
To compare dynamic contrast-enhanced (DCE)-MRI parameters and the relative number of time intensity curve (TIC) shapes as derived from pixel-by-pixel DCE-MRI TIC-shape analysis between knees of clinically active and inactive juvenile idiopathic arthritis (JIA) patients.

**METHOD AND MATERIALS**  
This prospective observational study was approved by the institutional review board and written informed consent was obtained. DCE-MRI datasets of JIA patients were prospectively obtained. Patients were classified into two clinical groups: active disease (n=49) and inactive disease (n=36). Parametric maps, showing 7 different TIC shape types, were created per slice. Statistical measures of the relative number of different TIC shapes, maximal enhancement (ME), maximal initial slope (MIS), initial area under the curve (iAUC), time-to-peak (TTP), and enhancing volume (EV) of each voxel were calculated in a three-dimensional volume of interest of the synovial membrane.

**RESULTS**  
Imaging findings from 85 JIA patients were analyzed. Significantly higher numbers of TIC shape 4 (P=0.001), median ME (P=0.004), MIS(P=0.001), iAUC (P=0.002), and EV (P=0.013) were observed in clinically active compared with inactive patients. TIC shape 5 was more present in the clinically inactive patients (P=0.018). The intra-observer reliability was very good regarding all DCE-MRI parameters (ICC=0.93-1.00)

**CONCLUSION**  
The pixel-by-pixel DCE-MRI TIC-shape analysis method proved capable of differentiating clinically active from inactive JIA patients by the difference in the number of TIC shapes 4 and 5, as well as by the descriptive parameters ME, MIS, iAUC and EV. Therefore, it may serve as an objective, more quantitative outcome measure of imaging in clinical trials and future research.

**CLINICAL RELEVANCE/APPLICATION**  
The pixel-by-pixel DCE-MRI TIC-shape analysis is able to differentiate clinically active from inactive JIA patients using the relative number of TIC shapes 4 and 5 and descriptive parameters ME, MIS, and iAUC.

**VSPD21-05**  
**Imaging the Pediatric Hip—Non-FAI**

Diego Jaramillo MD, MPH (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To recognize the normal appearance of developmental changes of the hip on MR images. 2) To be familiar with the main indications for MRI in pediatric hip disorders. 3) To be familiar with the MRI appearance of the main pediatric hip pathologies. 4) To be aware of technical factors that are unique to children.

Handout: Diego Jaramillo

http://media.rsna.org/media/abstract/2014/14001041/Pediatric Hip Jaramillo 2014 Handout.pdf

**VSPD21-06**  
**Diffusion-weighted MRI in Paediatric Patients with Gonarthrosis: A Novel Approach to Imaging of Synovitis**

Henning Neubauer MD, MBA (Presenter): Nothing to Disclose, Annette Holl-Wieden : Nothing to Disclose, Nicole Hassold MD : Nothing to Disclose, Thomas Alois Pabst PhD : Nothing to Disclose, Thorsten Alexander Bley MD : Nothing to Disclose

**PURPOSE**

Contrast-enhanced (ce-)T1w MRI is the current diagnostic standard for imaging synovitis in arthritis joints aiming at early diagnosis and sensitive therapy surveillance. Native MR imaging techniques for synovitis have been a focus of research for concerns of patient safety and cost. We evaluated diffusion-weighted MRI (DWI) as a novel technique for imaging of synovitis in young patients with gonarthrosis.

**METHOD AND MATERIALS**  
Twenty-five children and adolescents (age 11±5 years, 13 females) with clinically suspected gonarthrosis and nine age-matched controls underwent routine MRI, including transversal ce-T1w and single-shot echoplanar diffusion-weighted imaging (SS-EPI DWI, two b-values 0-50 and 800-1000 s2/mm, slice thickness 4-6 mm, 1.8 x 1.8 mm in-plane resolution, 2-6 averages, acquisition time 41 s to 190 s). DWI and ce-T1w images were evaluated for the presence of synovitis. Signal intensity ratios were calculated for synovial vs. bone marrow and synovia vs. effusion.
RESULTS
All examinations yielded diagnostic image quality. All patients showed synovial thickening and contrast enhancement on ce-T1w and corresponding synovial signal increase on DWI at high b-values. Mean total ADC was 2.2±0.5 (*10^-3 mm²/s) for synovitis and 2.8±0.4 for joint effusion. Mean signal intensity (SI) ratios were 5.4 (ce-T1w) vs. 9.1 (DWI) for SI (synovitis/bone marrow) and 4.8 (ce-T1w) vs. 1.5 (DWI) for SI (synovitis/effusion). There were no false-positive cases among controls.

CONCLUSION
Diffusion-weighted MRI reliably visualises synovitis of the knee joint based on altered tissue diffusivity and presents a novel approach to imaging of synovitis without application of i.v. contrast agent. A combination of DWI with dark-fluid techniques should be evaluated to further improve the delineation of synovitis in the presence of joint effusion.

CLINICAL RELEVANCE/APPLICATION
Imaging synovitis with diffusion-weighted MRI holds potential to increase patient safety, to streamline scan protocols and to reduce costs and thus deserves further evaluation.

VSPD21-07 The Use of DWI to Quantify Sacroiliitis in Adolescents with Enthesitis-related Arthritis (ERA) and Correlation with Conventional STIR Score
Kanimozhi Vendhan MBBS, FRCR : Nothing to Disclose , Timothy James Bray MB BCHIR, MA (Presenter): Nothing to Disclose , David Atkinson : Nothing to Disclose , Corinne Fisher : Nothing to Disclose , Debajit Sen : Nothing to Disclose , Yiannakis Ioannou : Nothing to Disclose , Margaret Anne Hall-Craggs MD : Nothing to Disclose

PURPOSE
To use diffusion weighted images to quantify inflammation of the sacroiliac joints in adolescents with enthesitis related arthritis (ERA) and to correlate this with the conventional STIR inflammation score.

METHOD AND MATERIALS
We performed a retrospective case control study on 20 patients (10 ERA cases; 10 controls with mechanical back pain). All patients had conventional MRI of the sacroiliac joints along with diffusion weighted MRI. The anonymised images were exported to Matlab for analysis. The STIR scoring was performed by two readers and was based on a modification of an established scoring system used in adults with ankylosing spondylitis. Inflammation was also scored on the ADC maps using a methodology previously developed and piloted by our research group. In this technique the synovial portion of the SJJs are evaluated using multiple linear regions of interest (ROI). A profile of ADC values are obtained across each of those ROIs. Disease severity and extent were quantified using 'integrated normalised ADC value' - a summation of normalised ADC values along the standardised 14mm line profile expressed as 10^-6 mm²s^-1 x mm.

RESULTS
There was a highly significant difference in mean integrated ADC values between cases (8000 x 10^-6 mm²s^-1 x mm) and controls (2000 x 10^-6 mm²s^-1 x mm). There was good agreement in STIR scores between the two observers as shown by an intra-class correlation value of 0.96 for controls and 0.94 for cases. Pearson correlation was used to examine the association between the STIR scores and the average integrated ADC values. For cases, the Pearson correlation coefficient was 0.89 and for controls it was 0.82. This suggests a highly significant association between the two scores.

CONCLUSION
This data shows clear separation between normal subcortical bone and areas of inflammation using 'integrated normalised ADC' scores obtained from ADC maps. It has the potential to serve as a quantitative tool to assess sacroiliitis.

CLINICAL RELEVANCE/APPLICATION
This technique can be used to assess change in ADC scores with treatment and to determine if there is a significant difference in scores between ERA patients treated with disease modifying anti-rheumatic drugs and those treated with anti-TNF agents.

Active Handout

VSPD21-08 Feasibility of Ultrasound-guided Sacroiliac Joint Injections in Children Presenting with Sacroiliitis
Mohamed Mahmoud Hamdy Abd Ellah MD (Presenter): Nothing to Disclose , Michaela Sailer Hoeck MD : Nothing to Disclose , Juergen Brunner MD, PhD : Nothing to Disclose , Christian Siedentopf MD : Nothing to Disclose , Gudrun Feuchtner MD : Nothing to Disclose , Mila S. Taljanovic MD : Nothing to Disclose , Fabian Plank MD : Nothing to Disclose , Werner R. Jaschke MD, PhD : Nothing to Disclose , Andrea Klauser MD : Nothing to Disclose

PURPOSE
To evaluate feasibility and effectiveness of ultrasound guided sacroiliac joint injection in the treatment of
sacroiliitis in pediatric patients

**METHOD AND MATERIALS**

In thirteen patients (7 females and 6 males), 9-16 years (mean +/- std 11.39 +/- 1.98), eighteen SI joint injections were performed under US guidance. All patients suffered from severe sacroiliitis. US scanning was performed using a linear-array transducer operating at 5-18 MHz. Rating of the patients pain using a 0-10 dolorimetry scale on a visual analog score (VAS) was recorded before, immediately after, and 3 months after injection to monitor severity and therapeutic response.

**RESULTS**

Injection could be performed in all patients without complication showing good response immediately and 3 months after injection with a decrease of the VAS from (mean +/- std 9.44 +/- 1.097, to 3.89 +/- 3.82, p <0.001, and to 0.56 +/- 1.097, p <0.05) respectively was noted.

**CONCLUSION**

US guided SI joint injection was feasible in all children, relatively quick and easy to perform and appeared effective in the treatment of pediatric patients with sacroiliitis.

**CLINICAL RELEVANCE/APPLICATION**

Dealing with sacroiliitis, US guided sacroiliac joint injection in the pediatric patients showed easy, safe, relatively fast, and effective treatment option.

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**Kocher Criteria Revisited in the Era of MRI: How Often Does the Kocher Criteria Identify Underlying Osteomyelitis?**

**Alexander Nguyen BS (Presenter): Nothing to Disclose**, J. Herman Kan MD : Nothing to Disclose, Scott B. Rosenfeld MD : Nothing to Disclose, George S. Bisset MD : Nothing to Disclose

**PURPOSE**

The Kocher criteria are established clinical parameters that predict hip septic arthritis (SA) with a 93% or greater positive predictive value when 3 or 4 variables are present but the incidence of underlying osteomyelitis has not been reported. The purpose of this study is to evaluate the incidence of underlying osteomyelitis (OM) in patients who have 3 or 4 positive Kocher criteria.

**METHOD AND MATERIALS**

77 consecutive patients (mean age 5.2 years) treated between 1/07 and 6/13 for suspected hip SA who had 3 or 4 positive Kocher criteria were retrospectively reviewed. The Kocher criteria variables include: nonweightbearing status, fever >38.5 C, WBC 12K, and ESR > 40 mm/hr. All patients underwent US and MRI as part of their work-up.

**RESULTS**

There were a total of 77 patients with 3 or 4 positive Kocher criteria. Of these, 37.7% (n=29) had a diagnosis of SA and 44.2% (n=44.2%) had a diagnosis of OM. Of the 77 patients, 56% (43/77) had a hip effusion by US. When an effusion was identified, 39.5% (17/43) had SA only and 37% (16/43) had OM. When no effusion was identified, 18/34 (51%) had underlying OM.

**CONCLUSION**

Patients with 3 or 4 Kocher criteria have a high incidence (44%) of underlying osteomyelitis. Our results suggest that the combination of Kocher criteria and US results is not sufficient to make a diagnosis in patients presenting with hip irritability.

**CLINICAL RELEVANCE/APPLICATION**

Patients with hip pain and 3 or 4 Kocher criteria should all routinely undergo MRI during work-up for suspected septic arthritis.

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**Cam-type FAI in the Pediatric Patient**

**Sarah Dantzler Bixby MD (Presenter): Nothing to Disclose**

**LEARNING OBJECTIVES**

1) To recognize findings on plain radiographs and magnetic resonance imaging (MRI) examinations in children and adolescents that indicate cam-type femoroacetabular impingement (FAI). 2) To identify the pediatric hip conditions that most commonly lead to cam-type FAI in children and adolescents. 3) To understand the mechanism by which cam-type FAI leads to joint damage and disability, and illustrate how surgical intervention, in the appropriate setting, may minimize this damage.

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**Appearance of the Synovium on Contrast-enhanced MRI of the Knee in Asymptomatic Controls Compared to Juvenile Idiopathic Arthritis Patients**

**Charlotte M. Nusman MSc (Presenter): Nothing to Disclose**, Robert Hemke MD, PhD : Nothing to Disclose
Implementation of Novel Ultra-Short TE (UTE) and Conventional Imaging Techniques for Assessment of Blood Degradation Products in Hemophilic Joints - Work in Progress

Arvind Kaur Shergill MBBS (Presenter): Nothing to Disclose, Marshall Stephen Sussman PhD: Nothing to Disclose, Andrea Schwarz Doria MD: Nothing to Disclose, Carina Man: Nothing to Disclose, Arun Mohanta: Nothing to Disclose, Charlotte M. Nusman MSc (Presenter): Nothing to Disclose, Robert Hemke MD, PhD: Nothing to Disclose, Marc Benninga MD, PhD: Nothing to Disclose, Angelika Kindermann MD, PhD: Nothing to Disclose, Marion Van Rossum MD, PhD: Nothing to Disclose, Taco Kuijpers MD, PhD: Nothing to Disclose, Mario Maas MD, PhD: Nothing to Disclose

PURPOSE
Quantification of early soft tissue joint changes with MRI and ultrasound (US) techniques that enhance visualization of blood products are crucial for diagnosis and follow-up of arthropathy in hemophilic children. The purposes of this study are: 1. To compare UTE and conventional MRI sequences for assessing blood degradation products in hemophilic children with subacute and chronic bleeds. 2. To assess the echogenicity/color pixel amount of soft tissues in hemophilic joints at different time points after bleeds using gray-scale and color doppler (CD) US in relation to corresponding MR images.

METHOD AND MATERIALS
30 hemophilic boys (5-17 years) with history of a subacute (<1 week) joint bleed [group 1], no history of a recent (<4 weeks) joint bleed [group 2], and 13 healthy controls (9-18 years) underwent US and MRI scans using conventional and UTE sequences. For UTE scans, the images from two echo times were subtracted to produce a short-T2 image. Two blinded radiologists reviewed US and MRI examinations according to International Prophylaxis Study Group scores.

RESULTS
In group 1 (n=14) intra-articular blood on US appeared hypo, iso and hyperecho in (6/14) 42.9%, (1/14) 7.1%, and (3/14) 21% of cases, respectively. On MRI (T1/T2) it showed intermediate/high signal in (12/14) 86% and low signal in (2/14) 14% of cases. In group 2, intra-articular blood appeared hypo, iso and hyperechoic in (8/16) 50%, (1/16) 6%, and (2/16) 13% cases. On MRI (T1/T2) it appeared as low signal in (12/16) 75% and intermediate/high signal in (2/16) 12.5% of scans (which presented with superimposed recent bleeds). On CDUS, increased synovial vascularity was seen in 38% of ankles and 50% of knees in group 1, and in 13% of ankles and 60% of knees in group 2. In all available UTE images chronic blood products demonstrated intermediate signal as opposed to dark signal on MPGR MR images.

CONCLUSION
Conversely to conventional MRI, neither gray-scale nor CDUS could distinguish subacute from chronic bleeds in hemophilic Joints. The use of UTE MRI holds promise for detecting minimal joint bleeds since the lack of
VSPD21-13

Reference Values of Fat Infiltration and Muscle Volume Loss for Morpho-functional Predictive Behaviour in Duchenne Muscular Dystrophy: A Longitudinal MRI Study
Claudia Godi MD (Presenter): Nothing to Disclose, Alessandro Ambrosi: Nothing to Disclose, Corrado Santarosa: Nothing to Disclose, Sara Napolitano: Nothing to Disclose, Antonella Iadanza: Nothing to Disclose, Letterio Salvatore Politi MD: Nothing to Disclose, Francesca Nicastro: Nothing to Disclose, Marina Scarlato: Nothing to Disclose, Stefano Previtali: Nothing to Disclose, Fabio Ciceri: Nothing to Disclose, Giulio Cossu: Nothing to Disclose, Yvan Torrente: Nothing to Disclose

PURPOSE

i) Quantitative and semiquantitative assessment of fat infiltration (FI) and muscle volume loss in lower limbs of children with Duchenne Muscular Dystrophy (DMD) by Magnetic Resonance Imaging (MRI); ii) computation of time-related quantitative curves of FI increase and MVI decay (Muscle Volume Index, a residual-to-total muscle volume ratio) in a cohort of DMD patients aged 6 to 14; iii) establishment of a morpho-functional relationship between MRI values and functional outcomes.

METHOD AND MATERIALS

26 male children with DMD (baseline age: 6-12 years) were longitudinally assessed by lower limb 3T MRI and functional tests (Gowers, 10-meter time, North Star, 6-minute walking test). 5 age-matched controls were also examined. A total of 85 MRI studies were performed. FI, atrophy and hypertrophy were visually scored on hips, thighs and calves. T1 Signal Intensity Ratio (SIR) of muscle and nearby fat was used to quantify FI. Muscle volume was measured by applying thresholds on T1-weighted images, and results were normalized for the whole muscle volume to obtain a MVI. Permutation and regression analyses according to both age and functional tests were calculated. P-values

RESULTS

FI was present on glutei and adductor magnus in all patients since the age of 6, with a proximal-to-distal progression in the lower limb and selective sparing of sartorius and gracilis. Atrophy was almost parallel to the FI pattern, whereas hypertrophy was observed in sartorius, gracilis and calf muscles. SIRs and MVIs were significantly different from the control values, except for SIRs of sartorius and gracilis. Age-related curves with percentile values were calculated for SIRs and MVIs, to provide a reference background for future experimental therapy trials. SIRs and MVIs significantly correlated with all clinical measures, and could reliably predict functional outcomes in a linear or exponential fashion.

CONCLUSION

SIRs and MVIs are objective predictors of functional outcomes, which can improve the staging of DMD patients. MRI-based curves display the multistep muscle involvement over time and can provide reference values of FI and muscle volume loss for both clinical and research settings.

VSPD21-14

T2 Mapping Evaluation of Occult Lateral Patellofemoral Compartment Chondral Injury in Children with Patellar Dislocation
Lorell Ruiz-Flores MD (Presenter): Nothing to Disclose, J. Herman Kan MD: Nothing to Disclose, Johanna Monsaive MD: Nothing to Disclose, Megan May MD: Nothing to Disclose, Zili David Chu PhD: Nothing to Disclose

PURPOSE

T2 mapping has been shown to improve detection of occult cartilage injury that may normally not be seen on conventional anatomic MRI sequences. Cartilage injuries are common in the medial patellar facet in the setting of lateral patellar dislocation (LPD), but are less common in the lateral patellar facet and trochlea. The purpose of this study is to determine the utility of T2 mapping in identifying occult lateral compartment chondral injuries in the setting of LPD in children.

METHOD AND MATERIALS

This retrospective case-control study with waiver of informed consent. The study group consisted of 27 patients (11 male, 16 female, average age of 14.6 years) who underwent MRI in the setting of LPD. All patients underwent multiplanar T2 and proton density fat saturated sequences and T2 mapping in the axial plane (Fig 1). T2 mapping sequence is a SENSE Multi-slice multi-echo sequence providing 6 echoes with TR of 2000 ms; TE of 13 n s, where n=1, 2, 3, 4, 5, 6; FOV of 160 mm; voxel size of 0.29x0.29x2.5 mm3, slice gap of 0.25 mm, 10 slices, acquisition time of 5:54 minutes. To be included in the study group, patients had to have a clinical history and classic MRI findings of LPD with no cartilage injury identified in the lateral patellofemoral compartment on multiplanar proton density and T2W sequences. T2 mapping measurements of the lateral patellar and lateral trochlear facets were obtained. A control group of 27 patients with normal knee MRI’s was used for reference (14 male, 13 female, average age of 14.4 years).

RESULTS
Review of the T2 color maps for both LPD and normal patients show no focal areas of increased T2 values in lateral patellar or trochlear cartilage. The T2 values of the lateral patellar facet in LPD and normal patients were 35.89 +/-5.62 msec and 36.93 +/-6.77 msec, respectively (P=0.388). The T2 values of the lateral trochlear facet in LPD and normal patients were 40.97 +/-5.39 msec and 42.45 +/- 6.61 msec, respectively (P=0.205).

CONCLUSION

In the absence of anatomic cartilage injury seen on conventional MRI sequences, T2 mapping does not appear to identify additional lateral patellofemoral compartment chondral injuries in the setting of LPD in children.

CLINICAL RELEVANCE/APPLICATION

Lateral patellofemoral compartment cartilage injuries are rare in LPD, and T2 mapping sequences does not identify additional cartilage injuries that are not already present on conventional cartilage MRI sequences in children.

Skeletal Hallmarks of Child Abuse

Paul K. Kleinman MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To learn patterns of skeletal injury characteristic of child abuse. 2) To learn radiologic-histopathologic correlates of these hallmark injuries. 3) To learn the appropriate imaging protocols for skeletal surveys in suspected child abuse.

PDS-MOA

Pediatric Monday Poster Discussions

Scientific Posters

PD

AMA PRA Category 1 Credits ™: .50

Mon, Dec 1 12:15 PM - 12:45 PM   Location: S101B

Participants

Moderator
Mahesh M. Thapa MD : Nothing to Disclose

Moderator
Amy Robben Mehollin-Ray MD : Nothing to Disclose

Sub-Events

PDS222

High Resolution Diffusion Tensor Imaging and Fiber Tracking of Human Fetal Brain Development from 14 to 41 WG (Station #1)

Olivier Ami MD, PhD (Presenter): Nothing to Disclose, Jean-Christophe Maran : Nothing to Disclose, Dominique Musset : Nothing to Disclose

PURPOSE

Diffusion-based cerebral fiber tracking (DTI) is a non-invasive tool often used to describe the three dimensional structure of adult white matter tracts. The goal of this study was to explore and quantify the human developing fetal brain in utero using fiber tracking as a tool to reconstruct and visualize main cerebral fascicules with magnetic resonance imaging, in order to establish an atlas of normal in utero developing anatomy.

METHOD AND MATERIALS

30 fetuses between 14 and 41 weeks of gestation planned for medical pregnancy interruption despite normal brain anatomy were enrolled in this study. An first in utero MRI set with DTI acquisition was performed at early morning before the abortion. A second DTI acquisition was performed on the fetuses ex vivo 12 hours after the abortion. A statistical analysis was then performed on the DTI reconstruction stacks. The analysis was done all along each fiber, subject to validation by an expert, from its beginning to its end. A local measure was done on FA value, density of reconstructed tracts and radial eigenvalues and the three dimensional structure of the fiber was sketched. The age-dependent variability was then assessed, and "healthy" and pathological datasets were confronted.

RESULTS

The entire set of ex vivo acquisition was exploitable for quantification. The anatomy has been demonstrated at each stage of development for caudate nucleus, motor and sensorial cortex. Each tract presented forms depending on the gyration stage and the myelination degree of the brain.
The density of fibers increased with pregnancy term, reflecting their maturation, due to the reinforcement of the FA during the gestation. The anisotropy decreased with the term of pregnancy. The mean density, FA value and ADC value were specified in a table.

CONCLUSION

The DTI protocol is feasible to explore fetuses brain in vivo and brings new insights towards early stages of brain development.

CLINICAL RELEVANCE/APPLICATION

Reference tables from this study will serve as comparison bases to help diagnose in utero brain pathologies and quantify the neurological impairment before birth.

PDS223 How Reproducibly Can Landmarks for a Standardized Coordinate System be Obtained from 3D Hip Ultrasound? (Station #2)

Myles Mabee BEng (Presenter): Nothing to Disclose, Jacob L. Jaremko MD, PhD: Nothing to Disclose, Richard Thompson PhD: Nothing to Disclose

PURPOSE

Accuracy of 2D ultrasound detection of developmental dysplasia of the hip (DDH) is limited by variation in acetabular appearance and alpha angles with changes in ultrasound probe orientation. 3D ultrasound can capture the entire acetabular shape in ~3 seconds. Reproducible identification of a "standard plane" from landmarks within 3D ultrasound would permit measurement of the alpha angle and other indices in that plane on each scan, reducing inter-scan variability vs. traditional 2D ultrasound while providing a more representative image of the hip. We noted that the anterior and posterior edges of the acetabular rim are relatively constant landmarks which may be reproducibly identifiable. We determined intra- and inter-observer variability of identification of these two landmarks, of the orientation of the resulting "standard plane," and of the alpha angle measured in this plane.

METHOD AND MATERIALS

We performed 2D and 3D ultrasound scans of 51 hips in 42 patients, 20 normal, 10 borderline initially but normalizing at follow up, and 12 treated for DDH. Two users each identified 2 landmarks within each 3D scan, blinded to each other's findings and clinical data, and repeated this after a 1-week delay. For each user at each session, we recorded 3D landmark locations, angles between the resulting "standard plane" orientations, and reliability of acetabular alpha angles measured on 3D "standard plane" images vs. concurrently acquired 2D scans.

RESULTS

The 3D distances between user-identified landmarks were 0.9 +/- 0.9 mm (mean +/- standard deviation SD) intraobserver, 1.6 +/- 1.0 mm between users. Angles between "standard planes" calculated from these landmarks varied by 4.2 +/- 3.9° intraobserver and 5.4 +/- 4.9° between users. Comparison of 3D and 2D alpha angles yielded a difference of -0.5 +/- 6.7°. All parameters trended toward lower variability in normal hips than dysplastic hips.

CONCLUSION

Acetabular landmarks and a "standard plane" calculated from these can be identified with high reliability within hip 3D ultrasound. Measuring indices in this standard plane has potential to improve reliability and accuracy of ultrasound assessment of DDH.

CLINICAL RELEVANCE/APPLICATION

A "standard plane" extracted from 3D ultrasound may more reproducibly capture infant hip shape than current 2D ultrasound, potentially improving accuracy and reliability of hip dysplasia diagnosis.

PDS224 Development of a Methodology to Quantify Inflammation of the Sacroiliac Joints in ERA Using ADC Maps (Station #3)

Kanimozhi Vendhan MBBS, FRCR: Nothing to Disclose, Timothy James Bray MB BCHIR, MA (Presenter): Nothing to Disclose, David Atkinson: Nothing to Disclose, Corinne Fisher: Nothing to Disclose, Debajit Sen: Nothing to Disclose, Yiannakis Ioannou: Nothing to Disclose, Margaret Anne Hall-Craggs MD: Nothing to Disclose

PURPOSE

To develop a technique to quantify inflammation of the sacroiliac joints in adolescents with enthesitis related arthritis (ERA) using diffusion-weighted MRI.

METHOD AND MATERIALS

We performed a retrospective case control study on 10 patients (5 ERA cases; 5 controls with mechanical back pain). All patients had conventional MRI of the sacroiliac joints along with diffusion weighted MRI. The anonymised images were exported to Matlab for analysis. In the cases, T1 and STIR images of the SIJs were reviewed in conjunction with the diffusion-weighted images to select the image that demonstrated the most severe inflammation of the right and left SIJs. In the controls, the slice representing the central axial image of the SIJs was selected. On these selected ADC images the synovial portion of each sacroiliac joint was divided into anterior, mid and posterior thirds. Using Matlab, a linear region of interest (ROI), measuring 14 - 16mm, and centered on the SIJ, was drawn in each third of the joint. In order to provide internal standardisation, a
further linear ROI of the same measurement was placed on normal sacral bone to obtain a reference value. A custom written Matlab program was used for image analysis. The user drawn linear ROI is automatically cropped about its centre to a standardised length of 14mm. The program then creates a profile of ADC values across each of the linear ROIs. Using these profiles the normalised ‘integrated ADC value’ is calculated for all patients. The ‘worst’ ADC value, which is defined as the summed ADC of the region of most severe inflammation in the cases, was compared with the average ‘integrated ADC value’ of the controls.

RESULTS

The average absolute ADC value in controls was 684 x 10-6 mm2s-1 and in cases was 1211 x 10-6 mm2s-1. The difference was highly significant with a p value = 0.001. The mean ‘integrated normalised ADC value’ in controls was 1453 mm2s-1x mm vs 10287 mm2s-1x mm in cases (p value <0.001).

CONCLUSION

This novel technique for quantifying SIJ inflammation shows promise and could potentially be used to monitor disease over time and to assess response to therapy.

CLINICAL RELEVANCE/APPLICATION

This method has the potential to serve as a quantitative tool to assess sacroiliitis. This is useful to compare follow-up studies to assess treatment response. It also has use in clinical trials to assess drug efficacy.

**PDS226**

Femoral and Tibial Torsion Measurements in Children: Comparison of MR Imaging and 3D Models based on Low-dose Biplanar Radiographs (Station #5)

**PURPOSE**

Femoral and tibial torsion measurements on 3D models based on low-dose biplanar radiographs (BPR) have been shown to be comparable to state of the art computer tomography (CT) measurements. However, CT measurements as well as BPR measurements are associated with radiation exposure of the child. The aim of our study was to evaluate reliability and interchangeability of femoral (FT) and tibial torsion (TT) measurements in children using magnetic resonance (MR) imaging compared to measurements on 3D models based on low-dose biplanar radiographs.

**METHOD AND MATERIALS**

Institutional review board waiver was obtained. FT and TT were measured in 30 children (mean age 10.1 years; range 6.2 - 15.6 years; 14 female) using axial MR images of the hip, knee and ankle by two independent readers. They were compared to measurements on BPR of the lower limb based on 3D models by two separate independent readers. Interreader and intermethod agreement was calculated using descriptive statistics, Intraclass correlation coefficient (ICC) and Bland-Altman analysis.

**RESULTS**

FT/TT was -6° - 47°/±1° - 44° on MR images and -13° - 46°/0°- 49° for measurements on BPR 3D models. The average difference between the two methods was 4.6° ± 4.1/6.0° ± 3.8, respectively. Interreader agreement (ICC) of FT/TT measurements was 0.97/0.96 on MR images and 0.99/0.94 on BPR 3D models. Intermethod agreement (ICC) for MR measurements was 0.93 (95% confidence interval [CI], 0.88 - 0.96) for FT and of 0.87 (CI, 0.39 - 0.95) for TT. Mean measurement differences between the two BPR readers were 2.1° (0.0° - 7.0°) for FT and 3.4° (0.0° - 12.0°) for TT. Mean interreader differences at MR were 3.2° (0.1° - 8.0°) for FT and 3.5° (0.1° - 9.5°) for TT. Bland-Altman plots showed a systematic underestimation of TT on MR measurements compared to BPR 3D models of 5°. All but 3/4 measurements of FT/TT were within the 95% limit of agreement.

**CONCLUSION**

FT and TT measurements in children using MR images are comparable to measurements on BPR 3D models.

CLINICAL RELEVANCE/APPLICATION

Femoral and tibial torsion measurements in children can be reliably performed without radiation exposure based on axial magnetic resonance images.

**PDE192**

Different Faces of Langerhans Cell Histiocytosis (LCH): What the Radiologist Needs To Know (Station #6)

**TEACHING POINTS**

Identify the pathophysiologic mechanisms of LCH Recognize various radiologic features of osseous and extra-osseous LCH involvement. Formulate appropriate differential diagnosis for various LCH imaging findings. Understand the current role of imaging in diagnosis, staging, and follow up. Demonstrate the utility of whole body MRI and PET/CT for activity monitoring and follow up.
### TABLE OF CONTENTS/OUTLINE


Review differential diagnosis and common diagnostic pitfalls. Disease management and prognosis. Highlighting the use of CT, MRI and PET/CT in diagnosis and follow up.

### PDE172

Acute Leukaemic Brain: Imaging of CNS Complications in Childhood Leukaemia (Station #7)

Shruti Kakkar MD (Presenter): Nothing to Disclose, Chandan Kakkar MBBS, MD: Nothing to Disclose, Kavita Saggar MD: Nothing to Disclose, Jatinder Singh Goraya MD: Nothing to Disclose, Navdeep Singh MBBS, MD: Nothing to Disclose, Archana Ahluwalia MD: Nothing to Disclose, RITU GALHOTRA MD: Nothing to Disclose, Siddharth Prakash: Nothing to Disclose

#### TEACHING POINTS

To discuss the various imaging patterns of the CNS involvement in leukaemia

To emphasize the role of MR imaging in management of CNS complications of Leukaemia

To develop a comprehensive approach to imaging diagnosis of CNS involvement in childhood leukaemia

### TABLE OF CONTENTS/OUTLINE

1) To classify the CNS complications into complications directly related to leukaemia and complications secondary to chemotherapy.

2) To illustrate the imaging patterns of direct involvement as leukaemic infiltration, microinfarcts secondary to hyperleucocytosis, stroke, cortical venous thrombosis, possible limbic encephalitis as a paraneoplastic manifestation.

3) To illustrate the imaging patterns of chemotherapy related complications like PRES, vasculitis, leucoencephalopathy, infections and thrombotic microangiopathy.

4) To emphasize on the key clinical and imaging findings which can be detrimental to the diagnosis of a particular condition.

### PDS227

The Snail Sign in Prenatal Intestinal Volvulus: A Specific Semiology on Fetal MRI in 8 Cases (Station #1)

Olivier Prodhomme MD: Nothing to Disclose, Magali Saguintaah MD (Presenter): Nothing to Disclose, Catherine Baud MD: Nothing to Disclose, Nancy Bechard-Sevette MD: Nothing to Disclose, Julie Bolivar-Perrin: Nothing to Disclose, Stephanie David MD: Nothing to Disclose, Alain Couture MD: Nothing to Disclose

#### PURPOSE

To present 8 cases of fetal intestinal volvulus and their outcome. To discuss their etiologies. To describe a specific sign of volvulus on MRI. To discuss the contribution of MRI to the diagnosis and prognosis in comparison with ultrasonography.

#### METHOD AND MATERIALS

Between 2006 and 2013, 8 cases of fetal intestinal volvulus were diagnosed in our institution. The term of diagnosis ranged from 25 to 33 weeks of gestation. We retrospectively studied their clinical, ultrasonographic and MRI data. MRI was performed on a 1.5 T device with T1 and T2 weighted axial, coronal and sagittal sequences. The volvulus was confirmed in 7 cases by surgery or foetopathology.

#### RESULTS

The main clinical abnormality was a decrease in fetal mobility (7). The volvulus was diagnosed on ultrasound in 2 cases by showing the whirlpool sign. It was suspected in 1 (bowel distension with hydrohydric level, ascitis). A hydrohydric level was recognized afterwards in 4 more cases. The diagnosis was established on MRI in all cases, with: - Snail sign in 8: direct visualization of spiraled bowel loops, at best in coronal planes and on T1W
sequences, with hyper signal of bowel content on T1W (8) and T2W (7) sequences - Hydrohydric level: 3 In all cases MRI allowed to better evaluate the amount of normal bowel loops. Associated abnormalities included a laparoscisis (1), cystic fibrosis (2), small bowel atresia (3), localized mesenteric fusion (in 2 twins). No midgut malrotation was present. The outcome was favorable in 5 cases after neonatal surgery. In 1 case, urgent cesarean section was realized at 33 weeks of gestation because of fetal bradycardia. The newborn died shortly after birth because of an associated huge meconial pseudocyst compromising the ventilation. 2 fetuses with cystic fibrosis were interrupted.

CONCLUSION

MRI is a reliable tool for the diagnosis of fetal midgut volvulus. The snail sign is constantly present in our series and easy to assess. MRI helps to determine the amount of normal bowel and thereby the evaluation of prognosis.

CLINICAL RELEVANCE/APPLICATION

Fetal midgut volvulus is rare. Its prognosis seems good if not associated with cystic fibrosis. An early diagnosis allows to improve prenatal follow-up, parents information, neonatal management.

PDS228

Correlating MRI and Anthropometric Measurements in Fixed Fetal Specimens (Station #2)

Mary Ellen Wickum MS (Presenter): Nothing to Disclose, Donald F. Siwek PhD : Nothing to Disclose, Hernan Jara PhD : Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co, Darryl R. Ricketts MS : Nothing to Disclose, Nadja Kodom MD : Nothing to Disclose, Kitt Shaffer MD, PhD : Nothing to Disclose

PURPOSE

To investigate the unknown internal integrity of an unprovenienced collection of fetal specimens housed for many decades by the University. There was no reliable information regarding the medical or curation histories of these specimens. The concern was that tissues could have shrunk due to fixation substances or other influences over time of storage. To determine if MR measurements compared to an anthropomorphic measurement of the feet could assess proportional tissue alteration in the specimens.

METHOD AND MATERIALS

Twenty-five specimens were arbitrarily selected from a total of forty-eight intact appearing specimens. All specimens were imaged using a 3.0T whole body scanner (Achieva, Philips Healthcare, Best, The Netherlands). A single investigator under supervision of a pediatric neuroradiologist obtained MR measurements of the cerebellar diameter (TCD) and femur length (FeL) using Osirix software. Foot measurements (FoL) were obtained using digital calipers. Two rounds of measurements were obtained for each structure to test reproducibility of measurements.

RESULTS

There was good intra-rater reliability because paired t-tests did not show significant differences between the rounds (two tailed α < 0.05). Analysis of correlation using Pearson’s correlation coefficient testing revealed strong positive correlation between TCD, FeL, and FoL measurements (α < 0.05, r - values were all > 0.91, p < 0.001, and R² > 0.82.

CONCLUSION

Our analysis shows a correlation of TCD, FeL, and FoL measurements. We show that a sampling of vital structures appears to be intact, without degradation or significant shrinkage. We conclude that in specimens with strong correlation of measurements, there is either no or proportionate tissue effects from chemical fixation. Further study of will yield more accurate gestational aging of these specimens.

CLINICAL RELEVANCE/APPLICATION

This study validates using this valuable historic collection for teaching normal fetal anatomy or rare abnormalities. It gives a strategy to access other anatomic collections for educational use.

PDS229

Fetal 3D High Resolution T2 TRUFISP MRI: Contribution to Prenatal Diagnosis of CHARGE Syndrome (Station #3)

Magali Saguintaah MD (Presenter): Nothing to Disclose, Alain Couture MD : Nothing to Disclose, Stephanie David MD : Nothing to Disclose, Julie Bolivar-Perrin : Nothing to Disclose, Nancy Bechard-Sevette MD : Nothing to Disclose, Catherine Baud MD : Nothing to Disclose, Olivier Prodhomme MD : Nothing to Disclose

PURPOSE

To present a MRI technic to explore the fetal petrous bone (3D high resolution MRI) and choanae, olfactory bulbs and sulci (3D whole brain sequence). To present the clinical applications in fetal detection of CHARGE syndrome. To remind the major diagnostic criteria of CHARGE syndrome.

METHOD AND MATERIALS

In 2012-2013, 97 fetuses between 27 and 37 weeks of gestation were prospectively explored, in addition to the usual brain exploration, with a 3D high resolution T2 sequence with 1.4 mm scans centered on the petrous bones, and a 3D T2 TRUFISP sequence with 1.5 mm scans on the whole brain. The tympanic cavity, cochlea,
vestibule, semicircular canals, choanae, olfactory bulbs and sulci were analyzed. These anatomical structures, as well as ocular globes, vermis and thymus were studied in 4 fetuses with US suspected CHARGE syndrome.

RESULTS

The cochlea, superior and lateral semicircular canals were identified in 95.8% of cases. In 4 cases motion artefacts prevented from a good analysis. Olfactory bulbs and sulci were correctly visualized in 94%. Choanae were always visible. 4 fetuses were referred for suspicion of CHARGE syndrome. The US abnormality were a cardiac malformation (3), external ears abnormalities (2), labiopalatine cleft (1), thymic hypoplasia (1). MRI was performed at 26 to 32 weeks of gestation and showed 3 colobomas 4 absent semicircular canals 3 absent olfactory bulbs and sulci 1 bilateral choanal atresia 2 vermis hypoplasia 2 thymic hypoplasia CHARGE syndrome was confirmed in all cases. 2 pregnancies were interrupted. 1 baby survived 8 weeks. 1 is 4 months old with multiple impairments.

CONCLUSION

Antenatal diagnosis of CHARGE syndrome is challenging because of the poor specificity of minor criteria (cardiac, limb, genitai, oesophageal, urinary tract and central nervous system malformations, facial cleft) and the high difficulty to assess some of the major criteria: semicircular canal agenesis, arhinencephalia, coloboma, choanal atresia. The 3D high resolution T2 TRUFISP MRI, as performed in our institution, provides a high sensitive tool to image these anatomical structures and thereby assess the diagnosis. Thymic and vermis hypoplasia are minor criteria that should lead to a petrous bone MRI exploration.

CLINICAL RELEVANCE/APPLICATION

Given the severity of the malformations association in CHARGE syndrome, prenatal diagnostic is useful to help parents counselling and/or interrupt the pregnancy.

PDS230

Brain Structural Network Abnormality in Pediatric Patients with Posttraumatic Stress Disorder Revealed by Cortical Thickness (Station #4)

Lei Li (Presenter): Nothing to Disclose, Xueling Suo : Nothing to Disclose, Du Lei : Nothing to Disclose, Fuqin Chen : Nothing to Disclose, Qiyong Gong : Nothing to Disclose

PURPOSE

Although previous studies have identified deficits in the gray matter volume of adult patients with posttraumatic stress disorder (PTSD), the research in pediatric PTSD is limited. Furthermore, the cortical thickness, as a more sensitive measurement of morphological alteration than volume, has seldom been investigated in PTSD patients. The aim of this study was to explore cortical thickness in pediatric patients with PTSD and investigate the brain structural network abnormalities revealed by cortical thickness between the regions.

METHOD AND MATERIALS

We recruited subjects 8-15 months after a severe earthquake in western China, including 28 children patients with PTSD and 26 matched controls. By using the FreeSurfer, cortical thicknesses were compared between patients and controls with the threshold of P < 0.01 at voxel level. The average thickness within each region in each individual was calculated, and tested for correlation with symptom severity as measured by clinician-administered PTSD scale (CAPS). The relationships between cortical thicknesses among brain regions with significant group differences were examined using an analysis of covariance.

RESULTS

Compared with controls, patients exhibited significantly reduced cortical thickness, primarily in the bilateral parietal cortex, bilateral dorsolateral frontal cortex and right middle temporal cortex. Moreover, significant cortical thickening was found in the left middle temporal cortex and right insula. The correlation analysis showed that the PTSD patients differed from controls in the network pattern of structural correlations between the cortical thicknesses in frontal, parietal and temporal cortex. In addition, in PTSD patients, the cortical thickness in the inferior frontal gyrus also positively correlated with CAPS scores (r=0.42; p<0.05).

CONCLUSION

Our findings demonstrate not only regional cortical thickness changes but an altered network pattern of interregional correlations of structural abnormalities in pediatric PTSD patients. Our study provides further insight into the supra-regional brain anatomical network in PTSD.

CLINICAL RELEVANCE/APPLICATION

Reduced cortical thickness in pediatric PTSD is a promising biomarker, and altered structural network may help us better understand the dysfunctional networks in posttraumatic symptoms.

PDS231

Patellofemoral Compartment T2 Mapping MRI Evaluation of Occult Chondral Injury in Children with Supernumerary Patella Fat Impingement (Station #5)

Johanna Monsalve MD (Presenter): Nothing to Disclose, J. Herman Kan MD : Nothing to Disclose, Lorell Ruiz-Flores MD : Nothing to Disclose, Zili David Chu PhD : Nothing to Disclose

PURPOSE

Patellofemoral compartment MRI is a promising tool to non-invasively evaluate the articular cartilage damage in children with supravalvar patella fat impingement.
Patellofemoral maltracking may lead to superolateral Hoffa's fat pad impingement due to asymmetric force in the lateral patellofemoral joint soft tissues during knee motion. The purpose of this study was to determine the utility of T2 mapping in identifying additional occult chondral injuries when classic imaging findings of superolateral Hoffa's fat pad impingement were identified on conventional sports medicine knee MRI exams in children.

METHOD AND MATERIALS

This was a retrospective case-control study. The study group consisted of 31 patients (8 male, 23 female, average age: 15 years) who underwent MR imaging of the knee. All children underwent multiplanar T2 and proton density sequences as well as T2 mapping sequences performed in the axial plane. T2 mapping sequence is a SENSE Multi-slice multi-echo sequence providing 6 echoes with TR of 2000 ms; TEs of 13*n ms, where n=1, 2, 3, 4, 5, 6; 160 mm FOV; voxel size of 0.29x0.29x2.5 mm3, slice gap of 0.25 mm, 10 slices, acquisition time of 5:54 minutes. Patients were included in the study population if there were features of superolateral fat pad impingement (presence of increased signal on fluid sensitive sequences in the superolateral region of Hoffa's fat pad—Figure 1) in the absence of lateral compartment chondral injury identified on conventional anatomic MR sequences. ROI values were measured of the lateral patellar and trochlear cartilage. This was compared with a normal knee MRI population (16 male, 15 female, average age: 14.5 years).

RESULTS

Review of the T2 color maps for both superolateral impingement and normal patients show no focal areas of increased T2 values in lateral patellar or trochlear cartilage. Lateral patellar T2 values in children with superolateral fat pad impingement and normal patients was 37.9 +/-8.1 and 36.7 +/-6.4 msec, respectively (P=0.399). Lateral trochlear T2 values in children with superolateral fat pad impingement and normal patients was 42.5 +/-4.6 and 46.2 msec, respectively (P=0.098).

CONCLUSION

T2 mapping of the lateral patellofemoral compartment in the setting of superolateral fat pad impingement does not appear to identify occult chondral injuries when conventional anatomic T2 and PDW MR sequences of cartilage are normal.

CLINICAL RELEVANCE/APPLICATION

Patellar maltracking with superolateral fat pad impingement identified by MR is not associated with chondral edema identified on T2 mapping sequences in children.

PDE167

Ultrasound of the Metaphyses in the Setting of Nonaccidental Trauma: Presentation of Normal Findings, Metaphyseal Variants, and Classic Metaphyseal Lesions (Station #6)

Megan Beth Marine MD (Presenter): Nothing to Disclose, Boaz Karmazyn MD: Nothing to Disclose

TEACHING POINTS

1. Appearance of the normal anatomy of the metaphyses of the long bones on ultrasound.
2. Correlation of metaphyseal variants on xray with findings on ultrasound.
3. Findings of classic metaphyseal lesions visualized on ultrasound.

TABLE OF CONTENTS/OUTLINE

Anatomy of the Long Bone Metaphyses Metaphyseal Variants: Metaphyseal Collar, Beak, Distal Metaphyseal Fragmentation, Step-off, Spur ----Ultrasound Appearance Correlated with Xray Classic Metaphyseal Lesions: Bucket-handle and Corner Fracture Appearance ----Ultrasound Appearance Correlated with Xray ----Ultrasound Findings: Subperiosteal Hematoma, Fracture Fragments, Periosteal Reaction Future Expectations

PDE111

Multimodality Imaging of Cystic Fibrosis Lung Disease in Children: Concurring Diagnostic Approaches (Station #7)

Irene Maria Olivia Borzani MD (Presenter): Nothing to Disclose, Giulia Cervellin: Nothing to Disclose, Mauro Campoleoni BS: Nothing to Disclose, Pietro R. Biondetti MD: Nothing to Disclose, Carla Colombo MD: Nothing to Disclose

TEACHING POINTS

The aim of this exhibit is: 1. To review the role of imaging in diagnosis and follow-up of lung disease in children with cystic fibrosis 2. To show the acquisition protocol of low-dose CT scan and MRI sequences 3. To illustrate the imaging features of lung alterations with different modality 4. To highlight benefits and weaknesses of plain film, CT scan and MRI in imaging the lung and in displaying lung alterations

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Clinical indications (chest radiograph, CT scan and MRI) 3. Low-dose CT scan protocols and post-processing 4. MRI sequences and post-processing 5. Specific appearances of lung findings (bronchiectasis, lung consolidation, bronchial wall thickening, mucus plug, bullae, air-trapping) a. Chest radiograph b. CT c. MR

PDE003-b

MRI of Musculoskeletal Impingement and Friction Syndromes in Children (hardcopy backboard)
TEACHING POINTS

At the end of viewing this exhibit the learner should be able to:

1. List several impingement and friction conditions that can be diagnosed in pediatric population by magnetic resonance imaging (MRI).
2. Describe MRI findings of subspine, ischiofemoral, and talocalcaneal impingement, and iliotibial band friction syndrome and patellar tendon-lateral femoral condyle friction syndrome (superolateral Hoffa fat pad impingement) in children.
3. Explain the importance of becoming familiar with such impingement conditions as they may be encountered on MRI due to biomechanical alterations following corrective or tumor-removal surgery.

TABLE OF CONTENTS/OUTLINE

The role of MRI in musculoskeletal impingement and friction syndromes Impingement and friction conditions in children that can be diagnosed by MRI Subspine impingement (between anterior inferior iliac spine and proximal femur) Femoral acetabular impingement Ischiofemoral impingement Patellar tendon-lateral femoral condyle friction syndrome (superolateral Hoffa fat pad impingement) Iliotibial band friction syndrome Talocalcaneal impingement Take home messages
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 b-value 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**

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 $FM(t) = FM_{max} - A* e^{-t/\tau}$ 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.

**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 limbic, 2 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, 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 PTSD. To test the hypothesis that aberrant functional brain connectivity is associated with PTSD, we examined resting state fMRI data from 25 children with PTSD and 25 healthy controls, aged 8-16 years. fMRI data were acquired using a 3T MR scanner (Siemens Medical systems) and analyzed 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. Our results suggest that aberrant functional brain connectivity is associated with PTSD.

**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 limbic, 2 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.
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 $\lambda$. 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.

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**VSPD31**

**Pediatric Series: CV/IR**

**Series Courses**

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**Participants**

Moderator
Rajesh Krishnamurthy MD : Research support, Koninklijke Philips NV Travel support, Koninklijke Philips NV
Moderator
William Eugene Shiels DO : President, Mauka Medical Corporation Royalties, Mauka Medical Corporation Patent holder, Mauka Medical Corporation
Moderator
John Miras Racadio MD : Research Consultant, Koninklijke Philips NV Travel support, Koninklijke Philips NV

**Sub-Events**

**VSPD31-01**

**Peripheral Vasc Imaging Technical Tips**

Shreyas Shreenivas Vasanawala MD, PhD (Presenter): Research collaboration, General Electric Company Stockholder, Morpheus Imaging, Inc

**LEARNING OBJECTIVES**

1) Know an approach to the choice of contrast agent for peripheral vascular imaging. 2) Know indications for non-contrast and pre-contrast imaging. 3) Know the types of fat suppression and how to pick which method to use. 4) Know sequence parameter modifications that enable imaging within stents.

**ABSTRACT**

This presentation will focus on methods of optimizing the MR imaging of peripheral vessels, addressing four questions. The first question is which contrast agent to choose. Most MR imaging can be performed with standard extracellular gadolinium agents. However, there are some advantages and disadvantages of blood pool agents that will be discussed. Next, situations when pre-contrast or non-contrast imaging is necessary are covered. Mostly, these sequences are only necessary in situations where the technical quality of post-contrast imaging is in doubt. Third, approaches to fat suppression will be covered. The benefits and disadvantages of
two-point Dixon methods compared with subtraction and spectrally selective suppression will be reviewed. Finally, MR imaging in the presence of vascular stents will be covered, including sequence modifications that enable visualization within the stents.

**VSPD31-02 Validation of Quantitative Phase Contrast MRI Assessment of Cerebral Haemo/Hydro Dynamics in Children**

**Eusra Hassan (Presenter): Nothing to Disclose , John Caine : Nothing to Disclose , Stavros Michael Stivaros PhD, FRCR : Medical Director, Obsidian Health Limited**

**PURPOSE**

Quantitative phase contrast MRI (PCMRI) enables the flow of blood or CSF to be measured over a cardiac cycle. PCMRI in children presents unique challenges in implementation relating to ECG acquisition technique and MRI scanning parameters which this study investigates.

**METHOD AND MATERIALS**

PCMRI was performed to measure flow through the right and left internal carotid and basilar arteries (rICA, lICA, BA), superior sagittal sinus (SSS), straight sinus vein (StrS), CSF through the foramen magnum (FM) and aqueduct of sylvius (AQ). Velocity encoding (venc) was varied based on evidence of under or or oversampling. PCMRI experiments were performed using central ECG gating and then repeated using peripheral pulse gating. The imaging was analysed by three experienced observers in the field of PCMRI analysis using the image analysis programme, Segment, to allow the respective flow rates to be calculated.

**RESULTS**

Data was collected from 16 children aged 1 to 15 years (mean 4 years 6 months). Nine children had central and peripheral pulse gating employed. The mean flow rates measured with peripheral gating was rICA = 0.094mls/s, lICA = 0.098mls/s, BA = 0.056mls/s, SSS = 0.007mls/s, StrS = 0.001mls/s, FM = 0.011mls/s, AQ = 0.001mls/s. Mean flow rates with central ECG measurements were rICA = 0.091mls/s, lICA = 0.091mls/s, BA = 0.057mls/s, SSS = 0.042mls/s, StrS = 0.306mls/s, FM = 0.003mls/s, AQ = 0.001mls/s. No significant statistical difference was detected based on the acquisition technique. Compared to published adult literature, the velocity encoding gradients (venc) in our childhood cohort were significantly different with arterial =120cm/s, venous=25cm/s and CSF=16cm/s.

**CONCLUSION**

Our data shows no significant difference with regard to peripheral versus central pulse measurement for PCMRI acquisition in children. Peripheral PCMRI acquisition is much easier to apply and better tolerated in the paediatric cohort. In addition this work provides child specific venc values for PCMRI assessment, which differs from published adult data.

**CLINICAL RELEVANCE/APPLICATION**

It is recognised that there exists a complex interaction between cerebral arterial, venous and CSF flow rates in hydrocephalus. Quantitative PCMRI allows for non-invasive assessment of these haemo/hydrodynamic flows which may one day supersed invasive intracranial monitoring. This work looks to develop and validate paediatric focused application of PCMRI for such applications.

**VSPD31-03 Cardiac Phase-dependent Image Quality of the Coronaries in Pediatric Cardiac High Pitch Computed Tomography**

**Matthias Stefan May (Presenter): Speakers Bureau, Siemens AG , Wolfgang Wust MD : Nothing to Disclose , Michael Uder MD : Speakers Bureau, Bracco Group Speakers Bureau, Siemens AG Research Grant, Siemens AG , Michael Marcus Lell MD : Research Grant, Siemens AG Speakers Bureau, Siemens AG Research Grant, Bayer AG Speakers Bureau, Bayer AG Research Consultant, Bracco Group , oliver rompel : Nothing to Disclose**

**PURPOSE**

The purpose of this study was to retrospectively evaluate the best cardiac phase for visualization of the coronaries in children younger than 1 year undergoing Cardiac High Pitch Computed Tomography (CT). The study applies to the declaration of Helsinki.

**METHOD AND MATERIALS**

Cardiac CT was performed on a second generation Dual-Source CT in 95 Patients (median age 31 days, range 1-336 days) with a high-pitch protocol (p=3,2) at 80 kVp, automatic exposure control and a total collimation of 2x64x0,6mm. The ECG-trace was used as trigger for automated heart-phase (HP) selection. Retrospective data analysis was carried out in dependence of the HP (<20%/n=9, <30%/n=17, <40%/n=10, <50%/n=26, <60%/n=14, <70%/n=13, <80%/n=6). Motion artifacts in the coronary arteries were recorded for the proximal and distal segments on a 5-point Likert scale by two radiologists.

**METHOD AND MATERIALS**

Cardiac CT was performed on a second generation Dual-source CT in 95 Patients (median age 31 days, range 1-336 days) with a high-pitch protocol (p=3,2) at 80 kVp, automatic exposure control and a total collimation of 2x64x0,6mm. The ECG-trace was used as trigger for automated heart-phase (HP) selection. Retrospective data analysis was carried out in dependence of the HP (<20%/n=9, <30%/n=17, <40%/n=10, <50%/n=26, <60%/n=14, <70%/n=13, <80%/n=6). Motion artifacts in the coronary arteries were recorded for the proximal and distal segments on a 5-point Likert scale by two radiologists.
RESULTS
Mean heart rate was 137 bpm (±27 bpm) and was not statistically different between the HP-groups (p=0.629). Image quality of the coronary arteries was best at <50% and worst below 20% of the HP for both, the proximal and distal segments (p<0.001). Visualization was still good and without statistically significant differences at <40% for the proximal (p=0.13) and at <40% and <60% for the distal segments (p=0.27/0.06). Inter rater agreement was substantial (κ=0.701).

CONCLUSION
Pediatric cardiac CT should be performed at 40-50% of the cardiac cycle in children below 1 year for best visualization of the coronaries.

CLINICAL RELEVANCE/APPLICATION
Technical settings undergoing pediatric cardiac CT should be optimized to obtain stable images at 40-50% of the HP.

4D Flow MRI Improves Hemodynamic Evaluation in Patients with D-transposition of the Great Arteries Following the Arterial Switch Operation Compared to 2D Phase Contrast MRI and Doppler Echocardiography

Marleen Vonder; Nothing to Disclose, Kelly Jarvis (Presenter): Nothing to Disclose, Susanne Schnell: Nothing to Disclose, Michael Markl PhD: Nothing to Disclose, Joshua D. Robinson MD: Nothing to Disclose, Cynthia Karfias Rigsby MD: Nothing to Disclose, Bradley D. Allen MD: Nothing to Disclose, Alex Barker: Nothing to Disclose

PURPOSE
Pulmonary artery (PA) stenosis either at the anastomosis or in the branch PAs is the most common complication leading to intervention after the arterial switch operation (ASO) for D-transposition of the great arteries (DTGA). Accurately depicting PA stenosis is paramount for postop DTGA evaluation. 2D PC MRI (2D PC) or Doppler echo (echo) rely on velocity quantification in a single imaging plane and one-directional velocity encoding and may not detect the peak velocity across entire vessel segments. 4D flow provides 3-directional velocity encoding and full volumetric coverage of the great arteries and may improve hemodynamic evaluation. Our aim was to compare peak velocities measured by 2D PC and 4D flow with the gold standard echo in patients with DTGA s/p ASO.

METHOD AND MATERIALS
Eleven patients with DTGA s/p ASO who underwent 2D PC and 4D flow were included (mean age 13.2 y (range 1-30)). Peak velocities were measured in the ascending aorta (AAo), main (MPA), right (RPA), and left (LPA) pulmonary arteries. Echo data was available in 10/8/5/4 patients in the AAo/MPA/RPA/LPA. Peak velocities were measured with: 1) a single cross section for 2D PC, 2) velocity maximum intensity projections (MIPs) of the entire aorta and PAs for 4D flow and 3) spectral Doppler for echo.

RESULTS
Significantly higher peak velocities were found with 4D flow than 2D PC in the AAo (1.27±0.37m/s vs 1.11±0.24m/s, p=0.021), MPA (2.22±1.17m/s vs 1.34±0.54m/s, p=0.006), RPA (2.60±0.67m/s vs 1.63±0.65m/s, p=0.026) and LPA (2.14±0.73m/s vs 1.64±0.69m/s, p=0.003) indicating the potential of 4D flow to provide improved stenosis assessment. Correlation analysis showed moderate to strong relationships between 4D and 2D PC in the AAo (R²=0.624), MPA (R²=0.696), RPA (R²=0.301) and LPA (R²=0.757) but consistent velocity underestimation by 2D PC (Slopes of linear regression =0.38 - 0.82). No difference in peak velocity was found between 4D flow and echo for all vessels.

CONCLUSION
4D flow assessment of peak velocities in DTGA s/p ASO was similar to echo and superior to 2D PC which consistently underestimated peak velocities.

CLINICAL RELEVANCE/APPLICATION
Improved assessment of peak pulmonary artery velocities using 4D flow velocity MIPs in DTGA s/p ASO may more accurately depict significant stenoses.

The Application of 70 kV Technique Combined with Sinogram Affirmed Iterative Reconstruction (SAFIRE) in Infants with Total Anomalous Pulmonary Venous Connections: An Experimental Study with Dual-Source CT

Yan Wang MMed, MS (Presenter): Nothing to Disclose, Dapeng Shi MD: Nothing to Disclose

PURPOSE
To explore the application of dual source CT with ultra-low tube voltage (70kV) combined with iterative reconstruction algorithm (SAFIRE) in infants with total anomalous pulmonary venous connections.

METHOD AND MATERIALS
This prospective study was approved by institutional review board, and written informed consents were obtained from all patients' parents. Twenty three infants (13 male and 10 female, mean age 3 months, range 1-36 months, mean weight 5kg) suspected of total anomalous pulmonary venous connections (TAPVC) in our hospital, underwent cardiovascular examination with DSCT and trans-thoracic echocardiography (TTE) one week before surgery. All DSCT scans used the Flash mode with a tube voltage of 70 kV, and the tube current,
amount of contrast medium and injection rate were adjusted according to patients' weight. Images were reconstructed with iterative reconstruction algorithm SAFIRE. DSCT and TTE results were compared with the results from surgery. Image quality was evaluated, and effective radiation dose (ED) was calculated.

RESULTS

All 23 cases were confirmed as TAPVA in operations. DSCT diagnosed all 23 cases, TTE missed 1 case; however, 22 cases were diagnosed correctly as TAPVA with DSCT except one mixed type case, 16 cases were diagnosed correctly with TTE, and 3 mixed type cases were misdiagnosed. 3 infracardiac were diagnosed when information from CT was considered. Seventy three anomalous pulmonary veins were identified by DSCT, which results in a detection rate of 91.6% (73/76); 65 were identified by TTE, with a detection rate of 85.5% (65/76); 39 combined malformations were detected by DSCT among all 41 malformations from surgery, with a detection rate of 95.1% (39/41). 40 combined malformations were detected by TTE, with a detection rate of 97.6% (40/41). For DSCT scans, image quality was good or excellent for 21 patients and diagnostic in 2 patients. The mean effective radiation dose ED was (0.95 ± 0.32) mSv.

CONCLUSION

DSCT Flash mode scans with combination of 70kV tube voltage technique and SAFIRE reconstruction algorithm can compensate for move artefacts caused by the rapid heart rate and free breathing in infants, improve the image quality, and perform CT examination with low radiation dose and less contrast medium.

CLINICAL RELEVANCE/APPLICATION

Flash mode on DSCT with a combination of 70kV tube voltage and iterative reconstruction algorithm SAFIRE has a good performance in infants with complicated TAPVC.

VSPD31-06  Cardiac Magnetic Resonance Imaging in Pediatric Patient’s ≤ 18 Years with Suspected Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC): A Correlation to Genetics

Wieland Staab MD (Presenter): Nothing to Disclose, Jan Martin Sohns MD: Nothing to Disclose, Martin Fasshauer MD: Nothing to Disclose, Christian Sohns: Nothing to Disclose, Joachim Lotz MD: Research Cooperation, Siemens AG, Christina Unterberg-Buchwald: Nothing to Disclose, Alexander Schwarz: Nothing to Disclose

PURPOSE

This study sought to determine the clinical influence of right and left ventricular findings in pediatric patients undergoing cardiac magnetic resonance imaging (CMRI) ≤ 18 years with suspected arrhythmogenic right ventricular cardiomyopathy (ARVC).

METHOD AND MATERIALS

In a consecutive series between September 2010 and December 2013 (38 months), 79 (14.0 ± 3.9 years, 46 male) young patients ≤ 18 underwent contrast-enhanced magnetic resonance imaging (CMRI) and genetic analysis after biopsy for evaluation clinically suspected ARVC.

RESULTS

Overall, 5 patients showed major criteria due to a combination of moderate to severe RV dysfunction and dilation as well as regional akinesia. Applying the revised TFC, 6 patients showed minor abnormalities such as mild RV dilatation, dys-synchronous RV contraction or regional akinesia. Overall 11 out of 12 (92%) patients with positive genetic characteristics were found to have major or minor abnormalities applying the revised Task Force Criteria. Here, positive predictive value (PPV) was 100%, negative predictive value (NPV) was 93%, sensitivity was 93% and specificity was 100%. Mean RVEDVI/BSA was 80 ± 16 and mean EF was 51 ± 8 in the whole study population. A subgroup analysis revealed a significantly (p = 0.01) decreased mean EF of 36 ± 9 and an increased RVEDVI/BSA of 101 ± 10 in 11 patients with major or minor abnormalities according to the revised TFC.

CONCLUSION

This is the first study applying the revised Task Force Criteria (TFC) regarding the detection of ARVC in young patient’s ≤ 18 years with suspected ARVC.

CLINICAL RELEVANCE/APPLICATION

Applying the revised Task Force Criteria (TFC) regarding the detection of ARVC in young patient’s ≤ 18 may increase the diagnostic value of CMR in this context.

VSPD31-07  3D Printing of Complex Intracardiac Morphology

Shi-Joon Yoo MD (Presenter): Owner, 3D HOPE Medical

LEARNING OBJECTIVES

1) Understand 3D printing process for heart models. 2) Know the utility of 3D printing in pediatric cardiac imaging and surgery. 3) Know the limitations of 3D printing technology. 4) Predict the future avenues of 3D printing in pediatric cardiology.

ABSTRACT

Rapid prototyping or 3D printing is an additive manufacturing technique where the object is digitally decomposed into thin layers and the printer adds the print material layer by layer until a physical model of the whole object is built. The prototype models can be made of solid material like plastic or ceramic, or rubber like
material with some resemblance of myocardial texture. Any 3D volume image data can be used for 3D printing. The most ideal is high-resolution isotropic voxel data with ECG-gating and breath-holding or respiration navigation. Breath-held and ECG-gated CT angiograms are most commonly applicable data set; MR angiograms with ECG-gating and respiration navigation obtained after injection of a blood pool contrast agent provides uniform enhancement of the blood pool with the spatial resolution comparable to CT angiograms. Using 3D image data of contrast angiograms, 3D models of both blood pool and endocardial surface can be manufactured. The blood pool model can be reproduced from contrast-enhanced angiograms by using thresholding technique and manual adjustment. The endocardial surface anatomy can be reproduced by graphically adding a layer outside the blood pool.; When it is printed, the added layer is a shell of the cavity, the inner surface of which represents the endocardial surface anatomy that will be encountered with at operation. The major clinical applications of 3D printing in pediatric cardiology are planning and simulation of surgical procedures for complex congenital heart diseases such as atypical forms of double outlet right ventricle and criss-cross heart. 3D print models allow instantaneous understanding of complex anatomy and eliminates the chances of misunderstanding and inappropriate choice between biventricular and univentricular repairs. In addition, 3D print models are valuable educational resources. This presentation will show a few clinical examples where 3D printing played the major role in surgical decision.

VSPD31-08 Percutaneous Drainage Procedures in Children
John Miras Racadio MD (Presenter): Research Consultant, Koninklijke Philips NV Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES
1) Review common indications for percutaneous drainage procedures in children. 2) Understand unique differences or special considerations needed in performing percutaneous drainage procedures in children versus adults.

VSPD31-09 Palliative Percutaneous Cryoablation in the Pediatric and Young Adult Population
Brian Faustino Baigorri MD (Presenter): Nothing to Disclose, Peter John Litstrup MD: Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc, Hussein D. Aoun MD: Nothing to Disclose, Barbara A. Adam MSN: Nothing to Disclose, Mark J. Krycia BS: Nothing to Disclose, Evan N. Fletcher MS, BA: Nothing to Disclose, Matthew Prus BS: Nothing to Disclose, Mohamed M. Jaber MD: Nothing to Disclose

PURPOSE
To assess the safety and efficacy of cryoablation for palliation and local tumor control in the pediatric/young adult oncology population.

METHOD AND MATERIALS
CT and/or US-guided percutaneous cryoablations were performed using established adult parameters of N+1 cryoprobes for N(cm) tumor diameter. Ablation locations were noted as head and neck, thoracic, liver, kidney, and soft tissue. Tumor type, complications, and length of stay were recorded. Tumors and ablation zones were measured in 3 planes. Complications were graded by the Common Terminology of Complications and Adverse Events (CTCAE v4.0). Patients received CT or MRI follow-up at 1, 3, 6, 12, 18, 24 months and yearly thereafter.

RESULTS
CT and/or US-guided cryoablation was performed on 111 tumors in 36 pediatric and young adults in 82 procedures. All patients received only conscious sedation. An average age of 23 (range 1.6-38) was observed in the pediatric population due to the proportion of young adult sarcoma patients. Benign tumors included 5 osteoid osteoma and 4 desmoids, and the malignant tumors included 32 alveolar soft part sarcomas, 24 renal cell carcinomas, 13 osteosarcomas, 6 synovial sarcomas, and 37 miscellaneous. Tumor ablation location was noted as: 52 thoracic, 11 liver, 12 kidney, and 36 soft tissue. Patient mortality was 0%, with all adverse events being mild/moderate except for two major complications (2.4%). One was due to a bronchopleural fistula following lung ablation of an osteosarcoma metastasis, and the other was due to anticipated facial edema requiring tracheotomy in a head and neck procedure. Local treatment failure or progression occurred in 2.7%(3/111) and satellite recurrence in 6.3%(7/111) of tumors.

CONCLUSION
CT guided percutaneous cryoablation is a safe treatment alternative in the pediatric and young adult population with associated low morbidity, and should be considered in the management of oligoneoplastic disease. Multifocal use of cryoablation is safe for pediatric patients with outcomes similar for adults, also emphasizing its low peri-procedural pain.

CLINICAL RELEVANCE/APPLICATION
Like adults, pediatric oncology patients also suffer from the morbidity of managing localized cancer recurrence or progression. Cryoablation provides for low pain, complication and recurrence rates.

VSPD31-10 CT-guided Placement of Hyperthermia Catheters to Support Regional Deep Hyperthermia for Pediatric Malignancies

VSPD31-08 Percutaneous Drainage Procedures in Children
John Miras Racadio MD (Presenter): Research Consultant, Koninklijke Philips NV Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES
1) Review common indications for percutaneous drainage procedures in children. 2) Understand unique differences or special considerations needed in performing percutaneous drainage procedures in children versus adults.

VSPD31-09 Palliative Percutaneous Cryoablation in the Pediatric and Young Adult Population
Brian Faustino Baigorri MD (Presenter): Nothing to Disclose, Peter John Litstrup MD: Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc, Hussein D. Aoun MD: Nothing to Disclose, Barbara A. Adam MSN: Nothing to Disclose, Mark J. Krycia BS: Nothing to Disclose, Evan N. Fletcher MS, BA: Nothing to Disclose, Matthew Prus BS: Nothing to Disclose, Mohamed M. Jaber MD: Nothing to Disclose

PURPOSE
To assess the safety and efficacy of cryoablation for palliation and local tumor control in the pediatric/young adult oncology population.

METHOD AND MATERIALS
CT and/or US-guided percutaneous cryoablations were performed using established adult parameters of N+1 cryoprobes for N(cm) tumor diameter. Ablation locations were noted as head and neck, thoracic, liver, kidney, and soft tissue. Tumor type, complications, and length of stay were recorded. Tumors and ablation zones were measured in 3 planes. Complications were graded by the Common Terminology of Complications and Adverse Events (CTCAE v4.0). Patients received CT or MRI follow-up at 1, 3, 6, 12, 18, 24 months and yearly thereafter.

RESULTS
CT and/or US-guided cryoablation was performed on 111 tumors in 36 pediatric and young adults in 82 procedures. All patients received only conscious sedation. An average age of 23 (range 1.6-38) was observed in the pediatric population due to the proportion of young adult sarcoma patients. Benign tumors included 5 osteoid osteoma and 4 desmoids, and the malignant tumors included 32 alveolar soft part sarcomas, 24 renal cell carcinomas, 13 osteosarcomas, 6 synovial sarcomas, and 37 miscellaneous. Tumor ablation location was noted as: 52 thoracic, 11 liver, 12 kidney, and 36 soft tissue. Patient mortality was 0%, with all adverse events being mild/moderate except for two major complications (2.4%). One was due to a bronchopleural fistula following lung ablation of an osteosarcoma metastasis, and the other was due to anticipated facial edema requiring tracheotomy in a head and neck procedure. Local treatment failure or progression occurred in 2.7%(3/111) and satellite recurrence in 6.3%(7/111) of tumors.

CONCLUSION
CT guided percutaneous cryoablation is a safe treatment alternative in the pediatric and young adult population with associated low morbidity, and should be considered in the management of oligoneoplastic disease. Multifocal use of cryoablation is safe for pediatric patients with outcomes similar for adults, also emphasizing its low peri-procedural pain.

CLINICAL RELEVANCE/APPLICATION
Like adults, pediatric oncology patients also suffer from the morbidity of managing localized cancer recurrence or progression. Cryoablation provides for low pain, complication and recurrence rates.

VSPD31-10 CT-guided Placement of Hyperthermia Catheters to Support Regional Deep Hyperthermia for Pediatric Malignancies
Preliminary Efficacy, and Future Perspectives

Intra-Arterial Transplantations of Mesoangioblasts (MABs) in 5 Dystrophic Children: Safety, Preliminary Efficacy, and Future Perspectives

VSPD31-11

First Phase-1 Study in the Treatment of Duchenne Muscular Dystrophy (DMD) by Multiple Intra-Arterial Transplantations of Mesoangioblasts (MABs) in 5 Dystrophic Children: Safety, Preliminary Efficacy, and Future Perspectives

Percutaneous hyperthermia catheter allow for the placement of Bowman probes for temperature measurements inside the tumor during deep regional hyperthermia treatment. The aim of this study was to evaluate the safety and effectiveness of CT-guided placement of percutaneous hyperthermia catheter in pediatric malignancies.

**METHOD AND MATERIALS**

Forty pediatric patients (mean age 5.8 ± 5.6 years, range 0-18 years) scheduled for regional deep hyperthermia treatment of germ cell tumors (n=20), rhabdomyosarcoma (n=11), Ewing’s sarcoma (n=3), desmoplastic tumor (n=3), hepatoblastoma (n=1), nephroblastoma (n=1) and lymphoma (n=1) were included in this retrospective analysis. A total of 46 hyperthermia catheters were placed under CT-guidance into tumors in the pelvis (n=29), liver/upper abdomen (n=6), neck (n=3), lower limb (n=5) and vertebral column (n=3). In all patients, the tumor was approached using a 13G puncture sheath under CT-guidance and a 6F percutaneous hyperthermia catheter (Somatex, Medical Technologies) was placed via the sheath inside the tumor. The duration of the intervention, technical success, perinterventional complications and the distance of the probe within the tumor were analyzed.

**RESULTS**

44 of 46 (95.7%) percutaneous hyperthermia catheters were placed successfully in the tumor. Mean tumor diameter was 4.7 ± 3.5 cm and the mean catheter distance within the tumor was 3.7 ± 3.3 cm. One hyperthermia catheter was placed 8 mm below a rhabdomyosarcoma in the lower limb and one hyperthermia catheter dislocated from a superficial metastasis immediately after the procedure. Mean procedure time was 39.5 ± 16.3 min. No complications were observed.

**CONCLUSION**

CT-guided hyperthermia catheter placement is a safe and reliable method to support treatment control in deep regional hyperthermia for pediatric malignancies.

**CLINICAL RELEVANCE/APPLICATION**

Deep regional hyperthermia is a promising salvage treatment option for pediatric malignancies. CT-guidance placement of hyperthermia catheter is a safe and reliable procedure and can therefore be recommended to support temperature measurements inside the tumor during deep regional hyperthermia treatment.
A higher MABs intra-arterial concentration, transplanted exclusively in the lower limbs, at an early disease stage, could determine an increase of dystrophin restoration and a consequent improvement of the clinical outcome.

**Clinical Outcomes in Pediatric Patients Who Underwent Catheter-Directed Portal and Mesenteric Vein Thrombolysis**

**David L. Lamar MD, PhD (Presenter): Nothing to Disclose, Giri Shivaram MD : Nothing to Disclose**

**PURPOSE**

Literature describing transcatheter portomesenteric thrombolysis in pediatric patients is lacking. The purpose of this study is to review our experience with catheter-directed thrombolysis in 8 children with a focus on etiology, presentation, and distribution of portomesenteric vein thrombosis and transcatheter thrombolysis technique, complications, and outcomes.

**METHOD AND MATERIALS**

Retrospective analysis of 9 cases of catheter-directed portomesenteric vein thrombolysis in 8 patients (6 female, 2 male) performed at a pediatric academic referral-center. Mean age was 15.0 years old (range= 8 to 17 years old) at the time of initial interventions performed between 2005 and 2014. A presumed etiology was determined in 5 of 8 patients and included portal hypertension from various causes (3 patients), splenic torsion, and thrombocytosis following splenectomy for idiopathic thrombocytopenic purpura. No patients had hepatic transplants. For all patients, transhepatic portal access was achieved either via direct percutaneous or transjugular-transhepatic routes. Outcomes examined included resolution of symptoms, degree of lysis, complications, and sustained clot resolution at follow-up.

**RESULTS**

Successful transcatheter thrombolysis was achieved in 7 of 8 patients; one patient (unknown etiology of thrombus) experienced recurrent thrombus and eventual cavernous transformation. Two patients experienced major bleeding complications requiring transfusion (hemothorax and hemoperitoneum) which were successfully treated percutaneously. Three patients required TIPS shunt placement for portal hypertension at the time of PV thrombolysis or subsequent to initial therapy. No patients died or received hepatic transplants during the follow-up interval (mean= 2.3 years, median= 1.8 years, range= 0.1 to 8.5 years).

**CONCLUSION**

In our experience, percutaneous transhepatic catheter-directed thrombolysis in children is a safe and effective approach to address portomesenteric thrombosis from a variety of causes.

Use of catheter-directed portomesenteric thrombolysis in children is underreported and our experience suggests this minimally invasive therapy is a safe and effective approach.

**Long-term Outcome of Percutaneous Transhepatic Balloon Angioplasty for Portal Vein Stenosis after Pediatric Living Donor Liver Transplantation**

**Minoru Yabuta MD (Presenter): Nothing to Disclose, Toshiya Shibata MD : Nothing to Disclose, Rinpei Imamine : Nothing to Disclose, Ken Shinozuka MD : Nothing to Disclose, Hiroyoshi Isoda MD : Nothing to Disclose, Kaori Togashi MD, PhD : Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Nihon Medi-Physics Co, Ltd Research Grant, Shimadzu Corporation Research Grant, Toshiba Corporation Research Grant, Covidien AG**

**PURPOSE**

To retrospectively evaluate the long-term outcomes of percutaneous transhepatic balloon angioplasty for portal vein stenosis after pediatric living donor liver transplantation.

**METHOD AND MATERIALS**

Between October 1997 and December 2013, 43 patients (19 boys, 24 girls; mean age, 4.1 years) who had undergone living donor liver transplantation were confirmed to have portal vein stenosis at direct portography with or without manometry, and underwent percutaneous interventions, including balloon angioplasty with or without stent placement. Technical success, patency rates and major complications were evaluated. Follow-up periods after the initial balloon angioplasty ranged from 5 months to 169 months (mean, 119 months).

**RESULTS**

Technical success was achieved in 65 of 66 sessions (98.5%) and in 42 of 43 patients (97.7%). At 1, 3, 5, and 10 years after the first percutaneous transhepatic balloon angioplasty, the rates of primary patency were 83%, 78%, 76% and 70%, respectively, and the rates of primary-assisted patency were 100%, 100%, 100% and 96%, respectively. In major complication, severe asthma attack and portal vein thrombosis subsequent to balloon angioplasty were noted.

**CONCLUSION**
Percutaneous transhepatic balloon angioplasty for portal vein stenosis after pediatric living donor liver transplantation was safe and effective.

**CLINICAL RELEVANCE/APPLICATION**

Percutaneous transhepatic balloon angioplasty might be a safe and effective treatment for portal vein stenosis after pediatric living donor liver transplantation.

**VSPD31-14**

**Comparison between Radiation Exposures Levels Using an Image Intensifier and A Flat Panel Detector-based System in Image-guided Central Venous Catheter Placement in Pediatric Patients Weighing Less than 10 kg**

- Roberto Miraglia MD: Nothing to Disclose
- Luigi Maruzzelli MD (Presenter): Nothing to Disclose
- Roberta Gerasia: Nothing to Disclose
- Simona Maggio: Nothing to Disclose
- Angelo Luca MD: Nothing to Disclose

**PURPOSE**

The purpose of this study was a comparison between the radiation exposure levels recorded during CVC placement in pediatric patients weighing less than 10 kg, in procedures performed using an image intensifier-based angiographic system (IIDS) and those performed in a flat panel detector-based interventional suite (FPDS).

**METHOD AND MATERIALS**

A retrospective review of 96 image-guided CVC placements, between January 2008 and October 2013, in 49 pediatric patients weighing less than 10 kg was performed. Mean age was 8.2±4.4 months (range 1 - 22 months). Mean weight was 7.1±2.7 kg (range 2.5 - 9.8 kg). The procedures were classified into 2 categories: non-tunneled and tunneled CVC placement.

**RESULTS**

Thirty-five procedures were performed with the IIDS (21 non-tunneled CVC, 14 tunneled CVC); 61 procedures were performed with the FPDS (47 non-tunneled CVC, 14 tunneled CVC). For non-tunneled CVC mean DAP was 113.5±126.7 cGy·cm² with the IIDS and 15.9±44.6 cGy·cm² with the FPDS (p< 0.001). For tunneled CVC mean DAP was 84.6±81.2 cGy·cm² with the IIDS and 37.1±33.5 cGy·cm² with the FPDS (p=0.02). The statistically significant differences of DAP between the two angiographic systems adjusted for the effect of the fluoroscopy time was confirmed by using a multiple generalized linear regression model. In all procedures image quality was considered adequate by a different interventional radiologist other than the operator with no trade-off between satisfactory image quality and procedural outcome. Technical success was obtained in all procedures without major complications.

**CONCLUSION**

The use of flat panel angiographic equipment reduces radiation exposure in small children undergoing image-guided CVC placement.

**CLINICAL RELEVANCE/APPLICATION**

Our data suggests that the use of flat panel angiographic equipment reduces radiation exposure in small children undergoing image-guided CVC placement and should be considered first line for pediatric interventional radiology procedures. The systematic recording of DAP and fluoroscopy time at the end of every procedure is also an essential step in determining local and/or general radiation exposure reference levels in this particular group of patients.

**VSPD31-15**

**Percutaneous Treatment of Aneurysmal Bone Cysts**

- William Eugene Shiels DO (Presenter): President, Mauka Medical Corporation

**LEARNING OBJECTIVES**

1) Identify 2 sites of aneurysmal bone cyst solid tumor localization for large gauge percutaneous core or scrape biopsy yielding diagnostic histologic tissue. 2) Define 3 mechanisms of action for doxycycline foam as a tumor ablation agent targeting aneurysmal bone cyst as a neoplasm. 3) Describe the role of tricalcium phosphate bone graft substitute in the successful treatment of aneurysmal bone cyst.
Factors Impacting Survival in a Multi-institutional Study of High-risk Neuroblastoma

Atmaram Pai Panandiker (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To evaluate factors impacting survival in patients with stage 4 abdominal neuroblastoma. Materials/Methods: A retrospective analysis was conducted in patients with neuroblastoma treated by surgery and radiotherapy (RT) during the period from January 1998 to December 2013. The analysis included patients who had undergone resection and RT with chemotherapy and follow-up data. Event-free and overall survival (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 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 disease, as well as two patients with distant metastatic disease, were 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 was observed, while no significant association was observed for OS. In contrast to recently published literature, the number of MIBG avid sites at diagnosis is prognostic of outcome.

Conclusion: The number of MIBG avid sites at diagnosis is prognostic of outcome. In contrast to recently published literature, the number of MIBG avid sites at diagnosis and EFS is prognostic of outcome, while OS is not associated with the number of MIBG avid sites at diagnosis. The results provided evidence that the number of MIBG avid sites at diagnosis is a significant predictor of outcome in patients with high-risk neuroblastoma.
Purpose/Objectives: 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. Our 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 fused with treatment planning scans. Patterns of failure were defined as: in-field (> = 95% of recurrence volume in the 95% isodose line), marginal (> = 45 Gy), and at-a-distance (<5 cm). 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: 36.9-60 Gy), with dose reduction for the other types of malignancies. Most patients (92.3%) were treated with concurrent chemotherapy: 10 with temozolomide, 1 with capectabine, and 1 with temozolomide and bevacizumab. With a median follow up of 52.8 months, 9 patients (69.2%) developed recurrent disease. Of recurrences, 6 (66.7%) were in-field, 2 (22.2%) were marginal, and 1 (11.1%) was at-a-distance. Conclusions: The majority of patients treated with adjuvant radiation fail in the region of high-dose RT, indicating the need for improvements in local therapy. These may include radiation dose escalation and novel radiosensitizing agents.

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 institution.

Materials/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 chemotherapy and RT (based on Radiation Therapy Oncology Group (RTOG) 9702) 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. Radiation doses ranged from 14.4 to 55.8 Gy (median: 43 Gy). Actuarial 3 year local control was 80%. 3 year distant failure rate was: 70%. The median OS was 97 months. 6 patients underwent surgery.

Conclusions: 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, Nasja Saba: Nothing to Disclose, Andrea Cappellano: Nothing to Disclose, Jose Carlos Cruz: Nothing to Disclose, Roberto Sakuraba: Nothing to Disclose

ABSTRACT

Purpose / Objectives: 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 evaluate our experience in treating these tumors with CT followed by Intensity Modulated Radiation Therapy (IMRT) to whole ventricles.

Methods and Materials: Between January 2006 and January 2014, 24 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 a 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 these 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. Of all of them had whole ventricle irradiation, 3 patients underwent a second course of radiation, consisting on craniospinal radiotherapy with an additional dose to spine residual masses. The 24 patients are alive, although three recurred with time to relapse ranging from 4 to 26 months. Of all of them had whole ventricle irradiation, 3 patients underwent a second course of radiation, consisting on craniospinal radiotherapy with an additional dose to spine residual masses. The 24 patients are alive, although three recurred with time to relapse ranging from 4 to 26 months. All of them had whole ventricle irradiation, with treatment volumes defined using residual disease, surgical bed, edema, and 2 cm margin. First failure MRI scans were fused with treatment planning scans. Patterns of failure were defined as: in-field (> = 95% of recurrence volume in the 95% isodose line), marginal (> = 45 Gy), and at-a-distance (<5 cm). 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: 36.9-60 Gy), with dose reduction for the other types of malignancies. Most patients (92.3%) were treated with concurrent chemotherapy: 10 with temozolomide, 1 with capectabine, and 1 with temozolomide and bevacizumab. With a median follow up of 52.8 months, 9 patients (69.2%) developed recurrent disease. Of recurrences, 6 (66.7%) were in-field, 2 (22.2%) were marginal, and 1 (11.1%) was at-a-distance. Conclusions: The majority of patients treated with adjuvant radiation fail in the region of high-dose RT, indicating the need for improvements in local therapy. These may include radiation dose escalation and novel radiosensitizing agents.

SSG16-07 Acute Toxicities and Treatment Outcomes of a Novel Combined Photon/Proton Craniospinal Irradiation (CSI) Technique for Medulloblastoma (MB) Patients

Andrew Hollander (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 posterior 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 proton boost to tumor bed 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 5 weeks. Conclusions: The majority of patients treated with adjuvant radiation fail in the region of high-dose RT, indicating the need for improvements in local therapy. These may include radiation dose escalation and novel radiosensitizing agents.
Vertebral body 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 anastomosis 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 carboptin. Chemo was initiated prior to RT for 1 pt due to medical delays. Most common acute toxicities were nausea/vomiting and fatigue (see table). Mean 9-8, bone marrow toxicity was ≤ grade 2 for all pts receiving standard weekly vincristine; 1 pt receiving daily carboptin 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 3.8-24.3), 13 are alive with no evidence of disease, 1 is alive with recurrence in the chest wall and pulmonary metastasis, 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 2 weeks, allowing treatment to be initiated within 31 days of surgery, although referral to proton center from outside institutions must be initiated technically. Acute toxicities experienced during photon/proton CSI with concurrent weekly vincristine in MB pts: Grade None 1 2 3 4 Fatigue (n=16) 4 (25%) 9 (56.25%) 3 (18.75%) 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) 1 (6.25%) 4 (25%) 3 (18.75%) 6 (37.5%) 0 Weight loss (n=16) 6 (37.5%) 7 (43.75%) 3 (18.75%) 0 0 Decreased appetite (n=16) 3 (18.75%) 12 (75%) 1 (6.25%) 0 0 Decreased hemoglobin (n=15) 1 (6.7%) 2 (13.3%) 0 Decreased WBC (n=15) 0 3 (20%) 10 (66.7%) 1* (6.7%)* Patient given pre-RT chemotherapy 1** (6.7%)** Patient received daily carboptin Decreased platelets (n=15) 13 (86.7%) 1 (6.7%) 0 1** (6.7%)** Patient received daily carboptin 0

SSG16-08

Vertebral Body Sparring in Wilm’S Tumor: Comparison between 3d-crt Vs Vmat

Hina Saeed MD (Presenter): Nothing to Disclose, Selim Yusuf Firat MD: Nothing to Disclose, Douglas Prah: 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 growth of the spine (decrease in sitting height and modest decrease in standing height). These effects are more pronounced in the younger patient as the patient is at the stage of growth. The most common growth abnormalities in the future.

Materials/Methods: Vertebral body sparing

Results: VMAT plan was dosimetrically superior to 3D-CRT plan. The volume of PTV receiving 10.8 Gy was 14.3% versus 4.4% for 3D-CRT and VMAT, respectively. For the vertebral bodies, the volume receiving greater than 3 Gy was 3.4% versus 96% for VMAT and 3D-CRT respectively. Conclusions: Use of VMAT for Wilm’s tumor can provide significant dosimetric advantages over 3D-CRT in delivering the desired dose to the PTV while minimizing the dose to the vertebral bodies in an attempt to avoid any musculoskeletal or growth abnormalities in the future.

SSG16-09

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 tumors were located in the extremities in 113 pts and 18 pts non-extremity. Their histopathological diagnosis were: 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.

Results: Median age was 50 years (range 15-73), 62 pts were treated at the outset with only chemotherapy, 30 pts received onefractional RT and 39 pts received postoperative RT. Preoperative RT was received by 54 pts. The mean number of fractions was 23 (range 10-50). Preoperative resection in some pts. Preoperative RT makes total resection possible in those pts, thus successful LC results are achieved.
**PDS-TUA**

**Pediatric Tuesday Poster Discussions**

*Scientific Posters*

**PD**

AMA PRA Category 1 Credits ™: .50

**Tue, Dec 2 12:15 PM - 12:45 PM**  
**Location: S101B**

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**Participants**

Moderator  
Joao Guilherme Amaral MD : Nothing to Disclose

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**Sub-Events**

**PDS232**  

**Dose-optimized Bolus Tracking in Pediatric Cardiac CT Angiography (Station #1)**

Lena Gordon Murkes MD (Presenter): Nothing to Disclose, Marika Gullberg Lidegran MD, PhD : Nothing to Disclose

**PURPOSE**

Bolus tracking (BT) in pediatric CTA is associated with non-negligible contributions to the patient's radiation dose. To mitigate radiation dose, a fixed scan delay for the timing of iodinated contrast medium (ICM) has been recommended by other institutions, in place of BT. The aim of this study was to minimize the radiation dose contribution from BT while preserving optimal ICM timing, for pediatric cardiac CTA.

**METHOD AND MATERIALS**

The BT was optimized (from scanner default) by setting the tube parameters to 80 kV/10 mAs, postponing the start of BT to 10 seconds after the start of the bolus injection, and decreasing the BT monitoring frequency to 1-43 s. The DLP was used to compare the radiation dose from BT prior to and after optimization. The study included 118 children (2 days-3 years old) examined with a cardiac CTA protocol, over a 3-year period. The ICM (2 ml/kg, 320 mgI/ml) bolus was administered with a dual power injector followed by the double amount of saline chaser. Depending on the vessels of interest, the ICM injection time varied between 12-15 seconds. The diagnostic scans were triggered manually using BT as a reference for the arrival of ICM. The feasibility of using fixed scan delays for ICM timing was investigated by studying the time between the start of the bolus injection and the start of the diagnostic scan.

**RESULTS**

All 118 examinations provided CTA images of diagnostic value and the majority of the scans had excellent ICM timing. Prior to optimization, the DLP for BT varied from 1-15 (mean 7.9) mGycm. After optimization, the DLP for BT decreased to 1-2 (mean 1.4) mGycm. As a comparison, the mean DLP for the diagnostic scans was 16 mGycm. The time from bolus injection start to diagnostic scan varied between 18 and 32 seconds, making a fixed scan delay for ICM timing elusive.

**CONCLUSION**

BT is an important tool to achieve a well-timed CTA examination, with respect to ICM. Excellent ICM timing can be preserved with an optimized BT, which only contributes a fraction of the radiation dose compared to non-optimized BT. Furthermore, optimal ICM timing is paramount to allow for further dose optimization in pediatric CTA.

**CLINICAL RELEVANCE/APPLICATION**

The use of bolus tracking is recommended to achieve a well-timed CTA examination and with optimized settings the dose contribution will be negligible.

**PDS233**  

**CE MRA in Pediatric Patients with Vascular Malformations and/or Congenital Heart Disease: Combination of Time Resolved and Multiphase High Resolution MRA in One Examination at a Total Contrast Medium Dose of 0.1 mmol/kg BW Gd-BOPTA (MultiHance) (Station #2)**

Guenther Karl Schneider MD, PhD (Presenter): Research Grant, Siemens AG Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bracco Group Speakers Bureau, Guerbet SA, Jonas Stroeder MD : Nothing to Disclose, Arno Buecker MD : Consultant, Covidien AG Speaker, Covidien AG Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG, Alexander Massmann MD : Nothing to Disclose

**PURPOSE**

To evaluate the combination of time resolved and high resolution dynamic contrast enhanced MRA of vascular malformations in the pediatric age group during one examination with a total dose of 0.1 mmol/kg Gd-BOPTA (MultiHance) divided for the two examinations.

**METHOD AND MATERIALS**
MRA was performed in a total of 28 pts. (2-15 yrs) with congenital vascular malformations / CHD, either for diagnosis or in follow-up post surgery. MRI was performed on a 1.5 T Siemens scanner (Aera). The total contrast medium dose was divided in a dose of 0.025 mmol/kg for a high temporal resolution TWIST sequence (time per dataset < 3 sec) and 0.075 mmol/kg for a high spatial-resolution 3D GRE-Sequency MRA (6-14 sec), which was acquired 2-3 times post contrast medium injection. To allow for an extended breath-hold younger children underwent imaging during intubation and controlled ventilation. Images were evaluated by two readers regarding detection of vascular malformations, post surgical anatomy and shunt dynamics and morphology.

RESULTS
A dose of 0.025 mmol/kg Gd-BOPTA allows for depiction of vascular anatomy and flow using a time-resolved angiography with interleaved stochastic trajectories (TWIST). Additional functional information, regarding flow directions in shunts, post surgical evaluation of anomalous venous return incl. scimitar malformation and other malformations in CHD could be demonstrated by both readers in 17 of 28 patients in time resolved MRA. However high-spatial resolution images at a dose of 0.075 mmol/kg allowed for detection and exact quantification of vascular stenosis respectively vessel diameters and small abnormal vessels, which were not demonstrated on time-resolved imaging, for example small sequestration arteries. Both readers rated the degree of enhancement as good or excellent as well in time resolved and high resolution imaging.

CONCLUSION
Time resolved and high resolution MRA can be performed by dividing a total dose of only 0.1 mmol/kg BW Gd-BOPTA for both examinations. The higher relaxivity of Gd-BOPTA allows for this small amount of contrast medium. The two techniques should be regarded as complementary since both techniques gave additional clinical relevant information.

CLINICAL RELEVANCE/APPLICATION
Since the advent of NSF Gd-dose in CE MRA should be kept as small as possible, time resolved and high resolution imaging can be performed in one examination with a total dose of only 0.1 mmol/kg BW.

PDS234
Pediatric Interventional Radiology Radiation Dose Reduction with a Novel C-Arm Imaging Technology: A Population Study Based on 355 Patients (Station #3)
Keith J. Strauss MS (Presenter): Research Consultant, Koninklijke Philips NV Speakers Bureau, Koninklijke Philips NV, John Miras Racadio MD : Research Consultant, Koninklijke Philips NV Travel support, Koninklijke Philips NV / Rami Nachabe PhD : Consultant, Koninklijke Philips NV

PURPOSE
To compare pediatric procedural doses when using a reference technology (Allura Xper, Philips Healthcare) and a novel advanced image processing and dose reduction technology (AlluraClarity, Philips Healthcare) interventional radiology systems.

METHOD AND MATERIALS
Radiation dose structured reports were retrospectively collected from 408 clinical pediatric cases; half performed with the reference and half with the novel X-ray technology. Dose-area product and fluoroscopy time were collected to compare procedural radiation dose. Procedural dose is defined as the total dose excluding any volumetric acquisitions (i.e. 3D rotational or cone beam CT).

RESULTS
180 and 175 patients underwent procedures with the reference and the novel technology, respectively. The 21 different procedure types covered a wide spectrum of pediatric interventional procedures yielding a total number of 204 procedures with each technology. The observed median ages of 12.6 and 11.6 years for the reference and the novel technology, respectively were not statistically different. No statistical difference in age distribution for both groups was observed. Weight and body mass index for both groups were not statistically different in median and distribution with medians being 39 kg and 18.3 vs 18.2 kg/m2 for reference vs novel technology. Fluoroscopy time per procedure (median of 1.6 and 1.5 min for reference and novel technology respectively) and total recorded images (median of 2 frames per procedure) had statistically similar median, variance, and distribution for both groups. Procedural dose was significantly decreased from reference to novel X-ray imaging technology yielding a radiation dose 35% of its original value (1090 vs 385 mGy.cm2, p<0.0001). The fluoroscopy and fluorography acquisitions with the novel X-ray technology delivered 37% and 30% of the dose, respectively of the reference technology.

CONCLUSION
With the novel advanced image processing and dose reduction technology, radiation dose of pediatric interventional procedures was reduced to 35% of its original value.

CLINICAL RELEVANCE/APPLICATION
Pediatric Interventional Radiology procedural dose is significantly decreased with AlluraClarity, a novel advanced image processing and dose reduction technology.
PURPOSE
To evaluate arterial flow changes of the lower extremities ipsilateral to the puncture site using Doppler ultrasonography (US) during transfemoral cerebral angiography (TFCA) in children.

METHOD AND MATERIALS
From April 2013 to August 2013, a total of 27 pediatric patients underwent TFCA in our institution comprising our study population. Doppler US was performed to evaluate diameters and peak systolic velocities (PSVs) of the common femoral artery (CFA) and superficial femoral artery (SFA) before and after femoral sheath insertion. Patients were subclassified into three groups based on the spectral waveform changes of the SFA after femoral sheath insertion. Thereafter, one-way ANOVA followed by Bonferroni’s post-hoc comparisons test was performed to compare values among the groups.

RESULTS
Mean CFA and SFA baseline diameters were 4.10 mm and 3.32 mm, and mean CFA and SFA baseline PSVs were 218.26 cm/sec and 166.51 cm/sec, respectively. Fourteen of 27 patients showed persistent triphasic flow in the SFA (group 1), 7 patients showed altered flow of biphasic (n=3) or monophasic (n=4) waveforms (group 2), and 6 patients showed "pulsus tardus et parvus" (group 3) after femoral sheath insertion. Mean baseline CFA diameter and mean subtracted value between CFA and femoral sheath size were significantly smaller in group 3 (P <.0001). Size discrepancy between CFA and femoral sheath was < 1mm in all cases of group 3. SFA diameter and PSV significantly decreased after femoral sheath insertion in group 3 compared to groups 1 and 2. A significant skin temperature drop after sheath insertion in the ipsilateral lower extremity was noted in group 3 (-1.83°C), compared to groups 1 and 2 (+0.42°C and -0.86°C, respectively).

CONCLUSION
Changes in the spectral waveforms of SFAs frequently occur in pediatric patients during TFCA (13/27, 48%). Significant arterial flow disturbance was noted on Doppler US in children with CFA < 1mm larger than the femoral sheath diameter.

CLINICAL RELEVANCE/APPLICATION
We suggest sonographic evaluation of the size difference between the CFA and the femoral sheath prior to transfemoral catheterization in pediatric patients.

PDS236
Clinical Findings from Semi-Automated Adipose Volume Measurements from Routine Body CT (Station #5)
Chunzhe  Duan  MS, BS :  Nothing to Disclose , Nabile M.  Safdar  MD :  Shareholder, Montage Healthcare Solutions, Inc , Evan P  Nadler  MD :  Nothing to Disclose , Jiamin  Liu  PhD :  Nothing to Disclose , Ronald M.  Summers  MD, PhD :  Royalties, iCAD, Inc Research funded, iCAD, Inc Stockholder, Johnson & Johnson Grant, Viatronix, Inc , Marius George  Linguraru  DPhil, MS (Presenter):  Nothing to Disclose

PURPOSE
To investigate the associations between adipose volumes, body mass index (BMI), and clinical parameters (i.e., insulin resistance (IR), hyperglycemia (HG), hypertension (HTN), blood pressure (BP) and blood glucose (BG)) in pediatric patients.

METHOD AND MATERIALS
This retrospective study was IRB approved. We collected axial contrast-enhanced CT images of 235 patients (96 boys and 139 girls) aged 13 to 20 years. The patients’ ethnic breakdown was: 47 Caucasian, 131 African-American, 40 Hispanic/Latino and 17 other race/ethnicity. There were 35 morbidly obese (BMI>40.0) and equal bins of 50 cases of under-weight (BMI<18.5), normal (18.5≤BMI<25.0), over-weight (25.0≤BMI<30.0) and obese (30.0≤BMI<40.0) cases. Adipose tissue volume measurements were performed using previously validated automatic software followed by manual corrections when necessary. We assessed the volume of visceral fat (VAT), subcutaneous fat (SAT), total fat (TAT) and body volume in the region of vertebrae L2 to L4. Percentage of fat in this region (%VAT, %SAT, %TAT) and maximum relative fat volume (MRVAT, MRSAT, MRTAT) in each axial slice were calculated. Spearman's rank correlation and generalized linear models (GLM) adjusted for age, sex and race/ethnicity were used for data analysis.

RESULTS
All adipose volumes and BMI were significantly correlated (p<0.001 for all). Adipose volume variables from VAT, SAT and TAT, and BMI were positive correlated with systolic BP and mean BP (p<0.05 for all). Additionally, adipose variables from VAT were positive correlated with BG (p<0.05 for all), as well as MRSAT and HG (p=0.048). GLM revealed that BMI was associated with BG (p=0.01), high BG (p=0.005) and systolic and mean BP (p<0.001). In the GLM of adipose variables, VAT, SAT and TAT were associated with high BG, systolic BP, mean BP, high HG, HTN, IR and HG(p<0.05 for all).

CONCLUSION
While both BMI and adipose volume measures was associated with BG, high BG, and systolic and mean BP using GLM in our sample, volumetric measures of adipose tissue from abdominal CT were better indicators of HTN, HG and IR than BMI alone.

CLINICAL RELEVANCE/APPLICATION
Volumetric measures of adipose tissue from imaging studies, such as CT, may identify risk factors for clinical conditions associated with obesity with higher precision than the popular BMI.

**PDS237**

Incremental Value of MR Cholangiography in the Diagnosis of Biliary Atresia (Station #6)

Siyoun Sung MD (Presenter): Nothing to Disclose, Tae Yeon Jeon MD: Nothing to Disclose, Ji Hye Kim MD: Nothing to Disclose, So Young Yoo MD: Nothing to Disclose, Hong Eo: Nothing to Disclose, Wekyoun Kim MD: Nothing to Disclose

**PURPOSE**

To evaluate the incremental value of MR cholangiography (MRCP) in combination with US compared with US alone for diagnosing biliary atresia in patients with cholestasis.

**METHOD AND MATERIALS**

Fifty-six neonates and young infants with cholestatic jaundice (mean age, 65 days; male to female ratio, 19:37) were enrolled. All patients underwent both MRCP and detailed US studies. Biliary atresia (n=41) was confirmed with surgical cholangiography, and hepatitis (n=15) was diagnosed with clinical improvement during the follow-up (n=14) or surgical cholangiography (n=1). Two observers independently reviewed a set of US alone and a combined set of MRCP and US, and rated them by a five-point scale. Diagnostic performance was compared using pairwise comparison of the receiver operating characteristics (ROC) curve. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value (NPV) were assessed.

**RESULTS**

The diagnostic performance (area under the ROC curve [Az]) to diagnose biliary atresia improved significantly after additional review of MRCP images; Az improved from 0.693 to 0.921 (P=.021) for observer 1 and from 0.648 to 0.888 (P=.005) for observer 2. The accuracy of MRCP combined with US (observer 1, 95% [53 of 56]; observer 2, 93% [52 of 56]), and NPV (observer 1, 93% [13 of 14]; observer 2, 92% [12 of 13]) were significantly higher than those of US alone (accuracy: observer 1, 77% [43 of 56], P=.021; observer 2, 73% [41 of 56], P=.007; NPV: observer 1, 57% [8 of 14], P<.001; observer 2, 50% [7 of 15], P<.001).

**CONCLUSION**

The combination of MRCP and US yielded better diagnostic performance to evaluate biliary atresia than US alone.

**CLINICAL RELEVANCE/APPLICATION**

Addition of MRCP to US can improve reader confidence in establishing a final diagnosis of BA and it may be helpful when the probability of US alone is intermediate results.

**PDE120**

Three-dimensional Cardiac Image of Congenital Heart Disease in Neonate and Infant: Optimal Enhancement Method and Ultra-high Pitch Scan of Dual Source CT Make It Possible to Reconstruct Finer Three-dimensional Image and Preoperational 3D Models (Station #7)

Masahiro Kobayashi MD (Presenter): Nothing to Disclose, Nobuyuki Shiraga MD: Nothing to Disclose, Keiko Matsumoto: Nothing to Disclose, Kenichi Suzuki: Nothing to Disclose, Hideaki Suzuki MD, PhD: Nothing to Disclose, Eiichi Kohda MD: Nothing to Disclose

**TEACHING POINTS**

How to obtain good data to reconstruct finer 3D cardiac images in neonate and infant with congenital heart disease (injection route, scan timing, mode of dual source scan, iteration strength, radiation exposure, etc), according to their shunt types (cardiohemodynamics). To understand important and rare congenital heart diseases and their embryology with three-dimensional images. To understand and evaluate post operation changes, including complications for main surgical procedures.

**TABLE OF CONTENTS/OUTLINE**

A: CT protocols of dual-source CT for congenital heart disease (CHD) according to their cardiohemodynamics B: Pathophysiology and embryology of CHD such as TOF, TAPVR, TGA, etc C: CT images (two and three-dimensional) D: Outcomes (3D printer models for operation and post-operative status evaluation, including complications)

**PDE005-b**

"Back from the Edge": Imaging of Extra-corporeal Membrane Oxygenation in the Paediatric Population—A Pictorial Review (hardcopy backboard)

Gillian Susan Cassels MBChB, FRCR (Presenter): Nothing to Disclose, Emily Jane Stenhouse MBChB: Nothing to Disclose, Greg Irwin MBChB: Nothing to Disclose, Daniel Heffernan-Ho: Nothing to Disclose, Gregor Walker: Nothing to Disclose, Mark Davidson: Nothing to Disclose, Susie Joy Goodwin MBChB, MRCS: Nothing to Disclose

**TEACHING POINTS**

1. To review indications for neonatal and paediatric ECMO therapy 2. To illustrate the range of arterial and venous cannulae used in paediatric ECMO 3. To discuss the normal radiologic appearances during paediatric ECMO therapy 4. To illustrate some of the radiologic appearances arising from the complications of paediatric ECMO
TABLE OF CONTENTS/OUTLINE

ECMO (extra-corporeal membrane oxygenation) is a modified cardiopulmonary or pulmonary bypass therapy for neonates and children with cardio-respiratory or respiratory failure. The aims of this educational exhibit are to review current indications for ECMO therapy in children, to illustrate the range of cannula appearances and radiological position and to illustrate the range of complications encountered during ECMO therapy with imaging examples from our institution over a 22 year period. Background Review of indications Normal cannula position Imaging of Complications Role of Imaging Summary/Conclusions

Sub-Events

PDS238

Description of a Novel Approach for TIPS Placement in the Pediatric Patient: The Constrained TIPS Technique (Station #1)

Brandon C. Perry MD (Presenter):  Nothing to Disclose , Jeffrey Scott Pollak MD :  Nothing to Disclose , Giri Shivaram MD :  Nothing to Disclose

PURPOSE

Transjugular intrahepatic portosystemic shunt (TIPS) placement is indicated in pediatric patients to manage bleeding and other complications of portal hypertension, with similar rates of technical success, clinical outcomes, and complications as in adults. However, given pediatric patients’ smaller anatomy and potential growth, a fixed shunt diameter is suboptimal. We describe a novel technique for pediatric TIPS using concentric placement of an outer, bare metal balloon expandable stent and inner, ePTFE endograft. This system creates an intentional stenosis of the shunt at initial placement that can be dilated at a later time to accommodate growth of the patient or hemodynamic changes.

METHOD AND MATERIALS

A modified TIPS technique was performed on two patients in February and March 2014. Patient 1 (6 year-old female) presented with massive gastric variceal bleeding secondary to portal hypertension from biliary atresia, which was unable to be controlled endoscopically. Patient 2 (15 year-old female) presented with recurrent portal and mesenteric vein thrombosis following splenectomy for idiopathic thrombocytopenic purpura. In both patients, a 6 mm x 27 mm Express LD balloon expandable stent was placed in the hepatic parenchymal tract of the TIPS to constrain a 10 mm diameter VIATORR stent. In patient 1, the constrained segment of the shunt was increased to 8 mm at the time of the initial procedure because of insufficient decompression and in patient 2 the constrained segment was left at 6 mm.

RESULTS

Technical success was achieved in both cases. In each case, the portosystemic gradient was reduced below 12 mmHg. This resulted in control of life-threatening variceal bleeding in Patient 1. She subsequently underwent liver transplant 3 days following TIPS placement. Patient 2 underwent successful catheter-directed thrombolysis through the TIPS to treat portal and mesenteric venous thrombosis.

CONCLUSION

TIPS can be created in children with the use of ePTFE endografts constrained by balloon expandable stents. This allows for more precise calibration of shunt diameter and allows for future increase in shunt diameter as necessary to accommodate patient growth or change in hemodynamics.

CLINICAL RELEVANCE/APPLICATION

TIPS placement in children can be challenging due to smaller anatomy and considerations regarding future growth. The constrained TIPS technique is safe and may be particularly useful in the pediatric patient.

PDS239

Initial Experience with Metal Artifact Reduction (MAR) Algorithm on C-arm CT Images Acquired during Pediatric Bone Biopsy Procedures (Station #2)

Sphoorti Shellikeri (Presenter):  Research funded, Siemens AG , Erin Girard PhD :  Employee, Siemens Corporation , Anne Marie Cahill MBBCh :  Nothing to Disclose

PURPOSE

Metallic objects in interventional procedures can induce artifacts in C-arm CT images, reducing the image quality and potentially affecting diagnostic decisions. The purpose of this study is to evaluate the efficacy of a Metal Artifact Reduction (MAR) algorithm in reducing metal artifacts in C-arm CT images acquired during pediatric bone biopsy procedures.

METHOD AND MATERIALS
C-arm CT images (syngo DynaCT, Artis Zee VC14, Siemens AG, Forchheim, Germany) were acquired during 8 bone biopsy procedures using an 8s-DR low dose protocol (0.1/0.17 µGy/p entrance dose). Two C-arm CT images of the biopsy needle were also acquired in an anthropomorphic torso phantom. All images were reconstructed offline on a clinical workstation (syngo XWP, VB15D) and corrected on a research workstation using the MAR prototype. The uncorrected and corrected images were qualitatively assessed by 2 readers of varying experience using a 3-point Likert scale (2: no/minimal artifact; 1: moderate artifact; 0: massive artifact). Additionally, the images were assessed quantitatively using mean and standard deviation, in Hounsfield unit, measured in 6 regions of interest in each data set (4 ROI’s surrounding the needle and 2 distant from the needle).

RESULTS

8/10 images corrected using MAR algorithm scored a 2 on the Likert scale, suggesting an improvement in the image quality with no/minimal artifacts and a very good needle and soft tissue visualization. There was no change in image quality for 2/10 images which already had no/minimal artifacts.

The MAR algorithm showed significant reduction in metal artifacts in regions surrounding the needle with noise reduction up to 177.25 HU (avg. reduction of 89.41 HU) in the patient group, and up to 289 HU (avg. reduction of 135.88 HU) in the phantom group. In tissue and air regions distant from the needle, noise level remained relatively unchanged (up to 7.5 HU noise reduction in the patient group and 2.5 HU noise increase in the phantom group).

CONCLUSION

Our initial experience with this C-arm CT MAR algorithm shows significant reduction in metal artifacts and improved image quality around the needle and the soft tissue in C-arm CT images acquired during pediatric bone biopsy procedures.

CLINICAL RELEVANCE/APPLICATION

The MAR algorithm can be used to reduce metal artifacts in C-arm CT images, acquired during interventional pediatric bone biopsy procedures, for better visualization of the needle and soft tissue.

PDS240

Percutaneous Radiologic Gastrostomy in a Pediatric Population: A Modified Chiba-needle Puncture Technique with Single Gastropexy (Station #3)

Jung-Hoon Park MS, RT (Presenter): Nothing to Disclose, Ho-Young Song MD : Nothing to Disclose, Ji Hoon Shin MD : Nothing to Disclose, Jin Hyoong Kim MD : Nothing to Disclose, Jong Kun Jang : Nothing to Disclose, Wei-Zhong Zhou : Nothing to Disclose, Young Chul Cho BS : Nothing to Disclose

PURPOSE

Purpose of this retrospective study was to evaluate the technical feasibility and clinical effectiveness of percutaneous radiologic gastrostomy (PRG) using a modified Chiba-needle puncture technique with single gastropexy in pediatric patients.

METHOD AND MATERIALS

From July 2006 to December 2013, PRG was performed in 12 children (median age, 21 months; range, 6 - 46 months) using fluoroscopic guidance. Their stomachs were punctured using a 21-gauge Chiba needle. A single anchor was used for gastropexy through 6Fr Neff catheter, and a tube was inserted through the same tract of the anchor using a 12-14 Fr pigtail catheter. We then evaluated the technical success of the procedure, the number of puncture attempts using a 21-gauge Chiba-needle, the procedure time, complications, and treatment of complications.

RESULTS

PRG was technically successful in all patients. A single puncture attempt was all that was required in 10 patients (83%); two attempts were needed in two patients (17%). The average procedure time was 10 min, 25 s (range 5 min, 5 s - 25 min, 24 s). Pneumoperitoneum requiring tube change occurred in two of the 12 patients (17%). Two patients experienced pain immediately following the procedure. Three patients who showed an esophagogastric reflux after PRG underwent conversion percutaneous radiologic gastrojejunostomy (PRGJ).

CONCLUSION

PRG using a modified Chiba needle technique with single gastropexy is technically feasible and clinically effective. All complications are managed by minimally invasive or conservative techniques. PRGJ can be considered as an alternative option in patients with a high risk of aspiration pneumonia resulting from esophagogastric reflux.

CLINICAL RELEVANCE/APPLICATION

PRG using the Chiba-needle puncture technique and with the use of single gastropexy was technically feasible, and we were able to achieve 100% technical success.

PDS241

Influence of Increased Weight and Blood Pressure in Prepubertal Children Related to the Carotid Artery Intima-media Complex Thickness (Station #4)
**Purpose**

Childhood obesity is a public health problem and its consequences on the vascular endothelium may be measured by ultrasound. This study intends to evaluate the behavior of the intima-media thickness comparing eutrophic, overweight and obese children.

**Method and Materials**

Carotid ultrasound was performed in 129 prepubertal children of about 7,7 (5-10) years old, 80 of them obese, 18 overweight and 31 eutrophic, all without comorbidities and classified by body mass index Z-score (BMI). The measurements were performed manually by two independent observers, with at least three measurements in the common carotid artery (CIMT Right) and the left common carotid artery (CIMT Left), in the plane located about 2.0 cm below the bifurcation. Blood pressure (BP) was also measured.

**Results**

The median CIMT Right was 0.040 in eutrophic children, in that of overweight, 0.045, and 0.050mm (p-value 0.35) in the obese ones. Concerning the CIMT Left, it was respectively 0.040, 0.047 and 0.050mm (p-value 0.03). The mean CIMT Right and Left was 0.045, 0045 and 0050 successively in the three groups (p-value 0.07). In bivariate logistic regression analysis, there was a positive association, with statistical significance of BMI index-Z and systolic BP with the average thickness of the carotid intima (BMI Thick trace) of the left and right sides, and of the average values of both. Diastolic BP was positively associated with statistical significance with left BMI Thick trace and the average of the values of the left and right sides. In multivariate analysis, a positive association with statistical significance of BMI Z-index and systolic BP with left BMI Thick trace was verified. The systolic BP was associated positively and with statistically significance with BMI Thick trace to the average of the values of both left and right sides.

**Conclusion**

The increased weight in children directly affects the intima-media complex thickness, although it is only statistically positive in the left carotid artery. The systolic blood pressure levels were positively associated with thickening of the carotid intima-media left, and to the average of the values of intima-media thickness of the left and right carotid arteries.

**Clinical Relevance/Application**

The pathogenesis found in most cardiovascular disease is atherosclerosis, which begins in childhood, and the thickening of the carotid intima-media determined by ultrasonography is excellent marker.

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**Effectiveness of Diffusion Weighted Imaging in Evaluation of Intra-abdominal Abscesses in Children (Station #5)**

**Purpose**

Intra-abdominal abscesses in children are often imaged with contrast enhanced CT, and there are few data regarding MRI appearance. MRI offers superior contrast resolution without ionizing radiation, which is an important consideration in children. The purpose of this study is to describe the appearance of abscesses on MRI, particularly diffusion weighted imaging, with particular reference to distinguishing abscess from bowel loops using ADC values.

**Method and Materials**

Twenty five intra-abdominal abscesses in twenty two children were retrospectively evaluated with axial DWI, axial and coronal T2 weighted SSFSE, and sagittal T2 weighted images with fat saturation. The abscess region showing the most restricted diffusion on ADC map was measured using a circular region of interest of 0.3 mm². ADC in an adjacent bowel loop and in the bladder was also recorded. Four observers (three pediatric radiologists and one pediatric radiology fellow) performed the same measurements on all abscesses. Interobserver variation was assessed using 95% Bland Altman limits and intraclass correlation coefficients.

**Results**

The mean ADC was significantly decreased (p <0.05, student t test) in all abscesses relative to adjacent bowel loops for all observers as follows, with mean values of 0. 715 +/-0.083, 0.727 +/-0.087, 0.756 +/-0.048, and 0.784 +/-0.067 (x10^{-3}mm²/s) compared to mean values for adjacent bowel loops which were 3.256 +/-0.079, 3.286 +/-0.095, 3.131 +/-0.098 and 3.185 +/-0.106 (x10^{-3}mm²/s) respectively. The mean ADC for bowel loop contents was similar to that of urine ADC for all observers at 3.444 +/-0.021, 3.327 +/-0.212, 3.435 +/-169, 3.386 +/-0.187 (x10^{-3}mm²/s) respectively. There was good interobserver agreement with 95% limits of agreement between readers varying between 17 and 22% of the mean.

**Conclusion**

Diffusion weighted imaging is effective at distinguishing abscesses which show restricted diffusion (arrow in figure) from bowel loops or bladder (b in figure) which do not. Mean ADC in abscesses is significantly lower than in bowel loops. The ADC in bowel loops adjacent to teh abscess are similar to that of free fluid (urine).

**Clinical Relevance/Application**

Diffusion weighted MRI can distinguish abscess from adjacent bowel loops in children, without ionizing radiation or intravenous contrast.
The New Kids on the Block: Childhood Interstitial Lung Disease (ChILD) Classification in 2014 - Introducing the two recent additions: Pleuroparenchymal Fibroelastosis and Filamin A Protein Deficiency (Station #6)

Thomas Robert Semple MBBS, BSC (Presenter): Nothing to Disclose, Catherine Mary Owens MD : Nothing to Disclose, Michael Ashworth: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: Review and update the classification of childhood interstitial lung diseases (ChILD), introducing the new and important added conditions of pleuroparenchymal fibroelastosis and Filamin A protein deficiency Demonstrate and introduce the HRCT features of these conditions with cases from our institution, with histological correlation

TABLE OF CONTENTS/OUTLINE
Introduction Review of Classification - Infantile ChILD - Developmental disorders, Lung growth disorders, Surfactant dysfunction and undefined (NEHI and PIG) Childhood ChILD - Normal host, Immunocompromised host, Systemic disorders New-comers - Pleuroparenchymal fibroelastosis (PPFE) and Filamin A protein (FLNA) deficiency Imaging features and histopathologic correlation - Infant ChILD Developmental disorders (including ACD/MPV) Lung growth disorders (including CAD) Surfactant dysfunction Undefined aetiology (NEHI and PIG) New-comers (FLNA) Childhood ChILD Normal host (including constrictive bronchiolitis and NSIP) Immunocompromised (including LIP) Systemic diseases (including LCH) Mimics of ChILD The role of the radiologist Summary

MRI for Pediatric Appendicitis: Normal, Abnormal, and Alternative Diagnoses (Station #7)
Evan James Zucker MD (Presenter): Nothing to Disclose, Shreyas Shreenivas Vasanawala MD, PhD : Research collaboration, General Electric Company Stockholder, Morpheus Imaging, Inc

TEACHING POINTS
1. To describe our institutional imaging algorithm and protocol for emergency MRI in pediatric patients with suspected appendicitis.
2. To illustrate examples of the normal and abnormal appendix by MRI, including the perforated appendix.
3. To demonstrate the broad spectrum of pathology that may mimic appendicitis and yet be accurately diagnosed by MRI.

TABLE OF CONTENTS/OUTLINE
Beginning in October 2013, our institution began performing emergency MRI in place of CT as the second-line modality for imaging pediatric patients with suspected appendicitis and equivocal ultrasound. The imaging algorithm and MR protocol are discussed. Illustrative cases of the normal and abnormal appendix are presented, including examples of the perforated appendix and related complications such as abscess formation. A broad spectrum of alternative diagnoses that may be accurately diagnosed by MRI are demonstrated, including: mesenteric adenitis, gastroenteritis, enema-induced free fluid, Crohn’s disease, pylonephritis, renal transplant rejection, congenital renal duplication and malrotation, pancreatitis, ovariary free fluid, hemorrhagic ovarian cyst, paratubal cyst, rectus femoris avulsion, and abdominal wall edema due to asthmatic cough. In summary, MRI is highly useful for evaluating children with suspected appendicitis and elucidating alternative causes of pain.

The Value of 3D Hydronephrosis Index in the Assessment of Pediatric Hydronephrosis (Station #8)
Juan Cerrolaza PhD : Nothing to Disclose, Nabile M. Safdar MD : Shareholder, Montage Healthcare Solutions, Inc, Emmarie Myers : Nothing to Disclose, Craig A. Peters MD : Nothing to Disclose, James Jago : Employee, Koninklijke Philips NV, Marius George Lingurarui DPhil, MS (Presenter): Nothing to Disclose

PURPOSE
To evaluate the potential of a new ultrasound (US) based 3D Hydronephrosis Index (HI) to assess the severity of hydronephrosis from the semi-automatic quantification of renal parenchyma (P) and collecting system (CS).

METHOD AND MATERIALS
The retrospective dataset (IRB approved) consists of 10 patients (0-7 years) whose severity varies from grade 1 to 3 according to the Society for Fetal Urology hydronephrosis scale (SFU-HS). 3DUS images were acquired from an iU22 system with a X6-1xMatrix transducer (Philips Healthcare). The kidney (K) was segmented using semi-automated active shape models, including new shape and texture models tailored to US physics. The CS was obtained with a new extension of 3D graph cuts that includes brightness and contrast normalization, and anatomical prior information. K and CS were delineated manually by a board certified radiologist to evaluate the accuracy through volume overlap (VO), relative volume difference (RVD) and average surface distance (ASD) (leave-one-out cross-validation). A 2D slice containing a longitudinal section of the K and its CS was manually segmented to compute the 2DHI. Finally, we analyze the Spearman correlation of both 3DHI and 2DHI to the SFU-HS.

RESULTS
For the segmentation of the K and CS, VO was 86% and 62%, RVD was 3% and 26%, and ASD was 3.06mm
and 0.35mm, respectively. The error in the estimation of the 3DHI was 1.5 percentage points. For the groups with SFU-HS 1, 2, and 3, the average (and range) 3DHI was 0.83 (0.82-0.83), 0.71 (0.56-0.80) and 0.43 (0.35-0.48), respectively. The values for the 2DHI were 0.80 (0.73-0.83), 0.62 (0.55-0.66) and 0.49 (0.35-0.64) for SFU-HS 1, 2, and 3 respectively. The correlation coefficient between the HI and the SFU-HS was 0.92 (3DHI) and 0.82 (2DHI).

CONCLUSION

The quantification of 3DUS images shows the potential of 3DHI for the assessment of severity of hydronephrosis with better agreement with the SFU-HS than the classic 2DHI. Further studies will focus on developing rigorous correlations with more detailed functional parameters.

CLINICAL RELEVANCE/APPLICATION

Automated analysis of 3D kidney US data demonstrates higher correlation with SFU-HS than manual 2D measures, demonstrating the potential for 3D US image processing techniques.
gradient-recalled-echo sequences of our routine check-up MR protocol performed at 3T. We excluded children with abnormal laboratory finding or overweight (body mass index more than 25 kg/m2). Paired t-test was used to compare dual and triple fat fraction. Pearson’s chi-squared test was used to evaluate the correlation between fat fraction and clinical or laboratory findings.

RESULTS
Among the total 72 children visited our clinic during the study period, 18 were excluded due to the abnormal laboratory findings or overweight. The enrolled 54 children (M:F = 26:28) were 5-15 years old with a mean of 9 years. Dual fat fraction (range 0.1-8.0%, mean 2.3 ± 2.0 %) was lower than triple fat fraction (range 0.4-6.5%, mean 2.9 ± 1.4 %) (p=0.006). Eight children (8/54, 15%) on dual and six children (6/54, 11%) on triple-echo sequences showed more than 5% fat fraction. In the correlation analysis, only dual fat fraction and triglyceride level was correlated significantly (Pearson’s correlation coefficient 0.314, p=0.021).

CONCLUSION
The upper limit of normal hepatic fat fraction was 8% on dual- and 6.5% on triple-echo sequences. Dual fat fraction was lower than triple fat fraction and correlated with triglyceride level in healthy children.

CLINICAL RELEVANCE/APPLICATION
Knowing normal range of hepatic fat fraction using dual- and triple-echo gradient-recalled-echo sequences of MRI is important for accurate diagnosis of fatty liver in children.

VSPD32-03
Preliminary Assessment of a Hi SNR mMRI Sequence for Use in Determination of Low Hepatic Proton Density Fat Fraction (PDFF) in Children

PURPOSE
Low signal-to-noise (SNR) could interfere with hepatic fat assessment by magnitude-based MRI (mMRI). The purpose of this study was to assess in children the accuracy of a high-SNR (Hi-SNR) mMRI sequence to determine hepatic proton density fat fraction (PDFF), at PDFF values less than ten percent.

METHOD AND MATERIALS
In this prospective, single-site, IRB approved, HIPAA compliant study, a Hi-SNR variant of an mMRI sequence was developed by increasing slice thickness from 8 to 10 mm, and decreasing matrix from 224x128 to 128x92. Pediatric subjects with known or suspected non-alcoholic fatty liver disease (NAFLD) were recruited, provided written informed consent, and underwent 3T MR examinations including mMRI and an advanced multi-TR-TE magnetic resonance spectroscopy (MRS) sequence capable of measuring T1 of water and fat as well as PDFF. The mMRI PDFF values used in this study are the means of three circular 1-cm radius regions of interest (ROIs) placed on source mMRIs co-localized to the MRS voxel location, one slice above that location, and one slice below that location. Linear regression models were used to assess accuracy of MRI-estimated PDFF for the three ROI locations, using multi TR-TE MRS PDFF as reference.

RESULTS
Standard and Hi-SNR mMRI, and multi-TR-TE MRS (to measure PDFF and T1) were obtained for 19 children (13 male, 6 female, age 11.8 ± 2.5 years). Regression analysis of Hi SNR mMRI using multi-TR-TE MRS had a slope, y-intercept and R2 value, respectively, of 0.960, 1.216% and 0.993 for all 19 subjects; and 1.185, 0.602% and 0.822 for the 13 subjects with PDFF less than ten percent. Those values for standard mMRI were 0.987, 0.738% and 0.990 for all 19 subjects; and 1.139, 0.240% and 0.691 for the 13 subjects with PDFF less than ten percent.

CONCLUSION
In children with known or suspected NAFLD, correlation of Hi-SNR MRI PDFF with MRS was similar, or slightly improved compared to that for mMRI, for PDFF values less than ten percent.

CLINICAL RELEVANCE/APPLICATION
PDFF estimation using a high SNR mMRI variant sequence in children is feasible, and may be helpful if future research suggests that low SNR affects accuracy.

VSPD32-04
Diagnosis of Liver Rejection by Acoustic Radiation Force Impulse in Pediatric Liver Transplant Patients
Lidia Monti: Nothing to Disclose, Marco Salsano (Presenter): Nothing to Disclose, Manila Candusso: Nothing to Disclose, Giuliano Torre: Nothing to Disclose, Chiara Grimaldi: Nothing to Disclose, Paola Francalanci: Nothing to Disclose, Francesco Callea: Nothing to Disclose, Giovanna Soglia MD: Nothing
**Acoustic Radiation Force Impulse (ARFI) imaging has been developed as a new non-invasive ultrasound-based elastography modality to investigate liver stiffness using shear wave velocity (SWV). The aim of this study was to evaluate the role of ARFI imaging for assessing episodes of liver dysfunction (rejection, hepatitis, cholangitis and fibrosis) during the post-operative course after pediatric LT.**

**METHOD AND MATERIALS**

ARFI was performed using an US device (Acuson S2000, Siemens Medical Solutions) equipped with a 4-MHz transducer. SWV by ARFI imaging was performed in 59 pediatric LT recipients (median 6 month after transplantation). Liver transplantation was performed with a full liver graft in 15 cases (25%) and with a split liver (segments II-III) in 44 (75%). SWV was measured ten times to quantify hepatic stiffness. Liver biopsy and laboratory analysis (including aminotransferases, alkaline phosphatases, albumin and bilirubin) were performed in a range of time from one day to one month from the ARFI imaging. SWV was compared to biochemical parameters using liver biopsy as reference standard. Data were evaluated retrospectively.

**RESULTS**

During the study period ARFI was performed 138 times. According to histopathology there were 15 rejections, 29 hepatitis episodes, 12 cholangitis episodes. Median SWV (m/s, IQR) was higher in patients with diagnosis of graft rejection than in patients without liver disease [2.03, 1.67-2.44, vs 1.22, 1.09-1.31, p < 0.01]. Median SWVs in patients with hepatitis and cholangitis were respectively 1.80, (IQR = 1.49-2.06) and 2.07 (IQR = 1.91-2.48). A few patients had fibrosis with a median SWV of 1.67 m/s. At ROC curve analysis ARFI resulted able to predict rejection (AUC = 0.932), hepatitis (AUC = 0.916) and cholangitis (AUC = 0.949). Statistical analysis wasn’t reliable for fibrosis (n = 4).

**CONCLUSION**

SWV obtained by ARFI predicts the diagnosis of rejection, hepatitis and cholangitis in pediatric liver transplantation independently to biochemical markers. ARFI could be useful to reduce the number of liver biopsy in order to guide the immunosuppressive therapy.

**CLINICAL RELEVANCE/APPLICATION**

ARFI, together with serological markers, is an efficient modality for the diagnosis of graft dysfunction allowing the reduction in the number of liver biopsies in pediatric patients after LT.
ARFI is a reliable noninvasive method in evaluating the severity of liver fibrosis in BA patients before Kasai surgery.

**VSPD32-06**

**Imaging of Ambiguous Genitalia**  
Jeanne S. Chow MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the imaging findings on prenatal ultrasound which may alert the radiologist to the possibility of DSD, a proposed imaging evaluation for the postnatal evaluation of a newborn with DSD, and the most common types of DSD that we encounter in the newborn child.

**Active Handout**  

**VSPD32-07**

**CT and MR Enterography**  
Alex Towbin MD (Presenter): Author, Amirsys Inc Shareholder, Merge Healthcare Incorporated Consultant, Guerbet SA

**LEARNING OBJECTIVES**

1) Describe the advantages and disadvantages of performing CT and MR enterography in children. 2) Describe the protocol employed to perform CT and MR enterography in children. 3) Describe the most common imaging findings of pediatric inflammatory bowel disease.

**ABSTRACT**

Inflammatory bowel disease (IBD) is a general term used to describe the idiopathic inflammatory disorders of the gastrointestinal tract. The most common types of IBD are Crohn disease and ulcerative colitis. A number of imaging studies can be used to diagnose IBD in the pediatric population. Over the past ten years, CT and MR enterography have become the imaging tests-of-choice due to their image quality, speed of procedure, lack of bowel preparation, and ability to diagnose the extraintestinal complications of IBD. The purpose of this talk is to compare the advantages and disadvantages of CT and MR enterography, describe the unique components of the imaging protocol required to perform CT or MR enterography in children, and describe the common imaging findings of IBD in the pediatric population.

**VSPD32-08**

**Magnetic Resonance Enterography Features of Mucosal Healing in Pediatric Patients with Crohn's Disease**  
Matthew Paul Moy MD (Presenter): Nothing to Disclose, Jess Kaplan MD: Nothing to Disclose, Christopher James Moran MD: Nothing to Disclose, Harland Steven Winter MD: Consultant, PAREXEL International Corporation Consultant, Johnson & Johnson Consultant, Shire plc Consultant, Salix Pharmaceuticals, Inc Institutional Grant support, Johnson & Johnson Institutional Grant support, AstraZeneca PLC Institutional Grant support, Shire plc, Michael Stanley Gee MD, PhD: Nothing to Disclose

**PURPOSE**

We evaluated qualitative and quantitative magnetic resonance enterography (MRE) findings which best correlate with mucosal healing assessed by ileocolonoscopy as a reference standard.

**METHOD AND MATERIALS**

In this IRB-approved, HIPAA-compliant retrospective study, patients 18 years of age or below with Crohn's disease were identified who underwent two ileocolonoscopy exams to assess disease activity with an MRE closely timed with the second endoscopy. Two pediatric gastroenterologists reviewed the paired endoscopic exams by consensus to assess inflammatory activity as reference. All bowel segments with macroscopic evidence of inflammation on the first endoscopy were included in the study, and were then categorized for the presence or absence of mucosal healing (MH) based on whether macroscopic inflammation was observed on the second endoscopy. An experienced pediatric abdominal radiologist evaluated the corresponding MRE exams of these patients, blinded to the endoscopic results, for multiple imaging features associated with active inflammation. Imaging-endoscopic correlation was then performed.

**RESULTS**

25 patients were included in the study (mean age 17.6 ± 2.8 years) with a mean time between MRE and endoscopy of 12.4 ± 7.3 days. On endoscopy, 38 bowel segments demonstrated MH and 22 segments demonstrated persistent inflammation. Among imaging features, MRI Index of Activity (MaRIA) score <8 (accuracy 85%, sensitivity 89%, specificity 77%) and bowel wall thickness (WT) < 4mm (82%, 87%, 73%) were most strongly associated with MH (P < 0.0001, Fisher's Exact Test). The average WT in healing segments was 2.7 ± 0.9 mm compared with 5.2 ± 2.2 mm in segments with persistent inflammation (P<0.0001, Student's t test). Other MRE features significantly (P < 0.005) associated with MH included mesenteric hypervascularity (78%, 97%, 45%), and bowel wall T2 hyperintensity (78%, 92%, 55%).

**CONCLUSION**

MRE is an accurate noninvasive technique for assessing mucosal healing in pediatric patients with Crohn's
disease. The MRE features most strongly associated with MH include MaRIA score < 8 and WT < 4 mm.

**CLINICAL RELEVANCE/APPLICATION**

MRE assessment of mucosal healing has great potential in pediatric Crohn's disease as a noninvasive imaging biomarker of disease activity and a therapeutic endpoint of clinical trials.

**VSPD32-09**

**Performance of Diffusion Weighted Sequences in Pediatric Patients with Inflammatory Bowel Diseases (IBD) Evaluated by MR-enterography**

Celine Dubron (Presenter): Nothing to Disclose, Elisa Amzallag-Bellenger MD: Nothing to Disclose, Alain Duhamel: Nothing to Disclose, DOMINIQUE TÜRK: Nothing to Disclose, Nathalie Bouthy: Nothing to Disclose, Fred E. Avni MD, PhD: Nothing to Disclose

**PURPOSE**

Prospective evaluation of the performances of DWI for the detection of active lesions on MR-enterography in children with IBD.

**METHOD AND MATERIALS**

Sixty five children (mean age 12.9 years (3-18 years), median age 14 years) with suspected or known IBD were examined by MR-enterography (1.5 Tesla magnets Philips - Eindhoven and GE - Milwaukee). Preparation included pre-examination ingestion of a mixture of Mannitol and water. T2 weighted, T1 after Gadolinium injection and diffusion weighted sequences were obtained. All images were reviewed on a PACS system by two radiologists, each blinded to the clinical data and to the conclusion of the second reviewer. The digestive tract was divided into 7 segments. The 2 radiologists were asked to analyze the images obtained and to report on the presence of active lesions defined as bowel thickening observed on T2 sequences associated with contrast enhancement. The radiologists analyzed successively and independently the images obtained by combining T2 and DWI on one site, T2 and T1 + Gadolinium on the other. The latter was considered as the gold-standard. Whenever no agreement was observed, analysis with consensus was obtained. Inter-observers agreement and sensitivity, specificity, PPV and NPV were calculated.

**RESULTS**

The couple "T2 + diffusion" detected 64 lesions in 42 patients whereas the couple "T2 + T1 with Gadolinium" detected 58 lesions in 36 patients. The inter-observer agreement was excellent with a Kappa coefficient of 0.84. Sensitivity, specificity, PPV and NPV for the couple "T2+DWI" for the detection of active lesions of IBD were respectively 100 %, 96 %, 79 % and 100 %. The accuracy between the two techniques reached 97%, with Kappa coefficient of 0.86. Seven supplementary lesions were detected by DWI and not by T1+gadolinium. 5/7 had an endoscopic or histologic study confirming active lesions.

**CONCLUSION**

Associated with T2 weighted sequence, DWI have equivalent or probably better performances than T1+gadolinium.

**CLINICAL RELEVANCE/APPLICATION**

Its use would allow to perform shorter examination and obviate the need for gadolinium injection.

**VSPD32-10**

**MR Enterography (MRE) Findings in Pediatric Ulcerative Colitis (PUC) vs Controls: The Added Value of DWI**

Simone Chaudhary BSC, MSc (Presenter): Nothing to Disclose, Jorge Humberto Davila Acosta MD: Nothing to Disclose, David Mack MD: Nothing to Disclose, Ericc Benchimol MD: Nothing to Disclose, Elka Miller MD: Nothing to Disclose

**PURPOSE**

To compare DWI, post-gadolinium enhanced MRI (PGE) and bowel wall thickness (BWT) in active PUC with a group of normal controls on endoscopy.

**METHOD AND MATERIALS**

This is a retrospective study that included newly diagnosed patients with PUC who underwent MRE within 7 days after endoscopy and a group of controls with normal endoscopy findings. Bowel was divided in Cecum (Ce); ascending colon (AC); transverse colon (TC); descending colon (DC); sigmoid colon (SC); and rectum (Re). Terminal ileum was not affected. MRE was performed in a 1.5 T Magnet. Protocol included coronal and axial DWI, b=1000; pre- and post- gadolinium coronal dynamic multiphase and axial LAVA fat saturation. DWI was restricted (DR) if there was high signal intensity on b1000 and corresponding low signal intensity on the ADC map. PGE was positive if there was avid mucosal enhancement in comparison with the small bowel. Endoscopy was positive if ulceration, inflammation or edema were documented. Two readers were blinded to diagnosis and assessed BWT, DR and PGE in each segment. Interclass correlation (ICC) and Linear Mixed Effects Models with Random Intercept (LMMERI) were calculated for BWT. Inter-rater reliability (kappa), sensitivity (Se) and specificity (Sp) for DWI and PGE were calculated.

**RESULTS**

Data from 15 patients with PUC and 15 normal controls was analyzed. Kappa values for DWI/PGE were: Ce 0.64/0.76, AC 0.62/0.67, TC 0.71/0.64, DC 0.81/0.49, SC 0.87/0.78 and Re 0.86/0.55. ICC for BWT were Ce 0.22, AC 0.63, TC 0.65; DC 0.40, SC 0.41 and Re 0.59. For reader 1/reader 2: Se of DWI: Ce 91/73%; AC 69/62%; TC 77/69%; DC 100/93%; SC and Re100%. Sp of DWI: Ce 94%; AC 100%; TC 94/100%; DC 87/100%; SC 93%; and Re 87%. Se of PGE: Ce 36/95%; AC 31/46%; TC 38/62%; DC and SC 60/73%; and
Re 47/67%. Sp of PGE: Ce and AC 100%; TC 94/100%; DC and SC 93/100%; and Re 87/93%. LMEMRI for BWT showed statistical difference in all segments (p<0.01) with exception of AC (p=0.11). The median difference was 0.5-1.5mm

CONCLUSION

PGE and DWI show high inter-rater reliability. Se of DWI detecting active PUC is superior to PGE; whereas specificity is comparable. BWT showed significant difference between active PUC versus controls, but these differences were only 0.5-1.5mm

CLINICAL RELEVANCE/APPLICATION

Routine MRE should include DWI sequences which increase the degree of detection of active PUC within 7 days of diagnostic endoscopy with high sp values when compared with controls

VSPD32-11 Development and Validation of an Ultrasound Scoring System for Children with Suspected Acute Appendicitis

Robert Orth MD, PhD (Presenter): Grant, Toshiba Corporation Research support, General Electric Company, Sara Fallon: Nothing to Disclose, R. Paul Guillerman MD: Nothing to Disclose, Martha Mappus Munden MD: Nothing to Disclose, Wei Zhang PhD: Nothing to Disclose, George S. Bisset MD: Nothing to Disclose, Monica Lopez MD: Nothing to Disclose, Mary Brandt MD: Nothing to Disclose

PURPOSE

To facilitate consistent, reliable communication among providers, we developed a novel scoring system for reporting limited right lower quadrant ultrasound (US) exams obtained for suspected pediatric appendicitis. The purpose of this study was to evaluate implementation of this scoring system and its ability to risk-stratify children with suspected appendicitis.

METHOD AND MATERIALS

We developed a risk-stratification scale (Appy-Score) and structured reporting template for limited abdominal US exams obtained for suspected pediatric appendicitis. Appy-Score strata were: 1=normal completely visualized appendix; 2=normal partially visualized appendix; 3=non-visualized appendix, 4=equivocal; 5a=non-perforated appendicitis; 5b=perforated appendicitis. The Appy-Score was applied retrospectively to all limited right lower quadrant US exams ordered through our Emergency Department during a 5-month pre-implementation period (1/1/2013-5/31/2013), and Appy-Score use was tracked prospectively post-implementation (7/1/2013-9/30/2013). Diagnostic performance measures of US exams were computed post-implementation. Secondary outcomes included CT imaging following US exams and negative appendectomy rates.

RESULTS

We identified 1,235 patients in the pre- and 687 patients in the post-implementation groups. Appy-Score use increased from 24% in July to 89% in September (p=0.0001). The likelihood of appendicitis progressively increased with each score stratum. Sensitivity, specificity, positive predictive value and negative predictive value post-implementation were 93.8%, 92%, 83.8%, and 97.1%, respectively. The rate of CT imaging after US decreased from 8.6% pre-implementation to 5.9% post-implementation (p=0.048). Negative appendectomy rates did not significantly change (4.4% vs. 4.1%, p=0.88).

CONCLUSION

The use of a risk-stratified scoring system and standardized template for reporting the results of US exams for suspected pediatric appendicitis clearly communicated the likelihood of appendicitis to the treating physician and decreased the need for CT imaging. Future studies should assess whether this streamlines care in the emergency room setting and whether the risk strata are generalizable to other institutions with varying expertise in US imaging.

CLINICAL RELEVANCE/APPLICATION

A scoring system for reporting limited US exams performed for suspected pediatric appendicitis can risk-stratify patients and decrease the rate of follow-up CT imaging.

VSPD32-12 Definition of Normal Newborn Anorectal Anatomy by Ultrasound Using a Novel Posterior Approach

Ellen Christine Wallace MD (Presenter): Nothing to Disclose, Jean-Marc Gauguet MD, PhD: Nothing to Disclose, Jeremy Aidlen MD: Nothing to Disclose

PURPOSE

Describe the normal anatomy and characteristics of the anus, rectum, levator ani, puborectalis, ischiorectal fossa, sacrum and coccyx using a novel, posterior, trans-sacrococcygeal, high resolution ultrasound imaging approach. Illustrate how to perform the technique and validate the information obtained by comparison with anatomic drawings and selected CT and MR images, which are more commonly used to evaluate this area.

METHOD AND MATERIALS
METHOD AND MATERIALS
Retrospective review of images obtained as part of routine spinal ultrasound evaluations in newborns between 2005 and 2014. High resolution linear ultrasound probes were used via a trans-sacrococcygeal approach, in the posterior sagittal and axial planes with the infant prone. A series of images demonstrate rectum, anus, presacral space, levator ani, puborectalis, sacrum, coccyx and ischiorectal fossa. Review of CT and MR imaging data, obtained for unrelated reasons, has been used to corroborate, compare and contrast with the ultrasound imaging data.

RESULTS
The anal canal is particularly well seen by high frequency, linear, ultrasound probes, when evaluated from a posterior trans-sacrococcygeal approach in newborns. It has a characteristic cylindrical appearance quite distinct from the rectum. The length, muscle thickness, anorectal ring, anal verge, and anorectal angle, are nicely depicted on sagittal images. The mucosa, internal and external anal sphincteric layers, and anorectal course through the levator ani muscles are well seen on axial images. The anal canal orientation with respect to rectum, sacrum, vagina and urethra can also be defined on the sagittal images. The integrity of the posterior sacrococcygeal elements is clearly seen. The images compare favorably with MR and CT of the same area without need for sedation or ionizing radiation in this young population.

CONCLUSION
Posterior, midline, trans-sacrococcygeal, high resolution, ultrasound imaging is a reproducible technique, which demonstrates normal anorectal and pelvic floor anatomy exquisitely well. Facility with this technique provides useful supplementary data to that obtained by transabdominal and transperineal ultrasound techniques.

CLINICAL RELEVANCE/APPLICATION
Confident demonstration and knowledge of normal ultrasound anorectal complex anatomy from a posterior approach provides a foundation to evaluate anorectal malformations, anterior ectopic anus and cloaca.

VSPD32-13 MRU: What Is Current Clinical Practice?
J. Damien Grattan-Smith MBBS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To discuss key protocol aspects for MR urography in children to reproducibly generate high quality studies and show how MR urography is has widespread application in the evaluation of children with urinary tract disease.

RC424
Mentored Case Approach to Pediatric Cardiovascular Disease 1: Vascular (An Interactive Session)

Refresher/Informatics

Participants
S. Bruce Greenberg MD (Presenter): Nothing to Disclose
Cynthia Karfias Rigsby MD (Presenter): Nothing to Disclose
Taylor Chung MD (Presenter): Speaker, Koninklijke Philips NV

LEARNING OBJECTIVES
1) Understand the morphology, treatment, and long term complications of treated and untreated congenital heart disease via an interactive mentored-case approach with audience response system. 2) Highlight appropriateness of MRI and CT with regard to technique, pitfalls, indications and critical imaging findings that affect management for common imaging scenarios, including vascular rings and slings, coarctation, aortopathy, coronary anomalies, and congenital pulmonary arterial and venous anomalies. 3) Provide an opportunity for general radiologists, pediatric radiologists and cardiac imagers who have limited exposure to this area in their workplace an opportunity to refresh their pediatric cardiovascular imaging skills in a focused manner.

MSSR41
RSNA/ESR Emergency Symposium: General Principles, Pediatric and ENT Emergencies (An Interactive Session)

Multisession Courses

Participants

LEARNING OBJECTIVES

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.

RC513

Advanced Pediatric US Imaging

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Wed, Dec 3 8:30 AM - 10:00 AM  Location: S102AB

Sub-Events

RC513A  Contrast Enhanced US and Elastography?
Nancy A. Chauvin MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the principles of contrast enhanced ultrasound and ultrasound elastography and how to perform both techniques. 2) Apply contrast enhanced US and elastography in their practice in order to evaluating pathology.

RC513B  Pediatric Doppler
Brian D. Coley MD (Presenter): Author with royalties, Reed Elsevier

LEARNING OBJECTIVES
1) Understand the basics of blood flow and hemodynamics, and how they are reflected in the Doppler waveform. 2) Apply the understanding of these changes to clinical cases involving the liver, kidney, and vasculature in children.

RC513C  Challenging Pediatric US Examinations
LEARNING OBJECTIVES

1) Review challenging cases. 2) Discuss strategies to recognize and evaluate challenging cases. 3) Review diagnoses and pertinent alternative diagnoses

ABSTRACT

In this session we will review selected challenging pediatric ultrasound cases, discuss some of the issues that make the case challenging, review the diagnoses and review alternate diagnoses
LEARNING OBJECTIVES

1) Review important acute pediatric abdomen presentations to ensure that appropriate etiologies are considered when a pediatric patient is imaged for an acute abdomen. 2) Understand the role of different imaging modalities in the assessment of an acute pediatric abdomen so that the right test may be performed in an appropriate time frame. 3) Understand the importance of critical pediatric imaging findings so that the important information is conveyed to the surgeon/clinician.

ABSTRACT

Children are not little adults and imaging of the acute pediatric abdomen requires a different approach than for adults. The history accompanying the clinical presentation may be vague or absent, the clinical symptoms are often nonspecific and the presentation often occurs after the condition is well established. Consequently, diagnostic imaging often plays an important role in the identification of the etiology and correct interpretation of the images is essential for an optimum outcome. Congenital abnormalities may be identified before birth and may not require post natal imaging prior to surgery, but other conditions will present in the neonatal period and require upper and/or lower GIT contrast studies. Hypertrophic pyloric stenosis is not the only cause of projectile vomiting in infants but the ultrasound findings can be diagnostic when recognized. Malrotation of the bowel giving rise to midgut volvulus is a surgical emergency that will result in bowel infarction if not relieved. Intermittent volvulus due to duodenal malrotation is more difficult to recognize when there is no bowel obstruction. The key landmark being the position of the D-J flexure; however, the D-J flexure can be falsely low when there is over distension of the stomach or the patient is imaged in an oblique position. It can also be in the correct position by chance due to increased mobility of the bowel and a repeat study should be considered if strong clinical suspicion remains. Intussusception (especially ileocolic) may lead to bowel perforation and/or infarction and peritonitis but can be safely treated if recognized and treated early. Appropriate use of medical imaging in the identification of patients with appendicitis can improve the management of these patients but it may provide false reassurance if the limitations of the study are not recognized. The role of imaging in these and other abdominal emergencies will be discussed.
After 2 years follow up in which surgery was indicated. MRI features tumors with incomplete remission were: ill defined margin and heterogenous contrast enhancement. Neither of the cases were associated with deletion of chromosome 1(p36) nor amplification of MYCN. Tumor markers were normal for all cases with complete remission.

**CONCLUSION**

MRI margin definition and tumor enhancement pattern are important imaging parameters to predict low risk suprarenal Neuroblastoma response to conservative therapy.

**CLINICAL RELEVANCE/APPLICATION**

MRI margin definition and tumor enhancement pattern could be of important clinical value to predict low risk suprarenal Neuroblastoma response following wait and see protocol therapy.

**SSK19-02 18F-FDG PET/MR for Local Staging of Pediatric Malignancies: Is Administration of Gd-chelates Necessary?**

Christopher Klenk MD (Presenter): Nothing to Disclose, Rakhee Sameer Gawande MD: Nothing to Disclose, Vythao Tran MD: Nothing to Disclose, Alex McMillan: Nothing to Disclose, Andrew Quon MD: Nothing to Disclose, Heike E. Daldrup-Link MD: Nothing to Disclose

**PURPOSE**

To evaluate if the administration of Gd-chelates is necessary for evaluation of pediatric abdominal and pelvic tumors on 18F-FDG-PET/MR scans.

**METHOD AND MATERIALS**

In a first step, we compared the accuracy of pre-contrast T2-weighted FSE, DWI and T1-weighted LAVA scans with Gadobenate-enhanced T1-weighted MR scans for the evaluation of 14 diagnostic criteria in 119 patients with abdominal and pelvic tumors. In a second step, we identified a subset of 36 pediatric patients who had received an 18F-FDG PET scan within 3 weeks of their MR scan. In these patients, we evaluated concordance or discordance of 18F-FDG PET and gadolinium tumor enhancement, using a McNemar’s test. In addition, we evaluated the diagnostic accuracy of 18F-FDG PET/T2-FSE and 18F-FDG PET/Gd-LAVA scans regarding the 14 diagnostic criteria for tumor staging. Histopathology, surgical notes and follow up imaging served as the standard of reference.

**RESULTS**

Pre- and post contrast MR scans did not show significant differences in diagnostic accuracies of 14 diagnostic criteria that evaluated image quality and tumor origin, extent, composition and differential diagnosis (p<0.05). The 18F-FDG PET/MR subgroup showed concordant Gd-enhancement and 18F-FDG avidity in 31 of 36 patients and 106 of 123 tumors. There was no significant difference in diagnostic accuracy of integrated 18F-FDG PET/T2-FSE and 18F-FDG PET/Gd-LAVA scans (p< 0.05).

**CONCLUSION**

Conclusion: Gd-contrast administration is not necessary for evaluation of pediatric abdominal and pelvic tumors on integrated 18F-FDG-PET/MR scans. Exceptions may include focal liver lesions.

**CLINICAL RELEVANCE/APPLICATION**

If Gd-administration does not provide additional information compared to 18F-FDG-PET scans, MR scans for local staging could be streamlined and Gd-chelates could be replaced by alternative, more specific MR contrast agents.

**SSK19-03 Whole Body MRI including Diffusion-weighted and Conventional Unenhanced and Contrast Enhanced Imaging as the Sole Staging and Follow-up Imaging Procedure in Pediatric Tumors - Comparison with Established Imaging Modalities**

Guenther Karl Schneider MD, PhD (Presenter): Research Grant, Siemens AG Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bracco Group Speakers Bureau, Guerbet SA, Stefan Radiologie Uniklinik Rick: Nothing to Disclose, Jonas Stroeder MD: Nothing to Disclose, Arno Buecker MD: Consultant, Covidien AG Speaker, Covidien AG Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG, Peter Fries MD: Nothing to Disclose

**PURPOSE**

In 53 pediatric pts. with suspected malignant tumors whole body MRI was performed and evaluated as the sole staging procedure including evaluation of the lungs in comparison to established staging procedures as FDG-PET, MIBG or bone scintigraphy, CT and ultrasound. Furthermore, findings in follow-up whole body MRI were used for evaluation of tumor response and tumor recurrence, again compared against other established imaging methods.

**METHOD AND MATERIALS**

209 whole body examinations in 53 pts. were performed for staging and follow-up of benign and malignant tumors confirmed by histology and/or surgical exploration. In 10 pts. benign tumors were diagnosed. In the remaining 43 pts 14 lymphoma and 29 solid tumors including neuro-, nephro- and hepatoblastoma as well as different types of sarcoma were found. MR protocol incl. T1w dynamic CE GRE sequences of the abdomen post CM injection (0,05 mmol/kg BW Gd-BOPTA (MultiHance)) and during the liver specific phase. DWI was acquired...
during free breathing and transversal T2w TSE sequences with navigator triggering and a composed whole-body STIR-sequence in coronal orientation were acquired. Comparison of whole body MRI was performed directly with the different available imaging methods and regarding the cumulative findings from all other imaging procedures together.

RESULTS

MRI correctly differentiated malignant and benign tumors in 52 out of 53 pts. Differences between MRI and CT were seen regarding the number of detected small lung metastases (<3mm), however relevant lesions for staging were correctly diagnosed. In a case of lung metastases with concomitant pneumonia MRI with DWI was able to identify a central metastases, which could not be differentiated from surrounding pneumonia and atelectasis on CT. Recurrent tumors and restaging was correctly facilitated by MRI, sensitivity for detection of small abdominal mets (<10 mm) was better for MRI as compared with PET imaging.

CONCLUSION

Whole body imaging studies performed with the described technique can correctly stage and diagnose a variety of malignant tumors in pediatric patients and further large scale studies have to prove whether MRI can replace at least some of the actually established staging procedures.

CLINICAL RELEVANCE/APPLICATION

Inferior accuracy of whole body STIR MRI was recently published, this study demonstrates the potential of whole body MRI using more advanced techniques for evaluation of pediatric malignancies.

SSK19-04

Correlation of 18F FDG Activity and Diffusion Restriction of Rhabdomyosarcomas on PET/MR: Potential Additional Prognostic Factors

Alexis Leigh Crawley MD (Presenter): Nothing to Disclose, Christopher Klenk MD: Nothing to Disclose, Andrew Quon MD: Nothing to Disclose, Daniel L. Rubin MD, MS: Nothing to Disclose, Heike E. Daldrup-Link MD: Nothing to Disclose

PURPOSE

The overall survival for pediatric patients with soft tissue sarcomas and metastatic disease continues to be less than 30%. New prognostic factors are desperately needed in these patients. No current imaging evaluation is predictive of tumor histopathology, therapy response or overall outcome which is needed to help determine patient therapy. The purpose of our study was to evaluate, if diffusion-weighted MR scans of pediatric soft tissue sarcomas provide complementary or equivalent information compared to 18F-FDG-PET scans.

METHOD AND MATERIALS

We retrospectively evaluated imaging studies of 21 children (age 1-20 years) with alveolar (n=6) and embryonal (n=15) rhabdomyosarcomas who had undergone an 18F-FDG PET/CT and a magnetic resonance (MR) imaging scan with diffusion weighted (DW) sequences within an interval of less than three weeks for initial tumor staging. 18F-FDG PET and DWI scans were fused using MIM software. Areas of increased tumor FDG-uptake, restricted diffusion and the whole tumor on anatomical MR were outlined on each slide and the relative tumor volume that showed increased FDG avidity, restricted diffusion or both was calculated. All data were compared for statistically significant differences using a Wilcoxon signed-rank test and a p<0.05.

RESULTS

All evaluated tumors demonstrated marked heterogeneity. Fused 18F-FDG PET/DW MR images demonstrated significant mismatch of tumor areas with increased 18F-FDG uptake and restricted diffusion. The average volume of restricted diffusion corresponded to 88% +/- 22% of tumor volume, average volume FDG avidity corresponded to 64% +/- 30% of the tumor volume, and average volume of tumor that demonstrated both corresponded to 45% +/-23% of the tumor volume. None of the quantitative imaging data showed significant differences between alveolar and embryonal RMS. Follow up imaging at week 15 demonstrated progressive disease in one patient which also demonstrated the greatest percentage of FDG and diffusion restriction overlap (97%).

CONCLUSION

DW MR scans of pediatric soft tissue sarcomas provide complementary or equivalent information compared to 18F-FDG-PET scans. Our ongoing studies evaluate, if the above mentioned parameters can be used to differentiate responders and non-responders to chemotherapy.

CLINICAL RELEVANCE/APPLICATION

FDG and diffusion restriction provide complimentary information and may be used to differentiate responders and non-responders to chemotherapy.

SSK19-05

Improving Quantitative Accuracy of PET/MRI in a Pediatric Patient Population Using a Dedicated Pediatric PET/MRI Reconstruction Paradigm

Claudia M. Martinez Rios Arellano MD (Presenter): Research Grant, Koninklijke Philips NV, Andrew Sher MD: Research Grant, Koninklijke Philips NV, Li Fan: Nothing to Disclose, Karin Anna Herrmann MD: Consultant, Koninklijke Philips NV, Lingzhi Hu PhD: Employee, Koninklijke Philips NV, Peter F. Faulhaber MD: Speaker, Koninklijke Philips NV Grant, Koninklijke Philips NV Medical Advisor, MIM Software Inc, Barbara Ann Bangert MD: Investigator, Koninklijke Philips NV

PURPOSE

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To demonstrate the clinical feasibility and quantitative accuracy of Positron Emission Tomography/Magnetic Resonance Imaging (PET/MRI) in a pediatric patient population using a dedicated pediatric PET/MRI acquisition and reconstruction protocol.

METHOD AND MATERIALS

Twenty patients (12.4±5.1 yr; 12 girls, 8 boys) were evaluated. Eight patients underwent a whole-body (WB) 3D T1-weighted spoiled gradient echo sequence (3DT1w) at two fields of view (FOV) 600 and 400 mm to evaluate MR-based Attenuation Correction (MRAC) segmentation algorithm. Lung boundaries from automatic versus gold standard manual segmentation were compared. Twelve oncologic patients underwent PET/CT followed by PET/MRI after a single injection of 18F-FDG. PET time was 65±5 and 96±6 minutes respectively after tracer injection. 3-segment MRAC was achieved utilizing two automatic segmentation algorithms, one developed for adults and one for pediatric patients. Non-enhanced WB 3D modified Dixon was performed for anatomical reference. Image quality assessment and regions of interest for quantitative analysis of standardized uptake values (SUVmax/mean) were performed on PET/CT and PET/MR. Statistical analysis included DICE coefficient, Pearson’s correlation, and t-test.

RESULTS

The correlation factor of lung volumes across groups was r>0.9 (p<0.001) with a similarity coefficient of 90±2% and 88±4% between automatic and manual segmentation. Accuracy of MR-based transmission map was appreciable with the pediatric MRAC compared to the adult method (0/12 vs 5/12 suboptimal, respectively). Correlation coefficients between SUV(max)/SUV(mean) of PET/MRI and PET/CT are 0.28/0.36, 0.52/0.58 and 0.39/0.52 for liver, spleen and lungs respectively with adult MRAC method. Pediatric MRAC lung segmentation increased correlation factors to 0.58/0.61, 0.77/0.62 and 0.44/0.61. Lung SUV(max) and SUV(mean) (0.48±0.15 and 0.33±0.11) on PET/MRI reconstructed with the pediatric protocol are significantly lower than PET/CT (0.59±0.22 and 0.45±0.16), p<.0017.

CONCLUSION

Improved quantitative accuracy of MRAC is seen with a dedicated pediatric PET/MRI reconstruction method, yielding superior image quality and increased SUVmax/mean correlation values in comparison to an adult reconstruction method.

CLINICAL RELEVANCE/APPLICATION

MRAC in children is uniquely challenging due to lung size variation and MR motion artifact. A dedicated pediatric PET MRAC allows superior quantitative accuracy for pediatric PET/MRI.

Simultaneous 18F-DOPA PET/MRI in Children with Congenital Hyperinsulinism: Advantages over PET/CT

METHOD AND MATERIALS

Twelve patients (2 boys, 10 girls; median age 6.7 months) with CHI underwent imaging on GE DVCT 64-slice PET/CT and PET/MR imaging on 3 Tesla Siemens Biograph mMR. Dynamic PET scans were acquired 20 and 40 min after injection of 4MBq/kg 18F-DOPA, with contrast enhanced CT, followed by PET/MRI with T2 weighted, diffusion weighted and T1-VIBE post gadolinium, 90 min post DOPA injection. Each acquisition was assessed by two independent observers with visual interpretation and confidence ratings. Standardized Uptake Values (SUVmax) were measured in the head, body and tail of pancreas at 40 minutes with PET/CT and at 90 minutes with PET/MR. Patients were diagnosed with focal versus diffuse CHI on the basis of visual analysis and a target to background ratio (TBR) of 1.5.

RESULTS

All images were diagnostic/evaluable. Two patients had focal CHI. Ten patients had diffuse CHI. In four cases (1 focal and three diffuse) there was a greater confidence in identifying the different types of CHI in PET/MR than in PET/CT. There was no significant difference between TBR ratios in PET/CT and PET/MR in distinguishing the different forms of CHI (p value1.0, t-Test). The results were concordant in 12/12 patients with both methods. The two patients with focal uptake underwent surgery with histopathological confirmation.

CONCLUSION

18F-DOPA PET/MR is not inferior to PET/CT in the preoperative differentiation of focal from diffuse CHI. In addition, PET/ MR provides better soft tissue contrast and has reduced radiation exposure which is particularly beneficial in the paediatric population. These results suggest that 18F-DOPA PET/MR should be considered in all infants with CHI.

CLINICAL RELEVANCE/APPLICATION

Simultaneous 18F-DOPA PET/MR has advantages over PET/CT to diagnose the focal versus the diffuse form of CHI in infants.
Preliminary Results Using VIBE Dixon Sequences in Simultaneous PET/MRI for Discrimination between Metabolic Active and Inactive Adipose Tissue

**PURPOSE**

To describe the potentiality of a 2-point VIBE Dixon sequence acquired for attenuation correction in whole-body simultaneous PET/MRI investigating fat- and water-signal of metabolically active and inactive adipose tissue in pediatric patients.

**METHOD AND MATERIALS**

19 PET/MRI (Siemens Biograph mMR) examinations of 10 patients (7 male, 3 female; mean age 13.5) with oncological diagnoses were retrospectively enrolled in the study. PET/MRI acquisition included a 2D VIBE Dixon sequence (TR/TE 3.60/1.23,2.46, SL 3.12, matrix 191x121, FOV 500) used for attenuation correction with calculation of fat- and water-images. In each patient ROIs were placed into supraclavicular and gluteal fat depots bilaterally and signal intensities on fat and water images as well as the SUV(mean) were determined. Fat-fraction was calculated from the ratio of the fat signal over the summed water- and fat signal. Standard of reference for metabolically active brown supraclavicular fat was at least one PET examination in every patient showing the characteristic pattern of high uptake in the typical regions of brown fat.

**RESULTS**

The fat-fraction was significantly lower (p<0.0001) in supraclavicular brown adipose tissue (BAT) (range: 0.53-0.83, Mean: 0.69) compared to gluteal white adipose tissue (WAT) (range: 0.85-0.96, Mean: 0.92). Mean SUV(mean) for BAT was 4.67 (range: 0.29-18.25), for WAT 0.19 (range: 0.08-0.5). No significant correlation between SUV(mean) and fat-fraction could be observed- neither for BAT (R=-0.06, p=0.73) nor for WAT (R=-0.10, p=0.37).

**CONCLUSION**

Fat-fraction-analysis of Dixon VIBE images anyway acquired for attenuation correction in PET/MRI can potentially be used to assess composition of fat and differentiate between brown and white fat tissue. Metabolic activity as determined by SUV-analysis showed no correlation with fat-fraction using Dixon VIBE sequences.

**CLINICAL RELEVANCE/APPLICATION**

1) Fat-fraction-analysis of MR Dixon images in fat depots of different regions of the body can potentially help identify different types of adipose tissue thus may help identify regions of brown fat, even without PET. 2) In pediatric patients showing PET-uptake in PET/MRI inconclusive for brown fat vs. malignant lesions fat-fraction-analysis can possibly help for further differentiation.
using mDixon was altered for either reader (P<0.05), the junior reader considered mDixon helpful (100%) for tissue characterization. Both readers agreed that mDixon water and fat images (k=0.75 and 0.62; P <0.005) were diagnostically useful.

CONCLUSION

mDixon yields equivalent diagnostic confidence for defining activated brown fat versus lesions as compared to PET/CT.

CLINICAL RELEVANCE/APPLICATION

Using the mDixon sequence in PET/MRI allows for distinction of brown fat from pathologic lesions in pediatric patients by virtue of its novel, fat delineating images.

SSK19-09 Role of Lower-limb MRI Screening of Post-treatment Osteonecrosis in Paediatric Patients Affected by Acute Lymphoblastic Leukaemia

Alessandro Masetto MD (Presenter): Nothing to Disclose , Davide Ippolito MD : Nothing to Disclose , Pietro Andrea Bonaffini MD : Nothing to Disclose , Alessandra Silvia Casiraghi : Nothing to Disclose , Camillo Roberto Giovanni Leopoldo Talei Franzesi : Nothing to Disclose , Sandro Sironi MD : Nothing to Disclose

PURPOSE

To evaluate the clinical relevance of screening and monitoring post-treatment lower-limbs osteonecrosis (ON) with MRI in symptomatic and asymptomatic children affected by acute lymphoblastic leukemia (ALL).

METHOD AND MATERIALS

We retrospectively evaluated a total of 73 patients (37 males, average age 12.4 years) affected by ALL, treated with chemotherapy and corticosteroids or bone marrow transplantation (BMT) and who underwent a lower limbs MRI examination between June 2007 and February 2014. In 47 patients the first study was performed after the early onset of symptoms referable to ON (bone and articular pain); the remaining 26 patients were asymptomatic and evaluated for screening purposes. The MRI examinations were performed either on a 1.5T (Achieva, Philips) or a 1T magnet (Panorama, Philips) acquiring coronal short tau inversion recovery (STIR) long TE and T1 weighted sequences, from the hips to the ankles. Additional sequences were acquired only in selected cases. The average acquisition time was 18 minutes.

RESULTS

A total of 195 MRI examinations (baseline and follow-up) were evaluated. Among the 47 symptomatic patients, 9/47 (19%) did not demonstrate ON and 13/47 (27%) had bone infarcts; 25/47 (53%) had ON involving at least one joint and 11 of these cases (44%) later collapsed. Considering the remaining 26 asymptomatic patients, 14 (54%) did not demonstrate ON, 7 (27%) had bone infarcts only, while only 5/26 (19%) had ON of one joint; in these 5 patients no joint collapse was observed at follow-up.

CONCLUSION

Lower-limbs MRI might be employed only in symptomatic ALL patients, who underwent treatment, as quick and feasible imaging technique for the assessment of osteonecrotic lesions. In asymptomatic cases, due to the reduced incidence of ON and subsequent Joint collapse, employment of MRI seems not to demonstrate a significant clinical relevance.

CLINICAL RELEVANCE/APPLICATION

Early detection and monitoring of ON is essential for conservative or minimally invasive treatment strategies but MRI should be specifically performed only in patients complaining symptoms.
PDS243  Punctate White Matter Lesions in Preterm Infants Using DTI, MRS, and MRI (Station #1)

Ying Qi (Presenter): Nothing to Disclose, Xiaoming Wang MD: Nothing to Disclose, Qiyong Guo MD: Nothing to Disclose

PURPOSE

This study aimed to detect the impacts on cerebral microstructure, metabolic changes and their neurodevelopment of punctate white matter lesions (PWML) by using DTI, MRS and conventional MRI.

METHOD AND MATERIALS

100 preterm infants with PWML were identified on MRI and DWI. DTI and MRS were performed when they were stable. The grades of PWML were described from mild to severe on conventional MRI and DWI. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) values were obtained for 20 cerebral regions of interest (ROI). NAA/Cr, Cho/Cr, Glx/Cr, Lac/Cr and ml/Cr were calculated beside the lateral cerebral ventricle. Follow-up MRI and neurodevelopmental assessment were performed.

RESULTS

There were 34, 41 and 25 infants in Grade 1, 2 and 3. Compared with the infants in Grade 1, infants in Grade 2 and 3 had significantly lower FA values in the centrum semiovale, lateral cerebral ventricle and posterior limb of internal capsule (P<.05). Infants in Grade 2 and 3 had significantly higher ADC values in the lateral cerebral ventricle and posterior limb of internal capsule (P<.05). There was no significant difference of the FA and ADC values between the infants in Grade 2 and 3 in other ROIs (P>.05). There were significantly different Cho/Cr, Glx/Cr, Lac/Cr and ml/Cr among the infants in Grade 1, 2 and 3 (P<.05). Corresponding to the classification, there were 27, 28 and 23 infants followed up respectively. The morbidities of PVL, ventricular dilation, atrophy of the white matter and/or neurodevelopmental delay were 7.41% (2/27), 67.86% (19/28) and 95.65% (22/23) accordingly.

CONCLUSION

PWML in Grade 2 and 3 might interfere the myelinization in cerebral microstructure of preterm infants. The higher Grade of PWML, the higher possibility of cerebral metabolic changes and their prognostic abnormality is.

CLINICAL RELEVANCE/APPLICATION

The preterm infants with PWML in Grade 1 often have normal outcomes of MRI and neurodevelopment. The infants with PWML in Grade 2 or 3 often have cerebral palsy or neurodevelopmental delay.

PDS244  3T MRI of Cerebellar Hemorrhage in Preterm Infants: Scoring System and Relationship to Neurodevelopmental Outcomes (Station #2)

Mai-Lan Ho MD (Presenter): Nothing to Disclose, Dawn Gano MD: Nothing to Disclose, Olga Tymofiyeva MD: Nothing to Disclose, Hannah Glass MD: Nothing to Disclose, Donna Ferriero MD, MS: Nothing to Disclose, A. James Barkovich MD: Research Consultant, General Electric Company

PURPOSE

Cerebellar hemorrhage (CH) is a significant imaging finding in preterm infants, and is routinely evaluated by MRI at 3 Tesla in our practice. We will describe a standardized scoring system for CH on 3T MRI, and correlate with supratentorial brain injury and neurodevelopmental outcomes.

METHOD AND MATERIALS

46 preterm infants (< 37 weeks gestational age) admitted to our neonatal ICU between 2011-2013 underwent 3T MRI with 3-D T1, axial T2, and axial susceptibility-weighted sequences. A pediatric neuroradiologist blinded to clinical data reviewed cases for intraventricular hemorrhage (IVH), supratentorial white matter injury (WMI), ventriculomegaly (VM), and cerebellar hemorrhage (CH). CH was graded based on laterality, number, size, location, and involved lobe. Neurodevelopmental assessment included neuromotor scores at birth and 6 months, and Bayley-III testing at 12 months.

RESULTS

Mean gestational age of subjects was 28.8 weeks (range 25.3 - 32.3 weeks). 11 subjects (24%) had CH, of which 27% were graded as mild, 18% as moderate, and 55% as severe. Of the patients with CH, 55% had IVH, 27% had WMI, and 18% had VM. For the 35 patients without CH, 9% had IVH, 17% had WMI, and 6% had VM. Based on Fisher’s exact test, CH was significantly associated with IVH (p = 0.02), but not WMI (p = 0.4) or VM (p = 0.3). Neurodevelopmental assessment did not identify functional motor deficits at birth or 6 months. Bayley-III motor, language, and cognitive scores at 12 months were 96 ± 26, 102 ± 23, 96 ± 23 for subjects with CH and 104 ± 10, 110 ± 10, 116 ± 11 in those without CH. Using a 2-sided t-test, CH was significantly associated with cognitive (p = .0003) and motor (p = 0.1) subscores, but not language (p = 0.7).

CONCLUSION

We have implemented a standardized scoring system for preterm cerebellar hemorrhage on 3T MRI, and correlate with supratentorial brain injury and neurodevelopmental outcomes.

CLINICAL RELEVANCE/APPLICATION

PDS244
3T MRI is the imaging standard for evaluation of cerebellar hemorrhage in preterm infants, and requires a standardized scoring system to assist in grading of overall brain injury and prediction of neurodevelopmental outcomes.

**PDS245 Aberrant Fractional Anisotropy in White Matter and its Relationship with Visual Attention Impairment in Children with Chronic Fatigue Syndrome: A DTI Study Using Tract-based Spatial Statistics (Station #3)**

Xiaoxia Liu MMed (Presenter): Nothing to Disclose, Fanxing Meng MMed: Nothing to Disclose, Bing Yu MD: Nothing to Disclose, Na Liu MD: Nothing to Disclose, Qiyong Guo MD: Nothing to Disclose

**PURPOSE**

To assess the potential relationship between attention impairment and fractional anisotropy in white matter (WM) of children with chronic fatigue syndrome (CFS) using integrated visual and auditory continuous performance test (IVA-CPT) and diffusion tensor magnetic resonance imaging (DTI).

**METHOD AND MATERIALS**

IVA-CPT and DTI data were obtained from 65 right-handed children, including 31 CFS children (M/F, 17:14; age, 10.0±1.5 y) and 34 age-matched healthy controls (M/F, 19:15; age, 10.2 ±1.3 y). All participants were assessed with the integrated visual and auditory continuous performance test (IVA-CPT). Auditory response control quotients (ARCQ), auditory attention quotients (AAQ), visual response control quotients (VRCQ), visual attention quotients (VAQ), full scale response control quotients (FRCQ) and full scale attention quotients (FAQ) were recorded. DTI scans were performed on a 3.0-T MR scanner and post-processed using FSL software. Comparisons of IVA-CPT data between groups were performed using the student t test. Voxelwise statistical analysis of the FA data was carried out using Tract-Based Spatial Statistics(TBSS).

**RESULTS**

The FAQ, VRCQ and VAQ of children with CFS were significantly lower than that of children in the control group. Children with CFS also had lower FA in WM fiber tracts of bilateral posterior limb of internal capsule (PIC) and left optic radiation (OR) than that of controls.

**CONCLUSION**

CFS Children exhibit visual attention deficits. Our findings suggest that white matter fiber tracts of bilateral PIC and left OR abnormalities are likely to be involved in the onset and progression of visual attention impairment in children with CFS.

**CLINICAL RELEVANCE/APPLICATION**

White matter fiber tracts of bilateral PIC and left OR abnormalities are likely to be involved in the onset and progression of visual attention impairment in children with CFS.

**PDS246 Early Experience of Combined 18F-FDG PET/MRI in Pediatric Cancer Patients (Station #4)**


**PURPOSE**

Combined PET/MRI is a promising new imaging modality in children, particularly pediatric cancer patients. Data regarding pediatric PET/MRI are scarce. In this pilot study, we report our initial experience with PET/MRI in young cancer patients.

**METHOD AND MATERIALS**

Patients 2.5 as a reference standard for malignancy. Statistical analyses of correlation between PET/CT and PET/MRI SUVmax values were performed using linear regression.

**RESULTS**

4 patients were enrolled with a total of 5 paired PET/CT and PET/MRI exams. Mean delay from tracer injection to PET/CT and PET/MRI was 70 and 175 minutes, respectively, with an average PET/MRI scan time of 35 minutes. Mean total effective dose for PET/CT was 12.94mSv, including 7.2mSv (56%) from CT. A total of 7 malignant and 19 benign lesions were included for analysis. There was significant correlation between PET/CT and PET/MR SUVmax for all lesions (r²=0.95, p

**CONCLUSION**

Our early experience suggests that PET/MRI derived SUVmax and ADC values are sensitive and specific for detection of malignant lesions compared with PET/CT reference. Substitution of PET/MRI for PET/CT would result in significant radiation dose reduction and may help characterize more indeterminate lesions. Studies with more subjects are needed to confirm these findings.

**CLINICAL RELEVANCE/APPLICATION**

Combined FDG-PET/MRI shows great promise as an imaging modality in children due to its similar cancer detection rates compared to FDG-PET/CT with reduced radiation exposure.
Contrast-enhanced Ultrasound (CEUS) in Blunt Abdominal Trauma: Utility in the Identification of Post-traumatic Splenic Pseudoaneurysms in Children and Young Adults—Initial Experience (Station #5)

Annamaria Deganello MD (Presenter): Speaker, Bracco Group, Kleanthi Kalogerakou MD, MSc: Nothing to Disclose, Eleni Konstantatou MD, MSc: Nothing to Disclose, Maria E. Sellers MD, FRCP: Nothing to Disclose, Paul Singh Sidhu MRCP, FRCP: Speaker, Bracco Group, Speaker, Siemens AG, Speaker, Hitachi, Ltd

PURPOSE

The spleen is the most commonly injured organ in children, and due to possible development of splenic pseudoaneurysm with risk of rupture, there is a need for close follow-up, normally with repeated CT. The purpose of this study is to illustrate the usefulness of CEUS for the detection and follow up of these lesions in children and young adults, sparing them the radiation burden of CT.

METHOD AND MATERIALS

Retrospective single-centre review of CT database of pediatric and young adult patients scanned for abdominal trauma over a period of 2½ years (Jul 2011, date in which we introduced CEUS in the follow-up, to Dec 2013). CT scans were performed with post-contrast split-bolus or dual-phase protocol. We documented the number of patients with a splenic injury at presentation, and, out of these, patients diagnosed with a splenic pseudoaneurysm. We also recorded the imaging modality used to diagnose and follow-up these lesions. All CEUS scans where performed by experienced radiologists with no adverse effects and all adult patients and parents had given informed consent.

RESULTS

A total of 27 patients had a splenic injury at presentation; of these, 6 patients (Females=1, Male=5, mean age 16, range 6-23y) developed a post-traumatic splenic pseudoaneurysm. The mechanism of trauma was a fall in 3 cases, road traffic accident in 2 cases and stabbing in 1 case; 4 patients had a grade IV injury and 2 patients a grade III. One of the patients had a pseudoaneurysm at presentation, and in the other cases the diagnosis was made at follow-up, with CT, confirmed with CEUS in 3 patients and with CEUS in the 2 small children, when CT failed to demonstrate a pseudoaneurysm. 2 patients required coil embolization and in 4 cases the lesions resolved spontaneously: all patients were followed up with serial CEUS, which confirmed effective embolization and resolution respectively, without further need for CT.

CONCLUSION

Although the use of CEUS in children is "off-label", our initial experience shows that its diagnostic accuracy equals that of CT. In all our cases, clear characterisation of splenic pseudoaneurysms with CEUS allowed a safe, radiation-free, conservative management of these young patients.

CLINICAL RELEVANCE/APPLICATION

CEUS can be an alternative to CT for the detection and follow-up of post-traumatic splenic pseudoaneurysms, reducing a potentially high cumulative dose in this young population.

Review of Imaging Features Along with Histopathological Correlation of Lipomas and Lipoblastomas in Children Presenting to a Tertiary Pediatric Teaching Hospital (Station #6)

Farhat Bano (Presenter): Nothing to Disclose, Joanne Warner MBChB, MRCS: Nothing to Disclose, Walid Al-Deeb MBBS, MRCP: Nothing to Disclose, Srikrishna Harave MBBS: Nothing to Disclose

TEACHING POINTS

1. Recognition of the radiologic spectrum of appearances of the various types of lipomas and lipoblastomas.
2. Understanding the features that facilitate initial radiologic differential diagnosis and describe the factors which may impact on subsequent management of the patient.
3. Provision of comprehensive accurate guide of US, CT and MRI findings in benign fat containing soft tissue tumours covering all body areas, with histopathologic correlation.

TABLE OF CONTENTS/OUTLINE

We present Imaging review of 36 patients with benign soft tissue tumours over a period of one decade from 2004 to 2014, including different modalities like Ultrasound MRI CT. We will discuss common imaging features suggestive of benign fat containing soft tissue tumours to help radiologists make confident diagnosis. Various features will include 1. Size 2. Homogeneity 3. Echogenicity 4. Intrinsic nature of the lesion e.g well defined, capsulated 5. Relation to surrounding structures e.g invasion 6. Vascularity 7. Fat content and Fat suppression 8. Absence of Contrast enhancement. Imaging features suspicious for malignant soft tissue tumours found warranting were On Ultrasound 1. Large lesion with Ill defined borders 2. Heterogenous apperances 3. Increased colour doppler flow On MRI 1. Lack of fat suppression 2. Presence of contrast enhancement

Magnetic Resonance Urography (MRU) in Duplicated Renal Collecting Systems: Just Impressive Images or More Information? (Station #7)

Melkamu Dessie Adeb MD (Presenter): Nothing to Disclose, Kassa Darge MD, PhD: Nothing to Disclose, Jonathan Russell Dillman MD: Research support, Bracco Group, Research support, Siemens AG, Michael Carr MD, PhD: Nothing to Disclose, Dana Spergel Schwartz MD: Nothing to Disclose, Monica Epelman MD: Nothing to Disclose
TEACHING POINTS

• Discuss the role of MRU in evaluation of duplicated renal collecting systems. • Describe the morphological and functional features of duplicated renal collecting systems as evaluated in MRU. • Emphasize the value of functional information obtained from fMRU in the evaluation of duplicated renal collecting systems.

TABLE OF CONTENTS/OUTLINE

• Terminology in duplex systems • Basic embryology • Types of duplex systems Complete Incomplete Magnetic resonance urography Advantages Role in duplex evaluation Advantages Technique: Patient preparation Important sequences fMRU: Curves: enhancement and excretion curves Times: CTT, RTT, TTP Differential renal functions (DRFs): vDRF, pDRF, vpDRF, patlak

PDE012-b

Twist and Shout: Imaging Acute Pelvic Pathology in Female Pediatric Patients - Ovarian Torsion and Beyond (hardcopy backboard)

Shanthan Yashoda Tumu DO (Presenter): Nothing to Disclose, Tejaswini Kishor Deshmukh MD: Nothing to Disclose, Arthur Benjamin Meyers MD: Nothing to Disclose, Kevin Paul Boyd DO: Nothing to Disclose

TEACHING POINTS

• Review normal anatomy, key anatomic relationships and age related changes.
• Discuss the appropriate choice of imaging.
• Review the imaging of female pediatric pelvic pathological conditions presenting in the emergent setting.
• Differentiation of surgical from nonsurgical entities.

TABLE OF CONTENTS/OUTLINE

Introduction
Normal anatomy
Imaging protocols
Gynecologic causes of acute pelvic pathology in the female pediatric patient
  • Variety of appearances of ovarian torsion
  • Congenital anomalies
  • Hernias containing female pelvic organs
  • Infection
  • Gynecologic tumors
  • Pregnancy related conditions
  • Malpositioned IUD
  • Trauma
  • Vaginal foreign body
  • Vesicovaginal and rectovaginal fistulas
Non-gynecologic causes of acute pelvic pathology

Conclusion:
In the female pediatric population, determining the cause of acute pelvic pathology is often a clinical challenge. Diagnostic imaging plays a key role in establishing a diagnosis and in directing medical and surgical treatment. This exhibit will review the spectrum of causes of acute pelvic pathology in female infants to teens. In addition to the variety of appearances of ovarian torsion seen at imaging, other causes of acutely presenting pelvic pathology will be demonstrated including entities specific to infants and children.

PDS-WEB

Pediatric Wednesday Poster Discussions

Scientific Posters

PD

AMA PRA Category 1 Credits™: .50
Wed, Dec 3 12:45 PM - 1:15 PM Location: S101B

Sub-Events

PDS248

Reduced Subarachnoid Fluid Diffusion in Enlarged Subarachnoid Spaces of Infancy (Station #1)

Matt Whitehead MD (Presenter): Nothing to Disclose, Audrey Pichair McCarron: Nothing to Disclose, Bonmyong Lee MD: Nothing to Disclose, Gilbert Vezina MD: Nothing to Disclose

PURPOSE

Benign enlargement of the subarachnoid spaces (BESSI) is a common cause of infantile macrocephaly. Although sound causal theories have been suggested, the mechanism remains unsolved. We have observed diminished subarachnoid fluid diffusivity in these patients, potentially reflecting insufficient frontotemporal capillary bed protein resorption, unbalanced hydrostatic/osmotic pressures, and secondary congestion. We retrospectively analyzed quantitative subarachnoid:ventricle ADC ratios in 52 macrocephalic patients with BESSI and compared
METHOD AND MATERIALS

The Radiology Information System was searched for all brain MRs over a consecutive 2 year period containing the term "macrocephaly". The search yielded 218 exams, all from different patients. All patients with noncommunicating hydrocephalus, moderate or greater ventriculomegaly, atrophy, structural bone and/parenchymal abnormalities, hemorrhages, meningitis, and normal imaging were excluded. 52 patients met inclusion criteria. Normal brain MR exams from 10 aged matched control normocephalic subjects were also evaluated. Studies were analyzed by a board certified neuroradiologist. 3mm elliptical regions of interest were drawn in the ventricular frontal horns and frontal subarachnoid space using FuncTool. Mean quantitative ADC values were recorded. The subarachnoid to ventricular ADC ratios were compared using a Mann Whitney U-test; p

RESULTS

The mean patient age was 13.4 +/- 2.8 months, range 0.25-54 months (macrocephalic cohort) and 13.4 +/- 12 months, range 0.25- 59 months (normocephalic cohort). The subarachnoid fluid mean ADC was 2474 +/- 74 x10-6 mm2/s in the macrocephalic group and 2946 +/-235 x10-6 mm2/s in the normocephalic group. The ventricular fluid mean ADC was 2960 +/- 104 x10-6 mm2/s and 2771 +/- 337 x10-6 mm2/s in the normocephalic group. The mean quantitative ADC ratio in the macrocephalic group was 0.87, significantly than the normocephalic group (1.1) (z=-5.2, p=0.0000001).

CONCLUSION

Subarachnoid space fluid diffusivity is reduced in patients with enlarge subarachnoid spaces of infancy.

CLINICAL RELEVANCE/APPLICATION

Expanded subarachnoid spaces in BESSI may represent a mechanism of attempted osmotic equilibrium whereby insufficient protein resorption is partially offset by decreased water resorption and bulk flow at the developing frontotemporal capillary level.

PDS249

Intra-Operative MR Imaging with Diffusion Tensor Imaging at 3T for Evaluation of the Extent of Disconnection of White Matter Tracts in Modified Functional Hemispherectomy (Station #2)

Jaykumar Raghavan Nair MD (Presenter): Nothing to Disclose, Christine Saint- Martin : Nothing to Disclose, Carlos I. Torres MD : Nothing to Disclose, Jean-Pierre Farmer MD : Nothing to Disclose, Jeffrey Atkinson : Nothing to Disclose, Jose Luis Montes MD : Nothing to Disclose

PURPOSE

1) To emphasize the role of intra-operative MR imaging (MRI) in the post-surgical outcome of modified functional hemispherectomy performed for seizure control in pediatric epileptic patients. 2) Evaluate the role of DTI in intra-operative MRI, for determining complete disconnection of the white matter tracts for optimal post-surgical results.

METHOD AND MATERIALS

Ten pediatric patients with recurrent seizures underwent modified functional hemispherectomy for various etiologies of seizures [Congenital Middle Cerebral Artery Infarct with gliosis , Hemimegalencephaly , Rasmussen encephalopathy, Extensive Polymicrogyria, Cortical Dysplasia and Hemorrhagic Encephalitis] All patients had undergone previous MRI examination and presurgical evaluation.Intra-operative MRI sequences included 3D T1, T2-weighted images and 32 directional DTI. All cases were scanned on the same intra-operative 3T MR scanner. Diffusion tensor images were acquired with SENSE head coil. Each DTI dataset was acquired with multislice, single shot echo-planar imaging spin echo sequence. Transverse slices were acquired (parallel to the line connecting the anterior and posterior commissures) covering the whole brain with no slice gap and 2.5 mm isotropic resolution. Diffusion weighting was applied along 32 directions with b value of 1000 s/mm2. To improve the signal to noise ratio, additional DTI datasets were acquired and averaged after co-registration. The complete sequence took seven minutes. The images obtained were postprocessed on the Philips Workstation to obtain color maps and also for fiber tracking. The studies were evaluated simultaneously by two fellowship-trained pediatric neuroradiologist blindfolded to the findings of each other.

RESULTS

Two out of the 10 patients had suspected incomplete disconnection on the conventional images which was confirmed further by DTI images. They proceeded for second surgery which showed complete disconnection on subsequent DTI.

CONCLUSION

Initial data suggests that addition of DTI sequence to intraoperative MRI, may significantly improve outcome in patients undergoing modified functional hemispherectomy which depends upon complete disconnection of the white matter tracts.

CLINICAL RELEVANCE/APPLICATION

Complete dissection of the commissural fibers in modified functional hemispherectomy helps to control seizures in pediatric epileptic patients. Incomplete dissection could result in relapse of seizures.

PDS250

Therapeutic Hypothermia Increases Phosphocreatine, A Critical ATP Reserve, in Neonatal Hypoxic-ischemic Encephalopathy: An In Vivo 1H MRS Investigation (Station #3)

Jessica Lee Wisnowski PhD (Presenter): Nothing to Disclose, Tai-Wei Wu : Nothing to Disclose, PDS249 PDS250
Simultaneous Whole-body PET/MRI in Comparison to PET/CT in Pediatric Oncology: Initial Results in Infants and Young Children (Station #4)

**Sergios Gatidis MD : Nothing to Disclose**, Holger Schmidt PhD : Nothing to Disclose, Brigitte Gueckel : Nothing to Disclose, Christina Pfannenberg MD : Nothing to Disclose, Christian la Fougere : Nothing to Disclose, Konstantin Nikolaid MD : Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG, Nina Schwenzer MD : Nothing to Disclose, Juergen F. Schaefer MD (Presenter): Nothing to Disclose

**PURPOSE**

To evaluate the technical feasibility and clinical performance of combined whole-body PET/MRI in comparison to 18F-FDG-PET/CT in infants and young children with solid tumors.

**METHOD AND MATERIALS**

This prospective study was approved by the local ethics committee. 10 examinations were performed in 9 children (3 female, age 4.4±1.8 years) with solid tumors. After i.v.-administration of 81±30 MBq 18F-FDG all patients were first examined by means of contrast-enhanced PET/CT (Biograph mCT, Siemens, 62±4 min uptake) and subsequently via non-enhanced PET/MRI (Biograph mMR, Siemens, 115±13 min uptake). The PET/MRI protocol included a Dixon sequence for PET attenuation correction as well as coronal STIR, axial T2w, axial T1w sequences and DWI. SUVs of PET(CT) and Pet(MRI) were measured in healthy tissues and tumor lesions. Lesion conspicuity was compared qualitatively between CT and MRI. Effective doses were estimated separately for PET and CT.

**RESULTS**

All examinations were completed offering good diagnostic image quality. PET of PET/CT and PET/MRI showed complete agreement in the detection of local FDG-uptake. SUVs of PET(CT) and PET(MRI) correlated well with correlation coefficients above 0.7. Relevant additional information was obtained by MRI compared to CT in 5 cases (local staging of soft-tissue lesions in 2 cases, morphological PET-correlation in 3 cases). Theoretical dose reduction in PET/MRI compared to PET/CT was 47±12 %.

**CONCLUSION**

PET/MRI is a promising modality for the examination of young children with solid tumors showing equivalent qualitative and quantitative results compared to PET/CT. Advantages of PET/MRI lie in the evaluation of soft tissue lesions. Importantly for this patient population, effective dose of PET/MRI is significantly lower than in PET/CT.
The results of this study encourage the use of FDG-PET/MRI as an equivalent alternative to FDG-PET/CT with significantly lower radiation exposure. When available, PET/MRI should be considered as the primary imaging tool for tumor staging of young children and infants with solid malignancies.

Diagnostic Errors by Radiology Residents in On-call Interpretation of Emergent Pediatric Musculoskeletal Radiographs (Station #5)

Erica Riedesel MD (Presenter): Nothing to Disclose, Michele M. Walters MD: Nothing to Disclose

PURPOSE

Interpretation of pediatric musculoskeletal radiographs can be challenging for residents new to pediatric imaging. Unique fracture patterns, variation in the appearance of the growing skeleton with age, and the prevalence of normal developmental variants may pose diagnostic dilemmas. The purpose of this study was to determine the most common errors made by residents in the interpretation of pediatric musculoskeletal radiographs from the emergency department.

METHOD AND MATERIALS

22,086 radiographs performed after hours in the emergency department at a tertiary care pediatric hospital over a 2-year period (2010-2012) were analyzed retrospectively. Initial interpretation was performed independently by on-call radiology residents (PGY3-4), with final interpretation by pediatric attending radiologists. Musculoskeletal radiographs, defined as radiographs of the appendicular and axial skeleton, were separated from this group and further analyzed to determine the type and incidence of missed pathology.

RESULTS

Nearly one third of resident diagnostic errors (29%, 172/591) involved musculoskeletal imaging studies. Musculoskeletal studies were also the most common error encountered resulting in a potential change of clinical management. Evaluation of fractures accounted for 97% of errors (166/172). Digit fractures were most frequently missed (27%), followed by elbow fractures (16%). Pathology unique to pediatrics was frequently encountered, including Salter-Harris fractures (14%), buckle fractures (12%), and normal anatomic variants (8%).

CONCLUSION

Musculoskeletal radiographs account for a significant proportion of diagnostic errors made by radiology residents interpreting emergency department studies in an on-call setting. These errors are often of a higher severity level, and missed diagnoses impact clinical management of patients. A proactive approach to resident education focusing on common musculoskeletal diagnostic errors can familiarize trainees with frequently missed entities and potentially decrease diagnostic error rate.

CLINICAL RELEVANCE/APPLICATION

A proactive approach to resident education focusing on common musculoskeletal radiography diagnostic errors can familiarize trainees with frequently missed entities and decrease diagnostic error rate.

Image Right: Automated Strategies for Reducing Radiation Dose in Pediatric CT Angiography (Station #6)

Rishi Mhapsekar MD (Presenter): Nothing to Disclose, Marilyn J. Siegel MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Juan Carlos Ramirez Giraldo PhD: Employee, Siemens AG

TEACHING POINTS

1. Review technical options that influence radiation exposure in CT angiography (CTA) 2. Describe automated technologies and software applications that will reduce radiation exposure in children undergoing CTA 3. Understand the effects on dose using these technologies in isolation and in combination

TABLE OF CONTENTS/OUTLINE

1. Introduction Relationship between kilovoltage, milliamperage, and image quality Phantom results of lowering the primary CT parameters 2. Automated tube current modulation How to choose the appropriate reference image quality to achieve optimal dose reduction 3. Automated kilovoltage section How to choose the optimal kVp on the basis of the diagnostic task and patient habitus 4. Iterative image reconstruction How to choose the best level of iterative reconstruction and how to minimize the effect of altered image quality on CT images by use of smoothing kernels. 5. Image examples describing the use of these technologies in isolation and synergistically. 6. Summary data table (figure 5) demonstrating how the combination of technologies has consistently driven doses towards sub-mSv ranges in a routine fashion. Conclusion: Understanding recently developed scanning techniques is essential for optimization of pediatric imaging protocols designed to achieve the desired image quality with a reduce dose.

Radiologic-Pathologic Update on Vascular Lesions: A Review of the 2014 Revised Classification of Vascular Tumors and Malformations According to the International Society for the Study of Vascular Anomalies (ISSVA) (Station #7)

Arnold Carlson Merrow MD (Presenter): Author, Amirsys, Inc Editor, Amirsys, Inc Employee, Amirsys, Inc, Manish Natvarlal Patel DO: Nothing to Disclose, Denise M Adams MD: Nothing to Disclose, Anita Gupta: Nothing to Disclose

TEACHING POINTS
Understand a newly updated classification scheme for vascular tumors and neoplasms as adopted by the International Society for the Study of Vascular Anomalies (ISSVA). Become familiar with clinical, imaging, histologic, and genetic features of these lesions.

**TABLE OF CONTENTS/OUTLINE**

- Introduction to vascular anomalies
- Vascular tumors
  - Benign vascular tumors
  - Locally aggressive or borderline tumors
  - Malignant tumors
- Vascular malformations
  - Simple malformations
  - Combined malformations of major named vessels
  - Malformations with other anomalies
  - Provisionally unclassified vascular anomalies

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**SSM20**

**Pediatrics (General Pediatrics)**

*Scientific Papers*

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**Wed, Dec 3 3:00 PM - 4:00 PM Location: S102AB**

**Participants**

- **Moderator**: Brian D. Coley MD: Author with royalties, Reed Elsevier
- **Moderator**: Ellen M. Chung MD: Nothing to Disclose

**Sub-Events**

**SSM20-01**

**Clinical Importance of Portal Vein Imaging in Neonates with Mild Hypergalactosemia**

Chihiro Tani MD (Presenter): Nothing to Disclose, Yoko Kaichi: Nothing to Disclose, Yukiko Honda MD: Nothing to Disclose, Daisuke Komoto MD: Nothing to Disclose, Shuji Date: 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, Wataru Fukumoto: Nothing to Disclose

**PURPOSE**

Severe hypergalactosemia is a genetic metabolic disorder due to a deficiency in an enzyme responsible for galactose degradation. In some neonates, mild hypergalactosemia is due to a disorder of the portal venous system. The purpose of this study was to investigate the incidence and morphological findings of portal venous abnormalities by ultrasound (US) in neonates in whom mass screening detected hypergalactosemia.

**METHOD AND MATERIALS**

This study included 89 neonates in whom mass screening detected hypergalactosemia during the last 4 years. All underwent color Doppler US at their first visit. Their mean age was 20.1 days (range 9-41 days). Using US, we retrospectively assessed the incidence and causative factors of the abnormal US findings.

**RESULTS**

US returned abnormal findings in 38 (42.7%) of the 89 neonates. Of the abnormal findings, 29 revealed delayed closure of the ductus venosus, 6 showed an intrahepatic portosystemic shunt, and in one case each we observed both delayed closure of the ductus venosus and intrahepatic portosystemic shunt, a congenital extrahepatic portosystemic shunt (CEPS), and biliary atresia. In 27 of the neonates with delayed closure of the ductus venosus the shunt flow disappeared after spontaneous closure and their blood galactose level decreased. In the other 2 neonates metabolic study returned a diagnosis of enzyme deficiency; their hypergalactosemia persisted even after spontaneous closure. In 4 of the 6 infants with an intrahepatic portosystemic shunt the shunt closed spontaneously during follow-up. In the other 2 neonates the shunt did not close spontaneously and they were monitored because the shunt flow was small. In the patient with both delayed closure of the ductus venosus and an intrahepatic portosystemic shunt, both closed spontaneously during follow up. The 2 neonates with CEPS and biliary atresia underwent additional imaging studies and surgery. In 51 of the 89 cases there were no abnormal findings; 46 manifested transient hypergalactosemia, and 5 presented with enzyme deficiency.

**CONCLUSION**

In neonates identified by mass screening as hypergalactosemic, US is important because it reliably identifies patients requiring surgical intervention.

**CLINICAL RELEVANCE/APPLICATION**

Although the pathogenesis of hypergalactosemia is variable, a major cause is portosystemic shunt. In neonates with hypergalactosemia, US should be acquired to rule out portal venous system anomalies requiring surgical intervention.
Diagnostic Performance and Safety of Contrast-enhanced Voiding Urosonography with a Second-generation Ultrasound Contrast Agent for the Diagnosis of Vesicoureteral Reflux: The Experience of a Single Center in 1350 Children

Frederica Papadopoulou MD (Presenter): Nothing to Disclose, Aikaterini Ntoulia MD, PhD: Nothing to Disclose, J. Christopher Edgar PhD: Nothing to Disclose, Kassa Darge MD, PhD: Nothing to Disclose

PURPOSE
To evaluate the diagnostic performance and safety of intravesical administration of a-second-generation ultrasound contrast-agent (UCA) for the diagnosis of vesicoureteral reflux (VUR) in children.

METHOD AND MATERIALS
1350 children (587 boys/763 girls, mean-age 2.6y, range 15d-17y) with 2720 pelvi-ureter-units, underwent contrast-enhanced voiding urosonography (ceVUS) to rule out VUR and/or urethral pathology. A second-generation UCA (SonoVue®, Bracco, Milan) was administered intravesically through 5-8F feeding-tube at a dose of 0.5 ml/bladder filling. Possible adverse-events were monitored during the examination and followed-up 7 days after the ceVUS by phone-calls. Urine analysis and culture were performed 3-5d before ceVUS in all children and 24-48h in any patient reported with adverse-events.

RESULTS
VUR was detected in 450/1350 (33%) patients (162 boys/288 girls). This was in 653 (24%) pelvi-ureter-units. The distribution of grade of reflux was: grade I=1, grade II=276, grade III=266, grade IV=100, grade V=10). The urethra was imaged in 1300 (96%) children and it was of normal morphology in all but one case of an infant with posterior urethral valves. Mean duration of examination was 14±7 min, including urethral imaging. Minor adverse-events were reported in 45 (3.3%) children. These included dysuria (n=40), abdominal pain (n=1), increased frequency of micturition (n=1), vomiting (n=1), perineal irritation (n=1), and urinary-tract-infection after ceVUS (n=1). The onset of adverse-events was sub-acute in 92% and delayed in 8% of cases and the symptoms were self-limited non-requiring hospitalization.

CONCLUSION
Ce-VUS with intravesical administration of a second-generation UCA was capable to detect and grade VUR and urethral morphology. There were no serious adverse-events with intravesical use of SonoVue®. Only a few minor adverse-events were reported during ceVUS most likely due to catheterization process.

CLINICAL RELEVANCE/APPLICATION
Ce-VUS with intravesical administration of a second-generation UCA is a safe and highly sensitive imaging modality for vesicoureteral reflux detection and urethral imaging in children.

Clinical Significance of Incidentally Discovered Renal Cysts in Pediatric Patients

Teerasak Phewplung MD (Presenter): Nothing to Disclose, Avram Zohar Traum: Nothing to Disclose, Ruth Lim MD: Consultant, Alexion Pharmaceuticals, Inc Officer, New England PET Imaging System, Michael Stanley Gee MD, PhD: Nothing to Disclose

PURPOSE
To determine the clinical significance of incidentally discovered renal cysts in pediatric patients and identify imaging predictors of polycystic kidney disease (PKD).

METHOD AND MATERIALS
An IRB-approved, HIPAA-compliant retrospective search of radiology reports from 1989-2013 was performed to identify patients < 18 years old with an imaging exam identifying at least one renal cyst as well as a follow up renal imaging exam for cyst evaluation and/or subsequent clinical evidence of PKD. Electronic medical records and imaging were reviewed. Cysts with clear solid mass components were excluded.

RESULTS
84 pediatric patients with renal cysts were identified (46 females and 38 males; mean age, 9.48 years), including 76 patients with incidentally discovered cysts and 8 patients with cysts identified from screening for family history of PKD. US (81%) was the most common imaging modality for initial cyst identification. Among the incidentally discovered cyst group, 7.9% (6/76) were found to have PKD compared with 100% (8/8) patients with cysts plus a positive family history of PKD. Multiple cysts or bilateral cysts were imaging features associated with a significantly higher (P < 0.01, Fisher's Exact Test) incidence of PKD, both for the entire study population (12/14 and 11/14, respectively) and the incidentally discovered cyst group (5/5 and 5/5, respectively). Renal cyst size or complexity was not significantly associated with PKD. 74 patients had a followup renal imaging exam (mean time 36.8 months from initial exam), and an increase in cyst size on the followup study was associated with a higher incidence of PKD (3/5 vs 1/69; P < 0.05). No malignancies were identified in the study population, although one case was found to be a multilocular cystic nephroma on follow up imaging and surgery.

CONCLUSION
Incidentally discovered renal cysts in pediatric patients are associated with a small but nonzero risk of PKD. Among cyst characteristics, bilaterality, multiplicity, and increased size on followup imaging were associated with significant elevation in PKD risk.

CLINICAL RELEVANCE/APPLICATION
Pediatric patients with bilateral, multiple, or enlarging renal cysts should be carefully screened for clinical/family evidence of PKD.

**SSM20-04**

**Open-label, Multicenter, Pharmacokinetic and Safety Study in Children Below 2 Years of Age undergoing a Contrast-enhanced MRI with an Intravenous Injection of a Single Standard Dose of Gadobutrol**


**PURPOSE**

To evaluate the pharmacokinetics (PK) of gadobutrol at the standard dose of 0.1 mmol/kg body weight in plasma of pediatric subjects aged <2 years as a primary objective. Safety, tolerability and efficacy are secondary endpoints.

**METHOD AND MATERIALS**

Subjects <2 years of age (term newborn infants to 23 months of age) with normal renal function, undergoing routine MRI of any body region following administration of 0.1 mmol/kg gadobutrol. Plasma PK was analyzed using a population-based PK approach. Qualitative imaging efficacy variables were assessed by investigators.

**RESULTS**

47 subjects 0.2-23 months of age were enrolled, 44 subjects were evaluated for safety and efficacy, 43 subjects were eligible for PK evaluation including 9 term newborns to <2 months of age. The gadobutrol PK profile in pediatric subjects <2 years, including term newborns, was similar to the PK profile in older children and adults. The most common non-serious AEs unrelated to gadobutrol were cough, nasopharyngitis, rhinitis, pyrexia and vomiting. In one subject, vomiting was reported as a mild AE related to gadobutrol. Serious AEs were unrelated to gadobutrol and were reported in 3/44 subjects (6.8%). The evaluation of gadobutrol-enhanced images provided improved diagnosis, increased confidence in diagnosis, and contributed to subject clinical management.

**CONCLUSION**

The PK of gadobutrol is similar to that observed in adults and children >2 years of age and supports the effectiveness of gadobutrol in this pediatric population <2 years. Body weight dosing of gadobutrol at a standard dose (0.1 mmol/kg) is therefore adequate for the pediatric population <2 years (including term newborns). Gadobutrol has shown a good safety profile and was well tolerated in children below 2 years of age.

**CLINICAL RELEVANCE/APPLICATION**

First clinical study to evaluate PK, safety and tolerability of gadobutrol in pediatric population <2 years of age, including term newborns.

**SSM20-05**

**Safety Profiles of Gadolinium-based Contrast Agents in Pre-Weaning Juvenile Rats Differ according to the Risk of Gadolinium Release**


**PURPOSE**

The need for contrast-enhanced MRI is widely recognized in neonates and infants with immature renal function. The aim of this study was to compare the tolerance of two marketed gadolinium-based contrast agents (GBCAs) of different thermodynamic stabilities in rats with immature renal function.

**METHOD AND MATERIALS**

Firstly, changes in renal function (plasma creatinine and cystatin C levels) and kidney histopathology were identified in juvenile rats (from post-natal day [PND] 4 to PND 30). Subsequently, juvenile rats received 5 intravenous injections (between PND 4 and 18) of gadoteric acid (macrocyclic and ionic GBCA, Dotarem®), gadodiamide (linear and non-ionic GBCA, Omniscan®) or saline. Daily clinical examinations were performed. At sacrifice (PND 25), the Gd concentration was measured in the tissues (plasma, skin, liver, bone, heart). Histopathologic and relaxometry studies were also performed. The study was blinded.

**RESULTS**

Biochemical characterization showed maturation of renal function from PND 21. The histopathology evidenced maturation of the renal structure from PND 11. In the comparative study, gadodiamide induced mortality (4 out of 14 rats from PND 10), heterogeneous hair growth (from PND 8), alopecia (from PND 18) and hyperpigmentation of the dorsal skin. Two gadodiamide-treated rats had severe epidermal and dermal lesions (from PND 21). No abnormal sign was detected following the administration of gadoteric acid or saline. Higher tissue Gd concentrations were found in gadodiamide-treated rats compared to those found in gadoteric acid-treated rats. Relaxometry studies showed dissociation of gadodiamide in the skin and liver, with the
presence of dissociated and soluble Gd3+. The dissociated Gd3+ concentration in plasma was < limit of detection for gadoteric acid and 0.12 ± 0.06 µmol/L in the gadodiamide group, corresponding to 61 ± 32% of the total Gd concentration.

CONCLUSION

Repeated administration of gadoteric acid was well tolerated in juvenile rats with immature renal function. Conversely, gadodiamide induced significant morbi-mortality, skin abnormalities, and more Gd retention (at least in part, in the dissociated and soluble form) in the skin and liver of juvenile rats.

CLINICAL RELEVANCE/APPLICATION

Neonates and infants with immature renal function could be at greater risk from the higher systemic toxicity induced by the linear GBCA gadodiamide vs. the macrocyclic GBCA gadoteric acid.

SSM20-06  Teleradiology through iPad May Positively Affects the Quality of Health Care in a Paediatric Children Hospital

Floriana Zennaro :  Nothing to Disclose, Sergio Demarini :  Nothing to Disclose, Gabriele Cont MD :  Nothing to Disclose, Pierpaolo Guastalla MD :  Nothing to Disclose, Francesca Vittoria :  Nothing to Disclose, Manuel Belgrano (Presenter):  Nothing to Disclose, Luca Odoni MD :  Nothing to Disclose, Valentina dicarlo :  Nothing to Disclose, Daniela Dibello :  Nothing to Disclose, Giuliano Barbo :  Nothing to Disclose, Antonella Steinbock :  Nothing to Disclose, Daniele Grosso PhD :  Nothing to Disclose, Marzia Lazzerini PhD :  Nothing to Disclose

PURPOSE

This was a prospective controlled study with the objective of evaluating the impact of teleradiology using iPad in two different emergency contexts in a tertiary care children hospital: an orthopaedic on-call service, and a newborn intensive care department with complex pathologies and young doctors supported by more senior staff.

METHOD AND MATERIALS

Radiologic examinations were sent anonymously to an iPad using an encrypted system, Aycan OsiriX Pro, to allow remote consultation from specialists on call. Orthopaedics and senior neonatologists received two sets of information subsequently - the written report from the radiologist (Phase I) and the X-ray image through the iPad (Phase II). Their decisions on case management during Phase 1 and Phase 2 were recorded blindly in a database and compared. The primary outcome of the study was any relevant change in decisions on case management. Other outcomes included: time needed for decision-making; technical difficulties; quality of the images and diagnostic confidence using iPad compared to a dedicated PACS (on a Likert scale from 1 to 10).

RESULTS

During the period September 2013 to December 2013, 111 radiological exams were sent with teleradiology using an iPad. In 21 (36%) of neonatology cases and in 16 (38%) of orthopaedic cases the approach on patient treatment was changed by the availability of the X-ray image via the iPad (p=0.01; p< 0.01). Technical difficulties occurred in 15/111 (13.5%) of cases, and were mainly due to a slow down in the internet line. Average time for decision making including time for image transmission was 11.3 minutes (range 3 to 42). There was not a statistically significant difference in quality of images neither in diagnostic confidence using iPad compared to the dedicated PACS.

CONCLUSION

Teleradiology through Aycan OsiriX PRO and iPad should be considered as a mean for providing the X-ray image for remote consultation to orthopaedics and neonatologists on call, for its potential of optimising case-management. Future studies could further explore the impact of teleradiology on cost of health care.

CLINICAL RELEVANCE/APPLICATION

This study supports the use of teleradiology through Aycan OsiriX PRO and iPad for allowing remote consultation to orthopaedics and neonatologist on call, for its potential of optimising case-management.
LEARNING OBJECTIVES

1) Access the results of new research and assess their potential applications to clinical practice. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Practice new techniques. 4) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 5) Apply principles of critical thinking to ideas from experts and peers in the radiologic sciences.

Sub-Events

MSCP51A

Abdominal Masses in Children
Sudha Ayyala Anupindi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the common types of abdominal tumors in children and the practical pathway of imaging. 2) Analyze the common features of these abdominal tumors in a case based format. 3) Discuss the differential diagnosis and therapeutic options for each case.

ABSTRACT

During this session we will be presenting cases of common pediatric abdominal tumors. The following are the learning objectives: At the end of the session the participant will be able to: 1) Identify the common types of abdominal tumors in children and the practical pathway of imaging 2) Analyze the common features of these abdominal tumors in a case based format 3) Discuss the differential diagnosis and therapeutic options for each case.

MSCP51B

Interventional Procedures in Infants and Children
Ricardo Restrepo MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCP51C

Pediatric Bone Marrow Imaging
Kirsten Ecklund MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Apply conventional and advanced MR techniques to design adequate protocols for assessment of pediatric bone marrow disorders. 2) Recognize normal age related variations in bone marrow signal intensity throughout the skeleton. 3) Identify primary and secondary marrow abnormalities that accompany focal and systemic disorders of the musculoskeleton.

RC613

Interactive Game: Pediatric: Oncology

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: S102AB

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

RC613A

Bone Mineral Density Changes in Survivors of Childhood Cancer
Sue Creviston Kaste DO (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Participants will learn risk factors for bone mineral density deficits in patients having been treated for childhood malignancies.
Pediatric Hybrid Imaging (PET/CT, PET/MR) and the Role of the Radiologist

Stephan Dieter Voss MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review the role of hybrid imaging in Pediatric Radiology, with a focus on Oncology. 2) To review strategies for integrating PET/CT, PET/MR and SPECT/CT into both Radiology and Nuclear Medicine workflows. 3) To develop an understanding of hybrid imaging techniques and their role in dose reduction and elimination of unnecessary duplicate scanning.

Secondary Malignancies and Surveillance Imaging

Kieran McHugh (Presenter): Consultant, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) To create an awareness of the radiation burden from radiological examinations in young children with cancer. 2) To identify the risks to children of repeated CT examinations. 3) To question the value of repeated surveillance imaging after treatment completion in children with cancer, as there is little evidence to support it.

Pediatric Series: Minimizing Sedation in Pediatric MRI

Series Courses

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AMA PRA Category 1 Credits™: 3.25
ARRT Category A+ Credits: 3.50
Thu, Dec 4 8:30 AM - 12:00 PM Location: S102D

Participants

Moderator
Donald P. Frush MD: Nothing to Disclose
Moderator
Aliya Qayyum MBBS: Spouse, Employee, Imorgon Medical
Moderator
Rajesh Krishnamurthy MD: Research support, Koninklijke Philips NV Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Highlight techniques for minimizing the need for sedation and intubation in pediatric MRI. 2) Provide abbreviated protocols for common indications in pediatric chest, abdominal, and neuroimaging that can be performed without sedation, or with brief conscious sedation. 3) Provide an overview of state of the art MR techniques for free-breathing acquisition in the pediatric chest, abdomen and pelvis. 4) Share experience with imaging aids that are available to enable unsedated imaging in children.

Minimizing Sedation in Pediatric Neuroimaging

A. James Barkovich MD (Presenter): Research Consultant, General Electric Company

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

There are several keys to minimizing sedation in Pediatric Neuroimaging. Most important are targeting the study to obtaining the specific answer requested by the referring clinician, and obtaining the data as efficiently as possible by using sequences that will answer the question in the shortest time. The second is that the strategy changes depending upon the age of the patient: neonates most often can be scanned without sedation; a relatively short scan can be performed on infants by the 'feed and swaddle' method, and older children (6 years and above) can very frequently be studied without sedation if training and/or movies (to give them focus) are used. For neonates requiring a relatively short scan (is injury present or not), a useful technique is to feed the baby immediately before the procedure and then wrap them in a vacuum bean bag or wrap (swaddle) them in a blanket. Reducing noise by use of ear muffs, insulating the inner bore of the magnet, parallel imaging or ultra-short TE sequences can help, as can retrospective motion correction. Infants can also be scanned using feed and swaddle; it helps to do the scan during their nap time, if possible, and to take them to a quiet room with a parent so that they are asleep when placed in the MRI scanner. Use quiet sequences early in the study, saving the noiser ones for the end. Again, use of parallel imaging or ultra-short TE sequences helps to reduce noise. It is very difficult to image children between ages of 1 and 6 years without sedation. The goal is to scan efficiently, for older children, a training session before the scan to reduce anxiety is useful. Use of a system that allows the child to watch a movie of their own choice is very helpful as well.

Optimized Neuroimaging in Infants Using a Prototype Dedicated16-Channel Neonatal Head Coil

Maura E. Ryan MD: Nothing to Disclose, Jie Deng PhD (Presenter): Nothing to Disclose, Jingyi Xie PhD
PURPOSE

Magnetic resonance imaging (MRI) is highly sensitive for evaluating intracranial pathology in newborns and infants, and can detect abnormalities not evident by ultrasound or computed tomography. However, MRI in this population can be technically difficult due to small size, motion and limited parenchymal contrast. Many infants are currently imaged with larger than necessary commercially available head coils or smaller coils designed for other uses. A dedicated phase array head coil with a smaller field of view (FOV) would allow for improved image quality through greater signal to noise, increased field uniformity, and shorter imaging times.

METHOD AND MATERIALS

A prototype 16 channel phased-array head coil (Siemens AG, Healthcare sector, Erlangen, Germany) was designed for neonatal and infant neuroimaging. Three of the posterior arrays overlapped with the standard spine array and could be used for cervical spine imaging as well. Imaging was performed on either a 1.5T or 3T (MAGNETOM Aera/Skyra, Siemens AG, Healthcare Sector, Erlangen, Germany) MRI scanner following the clinically diagnostic exam with standard commercially available head coils. Imaging parameters, well as subjective assessment of image quality were compared. Phantom measurements of signal to noise ratio (SNR) were also assessed.

RESULTS

30 examinations were performed with the prototype neonatal head coil. Patients ranged in age from 4 days to 6 months. Clinical indications included suspected structural abnormality (21), mass (5) seizure (2) and infection (1). Significant pathology was identified in approximately half of the studies (7/13 brain; 6/8 orbit/face/IAC; 3/9 spine). All pathology evident on comparable sequences on the commercial head coil was also detectable on the research coil. Some findings and anatomic evaluation were qualitatively better appreciated on research coil images (figure). The smaller FOV and higher SNR enabled higher resolution imaging without increasing imaging time.

CONCLUSION

In comparison to commercially available standard head or small part coils, the use of a dedicated neonatal head coil enables small FOV imaging with better SNR to improve diagnostic quality and decrease imaging time in infant patients.

CLINICAL RELEVANCE/APPLICATION

Neuroimaging in infants is technically difficult and the use of a dedicated neonatal head coil can improve diagnostic confidence.

Efficacy of Ultrasonic Elastography in Detecting Active Myositis in Children. Can It Replace MRI?

Netanel Berko MD (Presenter): Nothing to Disclose, Arielle Hay MD: Nothing to Disclose, Yonit Sterba MD: Nothing to Disclose, Dawn Wahezi MD, MS: Nothing to Disclose, Hillel Cohen PhD, MPH: Nothing to Disclose, Terry L. Levin MD: Nothing to Disclose

PURPOSE

To compare strain ultrasound elastography with magnetic resonance imaging (MRI) of the quadriceps muscles for the detection of active myositis in children with inflammatory myositis.

METHOD AND MATERIALS

Multisequence noncontrast MRI of the quadriceps muscles was compared to grey scale and cine ultrasound elastography in eighteen children with inflammatory myositis (15 juvenile dermatomyositis, 2 systemic lupus erythematosus, 1 polymyositis; 15 girls, 3 boys; mean age 10.5 +/- 4.7 years; range 3-19 years). Active myositis was defined on MRI as increased muscle signal on T2-weighted images. Elastography images were evaluated based on a previously published numerical scale of muscle elastography in normal children by two radiologists in consensus, blinded to the patients' MRI findings. Disease duration, serum muscle enzyme levels, and clinical assessment of active versus inactive disease were correlated with imaging findings. Statistical analyses were performed with Fisher's exact test, Spearman's correlation and Mann-Whitney U test as appropriate. P-value < 0.05 indicated statistical significance.

RESULTS

Quadriceps muscle signal was normal on T1-weighted images in all subjects. T2 hyperintensity was present in 9 subjects; of these, elastography was abnormal in two (decreased elasticity) and normal in seven. Twelve patients had normal MRI; elastography was normal in 7 and abnormal in 5 (decreased elasticity). MRI signal hyperintensity and increased muscle echogenicity correlated strongly with clinically active disease (p = 0.035 and p = 0.015, respectively). However, there was no significant correlation between elastography and clinically active disease (p = 0.144), or elastography and MRI (p = 0.64). A non-significant trend toward decreased muscle elasticity in children with longer disease duration was present (p = 0.265).

CONCLUSION

Ultrasound elastography does not accurately detect active myositis in children with inflammatory myositis.

CLINICAL RELEVANCE/APPLICATION
Ultrasound elastography does not replace MRI as the gold standard for detecting active myositis in children.

VSPD51-04  Minimizing Sedation and Radiation in Pediatric Cardiovascular Imaging
Rajesh Krishnamurthy MD (Presenter): Research support, Koninklijke Philips NV Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES
View learning objectives under main course title.

VSPD51-05  Clinical Validation of Using Free Breathing Navigator Echo and Triggered Cardiac Gated Delayed Myocardial Enhancement MR Imaging in Sedated Infants
Ryutaro Matsuura MSc (Presenter): Nothing to Disclose, Yuichi Omura: Nothing to Disclose, Noriaki Akagi BS: Yoshihide Itoh is employee of Siemens Healthcare, Sachiko Goto PhD: Nothing to Disclose, Yoshitomo Azuma PhD: Nothing to Disclose, Shuhei Sato MD, PhD: Nothing to Disclose, Seiji Tahara: Nothing to Disclose

PURPOSE
The delayed myocardial enhancement on MRI is preferred sequence in order to evaluate state of myocardium. However it is not yet performed to a sedated infant with congenital heart disease who has high heart rate and small myocardium since it requires suspended respiration. In this study, we validate a navigator echo triggered sequence that drives the magnetization before cardiac gated inversion recovery-T1 turbo field echo (IR-T1TFE) acquisition in the sedated free breathing pediatric population.

METHOD AND MATERIALS
Cardiac MRI was performed with clinical trial on 24 sedated infants with single ventricle (female: 11, male: 13) ranged in age from 0 to 5 years (mean age: 2.3 years). The Gadoteridol (0.4ml/kg) was injected into them as the contrast media. Imaging (Figure 1) was performed on a 1.5T MR scanner (Phillips Achieva 1.5T). To compare image quality, we calculated the signal to noise ratio (SNR) and contrast to noise ratio (CNR) of two image groups which were obtained by using respiratory triggering with navigator echo and without navigator echo. Wilcoxon signed rank test was performed to compare the significant difference among two image groups at each result. Furthermore, all the images were visually assessed by 2 radiologists who are specialist of cardiac MRI.

RESULTS
The SNR with navigator echo was higher than without navigator echo. The CNR shows no significant difference. The visual assessment scores with navigator echo were consistently better than without navigator echo. The high spatial resolution and low noise for a clinical image is required in order to diagnose, especially in the case of an infant cardiac MRI. In this study, free breathing navigator echo has the advantage which decreases the motion artifact caused by respiration. It brings the improvement of the noise and spatial resolution for a clinical image.

CONCLUSION
Cardiac gated IR-T1FFE sequence for free breathing and using navigator echo triggered respiration allows clinically diagnostic images in sedated infants with improved noise and spatial resolution for a clinical image.

CLINICAL RELEVANCE/APPLICATION
Free breathing navigator echo triggered respiration IR-T1FFE allows diagnostic image in sedated infant with improved good SNR and spatial resolution.

VSPD51-06  Pediatric Thoracic CT Angiography at 70 kVp: A Phantom Study to Investigate Effects on Diagnostic Quality and Patient Radiation Dose
Robert MacDougall MSc (Presenter): Nothing to Disclose, Edward Yungjae Lee MD, MPH: Nothing to Disclose, Patricia Louise Kleinman: Nothing to Disclose

PURPOSE
Feasibility of performing pediatric computed tomography angiography (CTA) at 70 kVP. Low kVP scanning has the potential to allow for reduced patient dose and improved diagnostic quality by virtue of increased contrast enhancement in the vessel. This phantom study aims to systematically evaluate the potential for dose reduction/improved image quality at 70 kVP in pediatric CTA exams for various patient sizes, contrast concentrations and reconstruction algorithms.

METHOD AND MATERIALS
Four anthropomorphic pediatric thoracic phantoms were used (nominal ages: newborn, 1, 5, 10 years). Phantoms contained holes (1 cm diameter) in the center and periphery. Rods with iodine concentrations of 0, 3, 6, 8, 10, 15 mg/cc (HU = 0, 85, 170, 230, 290, 450) were manufactured. Contrast rods were inserted into the phantom center between the lung regions. Each phantom size and concentration was scanned with the clinical
CTA protocol (80 kVp) as well as 70, 100, 120 and 140 kVp (Siemens Biograph mCT). The mA was fixed and adjusted at each kVP to match the CTDI obtained with the 80 kVp clinical protocol. Images were reconstructed using FBP and Iterative Reconstruction (SAFIRE). For each image set, the Contrast to Noise Ratio (CNR) was averaged over five images. Using the method of calculating the Relative Dose Factor (RDF) to optimize CNR with noise constraint (Yu, 2009), the RDF was calculated for each image set.

RESULTS
At conservative levels of noise contraint (< 1.25), there were conditions that resulted in an increased Relative Dose Factor at 70 kVp. The RDF showed dependence on the noise constraint parameter and iodine concentration. The RDF was lower at 70 kVp in all phantom sizes for noise contraints > 1.5.

CONCLUSION
These results challenge conventional wisdom that 'if 80 kVp is good, 70 kVp is better'. It is important to understand the factors that potentially allow for reduced dose at 70 kVp. It is accepted that the noise constraint should be lower for children, as children have smaller organs and less adipose tissue. Under such conditions, 70 kVp scanning provides benefits in a very limited set of clinical situations that depend on patient size and contrast concentration.

CLINICAL RELEVANCE/APPLICATION
We present the specific conditions where 70 kVP is appropriate and warn against scenarios where scanning at 70 kVp is inappropriate. This information is valuable to end-users designing pediatric CTA protocols on scanners with 70 kVp capability.

VSPD51-07 A Prospective Clinical Trial for the Determination of Minimum Radiation Dose in Pediatric Cardiovascular CTA
Aya Kino MD (Presenter): Nothing to Disclose, Jia Wang PhD: Nothing to Disclose, Beverley Mansfield Newman MD, MBBCh: Nothing to Disclose, Frandics Pak-Chan MD, PhD: Nothing to Disclose

PURPOSE
We conduct a prospective clinical trial to evaluate the minimum radiation dose, in terms of equivalent dose (ED) and organ doses (OD), that can produce diagnostic studies in children who underwent cardiac gated (CG) and high-pitch (HP) CTA. We also examine dose savings from image based iterative reconstruction (SAFIRE).

METHOD AND MATERIALS
With IRB approval, pediatric patients referred for thoracic CTA were recruited for a split dose protocol in which a high-dose and a low-dose scans were performed in tandem under a single contrast bolus and breath-hold on a Siemens Flash scanner. The tube current in each scan was adjusted such that the combined CTDI was the same as a routine scan. The percentage of dose split was randomized. Other scan controls, such as CG versus HP mode, tube-voltage, contrast protocol, and scan range were chosen according to the clinical needs. Images were reconstructed at 0.6 mm thickness without SAFIRE and with SAFIRE at all levels (1-5). Two cardiac radiologists categorized these images as diagnostic without SAFIRE, diagnostic with SAFIRE, and non-diagnostic at any SAFIRE level. ED was estimated from patient size and DLP. OD was calculated with an image-based Monte Carlo simulation.

RESULTS
31 patients (age 8 weeks to 7 years old, weight 4 to 74kg) were recruited, producing 62 scans. 48 scans are HP and 14 scans are CG. 44 scans are first-pass contrast bolus studies while 18 scans are delay-phase blood pool studies. For first-pass HP, the average ED is 0.78 mSv, and the OD for lung, bone, liver, and breast are 1.33, 3.13, 1.25, and 1.19 mGy. Dose values for delay-phase HP are similar. For CG, the average ED is 2.41 mSv, and the OD are 7.93, 16.65, 8.53, and 10.2 mGy, respectively. Among diagnostic studies without SAFIRE, the average ED are 0.8-0.9 mSv for first-pass HP, 1.8-2.0 mSv for delay-phase HP and 3.1-4.0 mSv for CG. Nondiagnostic first-pass HP at ED as low as 0.12 mSv are convertable to diagnostic studies with SAFIRE. The highest ED values for unrecoverable studies are 0.55 mSv for delay-phase HP and 0.93 mSv for CG.

CONCLUSION
With currently technology, we can expect a minimum dose of 0.1 to 0.5 mSv for non-gated CTA and 1 mSv for retrospectively gated CTA. In routine practice, actual dose will be higher, depending on patient size and protocol.

CLINICAL RELEVANCE/APPLICATION
Pediatric cardiovascular CTA of the chest should aim for less than 1 mSv for non-gated studies and 3 mSv for gated studies.

VSPD51-08 Minimizing Sedation in Pediatric Abdominal and Musculoskeletal MRI
Shreyas Shreenivas Vasanawala MD, PhD (Presenter): Research collaboration, General Electric Company Stockholder, Morpheus Imaging, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.
**ABSTRACT**

Sedation for pediatric MRI has multiple disadvantages. It confers risk of adverse events for what is an otherwise non-invasive procedure. Additionally, sedation contributes to cost, makes exam scheduling complex, and leads to inefficient imaging utilization. This presentation will present some approaches to reduce the incidence, duration, and depth of sedation for pediatric abdominal and musculoskeletal indications. An overview of child development approaches that reduce the incidence of sedation will be given. Then an approach for compact protocols to minimize duration of sedation will be presented. This will be followed by discussion of methods of managing respiratory motion artifacts without periods of suspended respiration, thus reducing depth of anesthesia.

**Rapid MRI in Pediatric Appendicitis without Contrast or Sedation**

Ryne Didier MD (Presenter): Nothing to Disclose, Bryan Robert Foster MD: Nothing to Disclose, Fergus V. Coakley MD: Nothing to Disclose, Sanjay Krishnaswami MD: Nothing to Disclose, David Spiro MD: Nothing to Disclose, Katharine Lee Hopkins MD: Nothing to Disclose

**PURPOSE**

Historically, limited availability, high cost and motion artifact prevented the use of MRI in the evaluation of acute pediatric appendicitis. However, recent developments have allowed utilization even in non-sedated pediatric patients. Concerns regarding ionizing radiation employed by CT have encouraged use of alternative imaging modalities. The purpose of this study was to evaluate the performance characteristics of MRI without contrast or sedation in the diagnosis of pediatric appendicitis.

**METHOD AND MATERIALS**

Patients <18 years of age with suspected acute appendicitis who underwent clinically indicated US were eligible. No contrast or sedation was administered. After a scout sequence was performed, five sequences were obtained including diffusion weighted imaging (DWI). The duration from the scout sequence to the presence of images in PACS (overestimate of total scan time) was recorded. Previously established diagnostic criteria for acute appendicitis were used to interpret the MR by two blinded reviewers. In the case of discrepancy, the official report issued by a non-binded radiologist was used as a 'tie-breaker.' Results were compared with US results, clinical outcome, operative reports, and surgical pathology results, if available.

**RESULTS**

To date, 36 examinations have been performed, 21 females (58%) and 15 males (42%). Mean age was 11.05 years (3.16-17.9). The examination was tolerated by all participants. The two reviewers demonstrated good agreement (kappa = 0.667). 5 discrepancies were identified; two were resolved by the 'tie-breaker.' The average time from scout to PACS was 27.44 minutes. The protocol yielded 92.9% sensitivity and 90.9% specificity for acute appendicitis with a diagnostic accuracy of 89.7%. Two false positives and one false negative were reported which were concordant with the ultrasound results. Additionally, these three studies produced discrepant results among the two reviewers. All three patients ultimately underwent appendectomy based on clinical data.

**CONCLUSION**

Preliminary implementation of a rapid MRI protocol without contrast or sedation in the evaluation of pediatric appendicitis yielded promising performance characteristics. Although further investigation is warranted, this imaging protocol may provide clinicians with an alternative to CT.

**CLINICAL RELEVANCE/APPLICATION**

Rapid MRI without contrast or sedation is a promising alternative to CT in the evaluation of pediatric appendicitis.

**Utility of a Motion Correction with Radial Blades (BLADE) MRI Sequence over Standard Single Shot Turbo Spin Echo (HASTE) T2 Weighted Imaging in Pediatric Abdominal MRI**

Unni K. Udayasankar MD, FRCR (Presenter): Nothing to Disclose, Chakradhar Reddy Thupili MD: Nothing to Disclose, Jennifer Bullen MSc: Nothing to Disclose, Neil Vachhani MD: Nothing to Disclose, Ellen Park MD, MS: Nothing to Disclose

**PURPOSE**

BLADE MRI sequence has been used to mitigate the motion artifact seen with T2-weighted imaging of the abdomen, and thus could improve the accuracy of abdominal MRI in children. The objective of the study is to evaluate the effectiveness of the BLADE MRI in comparison to the standard HASTE sequence in pediatric abdominal MRI.

**METHOD AND MATERIALS**

Fifty eight consecutive pediatric subjects (M:F 25:33) who underwent MRI study of the abdomen were included in this IRB approved study. Axial T2 BLADE and HASTE T2 FSE sequences were acquired on a 1.5T scanner as part of the protocol. Two radiologists retrospectively evaluated the images for image quality, presence of artifacts (respiratory, bowel motion, and other), sharpness of liver margins, conspicuity and sharpness of the portal triad, and lesion conspicuity. For quantitative comparison, ROIs were placed in similar areas of fat and air to measure signal intensity and noise levels. Wilcoxon signed rank test (qualitative) and paired t test (quantitative) were used for statistical evaluation.
RESULTS

The BLADE images were significantly superior for sharpness of the liver edge, definition of portal triad, and for respiratory motion artifacts on subjective evaluation (p < 0.001 for both readers). 30/58 studies demonstrated intra-abdominal lesions, and BLADE images also demonstrated significantly improved lesion conspicuity (p < 0.001 for both readers). No significant difference was noted for the bowel motion or other artifacts. Quantitative analysis revealed the image intensity and image noise were better with BLADE sequence.

CONCLUSION

In pediatric abdominal MRI, BLADE T2 weighted images demonstrate significantly improved image quality with better definition of the portal triad, liver edge and with reduced respiratory motion artifact when compared with the standard HASTE T2 sequence.

CLINICAL RELEVANCE/APPLICATION

BLADE T2 weighted sequence improves overall image quality of abdominal MRI in children and could function as an alternative to standard single shot fast spin echo sequence.

VSPD51-11 Predictable Index of Vesicoureteral Reflux (VUR) in Children with Urinary Tract Infection (UTI): Usefulness of Intravoxel Incoherent Motion (IVIM) Diffusion Weighted Magnetic Resonance Imaging (DW-MRI)

Jeong Woo Kim MD (Presenter): Nothing to Disclose, Chang Hee Lee MD: Nothing to Disclose, Yang Shin Park MD: Nothing to Disclose, Jong Mee Lee: Nothing to Disclose, Jae Woong Choi MD: Nothing to Disclose, Kyeong Ah Kim MD: Nothing to Disclose, Cheol Min Park MD: Nothing to Disclose

PURPOSE

To compare the index values made by combination of diffusion parameters between the "reflux" kidney and the "non-reflux" kidney and to evaluate the feasibility of IVIM DWI for predicting vesicoureteral reflex in children with urinary tract infection.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and the requirement for informed consent was waived. 83 kidneys from 57 pediatric patients with UTI were included. Kidneys were classified into two groups, "reflux" kidney and "non-reflux" kidney according to the results of voiding cystourethrogram (VCUG). DWI using IVIM was performed with eight b factors. ADC, true diffusion coefficient(D), pseudo-diffusion coefficient(D*), and perfusion fraction(f) in the renal pelvices of both "reflux" and "non-reflux" kidneys were measured five times by a radiologist and compared between the two groups. We used the median value of the measurements as the representative value of the measured parameter. Additionally, four indices(D*/ADC, D*/D, f/ADC and f/D) were developed by combining diffusion parameters and four indices were also calculated. ROC curve analyses were performed for each index to evaluate their diagnostic performance and to identify optimal cut-off value to predict the VUR.

RESULTS

VURs were detected in 21 kidneys on VCUG. Among ADC- and IVIM-derived parameters, ADC and D were significantly lower in the renal pelvis of the "reflux" kidney than that of the "non-reflux" kidney while D* and f were significantly higher. (p = 0.037, 0.020, 0.010, and <0.001, respectively) Four indices(D*/ADC, D*/D, f/ADC, and f/D) were all significantly higher in the renal pelvis of both "reflux" and "non-reflux" kidneys while D and f were significantly lower in the renal pelvis of the "reflux" kidney than that of the "non-reflux" kidney. (p = 0.022, 0.008, <0.001, and <0.001, respectively) In ROC curve analysis, f/D showed the highest AUC (Az = 0.813) with optimal cut-off value of 7.33 and corresponding sensitivity and specificity of 85.7 and 64.5%, respectively.

CONCLUSION

Perfusion fraction(f) was significantly higher in the renal pelvis of the "reflux" kidney than that of the "non-reflux" kidney. Our new index, f/D could detect VUR with relatively high sensitivity. In the future, IVIM DWI which is both radiation and contrast media-free, can be used for detecting VUR in children with UTI and further replace VCUG.

CLINICAL RELEVANCE/APPLICATION

Index of VUR in IVIM DW-MRI which is both radiation and contrast media-free can be easily calculated and may be used prior to VCUG study.

VSPD51-12 Reliability of Contrast-enhanced Voiding Urosonography with a Second Generation Ultrasound Contrast-agent in the Diagnosis and Grading of Vesicoureteral Reflux

Frederica Papadopoulou MD (Presenter): Nothing to Disclose, Aikaterini Ntoulia MD, PhD: Nothing to Disclose, J. Christopher Edgar PhD: Nothing to Disclose, Kassa Darge MD, PhD: Nothing to Disclose

PURPOSE

The diagnostic accuracy of contrast-enhanced voiding urosonography (ce-VUS) in the diagnosis and grading of vesicoureteral reflux (VUR) is high compared to voiding cystourethrogram. However, its reliability has not been yet adequately evaluated. The purpose of this study is to assess the reliability of ce-VUS in VUR detection and grading by estimating the inter- and intra-observer agreement of two pediatric radiologists.

METHOD AND MATERIALS

Two hundred ten children (86 boys/124 girls, mean-age 2.7y) with 421 pelvi-ureteral-units underwent ce-VUS examination with a second-generation contrast-agent to assess possible (180) or follow-up known (30) VUR. The video-clips of all ce-VUS examinations were twice independently assessed by two pediatric radiologists 4-6 weeks apart. The inter- and intra-observer agreement was estimated by kappa statistic.
weeks apart. The inter- and intra-observer agreement was estimated by kappa statistic.

RESULTS

The inter- and intra-observer agreement of both radiologists regarding the presence or grading of VUR was excellent (κ>0.94). There were only two disagreements regarding the presence of VUR (grade I and II false-negative and false-positive respectively). There were 5 cases of disagreement in VUR grading: three cases of VUR grade II-III and two cases grade III-IV. VUR was detected in 123 (29%) pelvi-ureteral-units of 87 (41.4%) children and it was more common in completely duplicated ureters (6/7) than in single ones (p=0.03). The rate of VUR was independent of sex, age and presence or side of hydronephrosis (p>0.05).

CONCLUSION

The reliability of ce-VUS with a second generation ultrasound contrast-agent in VUR detection and grading is high. Ce-VUS could be used as a radiation-free alternative.

CLINICAL RELEVANCE/APPLICATION

To demonstrate the reliability of ce-VUS for vesicoureteral reflux detection in children

VSPD51-13

Comparative Assessment of New Generation CT Scanners for Pediatric Applications

Whal Lee MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSPD51-14

Impact of Iterative Reconstruction and Low Dose on Low Contrast Detectability in Pediatric Patients in CT

Usman Mahmood MS (Presenter): Nothing to Disclose, Yusuf Emre Erdi DSc: Nothing to Disclose

PURPOSE

To determine low contrast detectability (LCD) in the pediatric patient while maintaining the noise magnitude and texture.

METHOD AND MATERIALS

A CIRS liver phantom with three rows of 7 spherical targets, ranging from 10 mm to 2.5 mm, that are 5, 10, and 20 HU below the liver equivalent background was used to assess low contrast detectability. A Gammex 464 CT accreditation phantom was used to calculate CNR. The minimum observable spherical target was detected under appropriate viewing conditions. CNR was calculated according to the method described in the ACR CT phantom scanning instructions. The phantoms were scanned with the current pediatric CT protocol (80 mA, 10% iterative reconstruction). In order to maintain an equivalent level of noise in the reduced dose protocol (45 mA, 40% iterative reconstruction), a decrease in mA was accompanied by an increase in iterative reconstruction. Multiple levels of mA and iterative reconstruction between the current protocol and the reduced protocol have also been investigated.

RESULTS

A minimum spherical target diameter of 6.3 mm was detectable on reconstructed images acquired with the current CT protocol. With the reduced dose protocols, a minimum spherical target diameter of 9.5 mm was detectable on the reconstructed images. CNR was 0.593 ± 0.006 for all protocols. For an equivalent noise magnitude and texture as the current CT protocol, CTDI was found to decrease by up to 43%.

CONCLUSION

Optimization of CT protocols, while maintaining an equivalent noise magnitude and texture of CT images, leads to a loss of LCD. Furthermore, trying to optimize protocols based on the CT accreditation phantom alone may not be enough for optimum LCD.

CLINICAL RELEVANCE/APPLICATION

Dose reduction achieved with a decreased mA and increased application of iterative reconstruction may result in a loss of LCD.

VSPD51-15

Radiation Dose Reduction in Pediatric Body CT Using a Novel Image-based Denoising Technique

Lifeng Yu PhD (Presenter): Nothing to Disclose, Joel Garland Fletcher MD: Grant, Siemens AG, Maria Shiuang: Nothing to Disclose, Kristen Barry Thomas MD: Nothing to Disclose, Jane Sexton Matsumoto MD: Nothing to Disclose, Shannon Nicole Zingula MD: Nothing to Disclose, Cynthia H. McCollough PhD: Research Grant, Siemens AG

PURPOSE
To evaluate the radiation dose reduction potential of a novel image-based denoising technique in pediatric body CT exams and compare it with an iterative reconstruction (IR) method.

**METHOD AND MATERIALS**

Fifty pediatric CT exams (25 chest, 25 abdominopelvic (AP)) acquired using a weight-based low-kV protocol were included in this retrospective study. For each case, we used a validated noise-insertion tool developed in our lab to simulate half-dose images. A novel denoising technique, adaptive non-local means (aNLM) filter, which was developed in our institution, was applied to the half-dose images. Three pediatric radiologists evaluated 4 sets of images for each of the 50 cases: (1) full dose + filtered-backprojection (FBP), (2) half dose + FBP, (3) half dose + IR, and (4) half dose + aNLM, in a randomized and blinded fashion. The overall image quality and the diagnostic confidence for each organ (chest: lung and mediastinum; AP: liver, kidney, and small bowel) were rated using a five point scale. For each case, each reader ranked dose/reconstruction method preference using a side by side comparison. Image sharpness for AP exams was rated.

**RESULTS**

The original CTDIvol was 5.3±2.1 mGy for AP exams and 2.4±1.1 mGy for chest exams. At half dose, both IR and aNLM improve the overall image quality over the FBP for both chest and AP exams (p<0.01). In AP, there was no significant difference between aNLM denoised images at half dose and the original full dose images (3.61±1.01 vs. 3.55±0.86, p=0.54), and aNLM performed better than IR (3.61±1.01 vs. 3.33±0.89, p<0.01).

In chest, there was no significant difference between IR at half dose and the original full dose images (4.12±0.61 vs. 4.16±0.58, p=0.66), but IR performed better than aNLM (4.12±0.61 vs. 3.68±0.69, p<0.01).

The organ-specific diagnostic confidence and preference order were consistent with the overall image quality evaluation.

**CONCLUSION**

The use of a novel image-based denoising technique resulted in a 50% radiation dose reduction in pediatric AP CT while maintaining the same diagnostic quality as in the full dose FBP images. IR image quality was worse than aNLM in the abdomen, but better in the chest.

**CLINICAL RELEVANCE/APPLICATION**

A novel denoising technique, which can be implemented across all scanner platform, can preserve diagnostic image quality despite a 50% radiation dose reduction in pediatric AP CT.
Common pediatric spine and spinal cord diseases will be discussed in a case-based format.

**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.

**Case-based Review of Pediatric Radiology (An Interactive Session)**

Multisession Courses

**MSCP52**

APA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 10:30 AM - 12:00 PM  Location: S406A

**Participants**

Director
Sudha Ayyala Anupindi MD Nothing to Disclose

**LEARNING OBJECTIVES**

1) Access the results of new research and assess their potential applications to clinical practice. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Practice new techniques. 4) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 5) Apply principles of critical thinking to ideas from experts and peers in the radiologic sciences.

**Sub-Events**

**MSCP52A**

Congenital and Acquired Thoracic Vascular Disorders in Children

Edward Yungjae Lee MD, MPH (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss practical imaging techniques for evaluating congenital and acquired thoracic vascular disorders in children. 2) Review helpful clinical aspects and imaging findings of pediatric thoracic vascular diseases. 3) Learn characteristic imaging findings to narrow the differential diagnoses of various pediatric thoracic vascular disorders.

**MSCP52B**

Pediatric Abdominal Infectious and Inflammatory Disorders

Thaddeus W. Herliczek MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the imaging appearance of conditions causing pediatric right lower quadrant pain. 2) Recognize the characteristic magnetic resonance imaging features of pediatric appendicitis. 3) Understand the imaging appearance, complications and etiologies of pediatric pancreatitis. 4) Describe the imaging features of pediatric infectious hepatobiliary disease.

**MSCP52C**

Pediatric Musculoskeletal Neoplasms

Jung-Eun Cheon MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the imaging approach to pediatric musculoskeletal neoplasms. 2) Discuss the role of different imaging modalities in the evaluation of pediatric musculoskeletal neoplasms. 3) Identify the common location and characteristic imaging findings of pediatric musculoskeletal neoplasms.
Frequency, location, and imaging characteristics are important diagnostic clues in pediatric bone and soft-tissue tumors, either benign or malignant. MR imaging has evolved as the most important diagnostic tool for local staging of primary bone and soft tissue tumors, for monitoring response to chemotherapy, and for detecting postoperative tumor recurrence. A detailed discussion of all bone and soft tissue tumors is well beyond the scope of this review; instead, we highlight the initial evaluation and staging of primary pediatric musculoskeletal neoplasms.

**SSQ16**

**ISP: Pediatrics (Chest)**

*Scientific Papers*

- **PD MR CT CH**

AMA PRA Category 1 Credits™: 1.50  
ARRT Category A+ Credits: 1.50

*Thu, Dec 4 10:30 AM - 12:00 PM  Location: S102C*

**Participants**

**Moderator**  
Robert Joseph Fleck MD : Nothing to Disclose  
Moderator  
Scott K. Nagle MD, PhD : Stockholder, General Electric Company Research Consultant, Vertex Pharmaceuticals Incorporated

**Sub-Events**

**SSQ16-01**  
**Pediatrics Keynote Speaker: Imaging of Cystic Fibrosis—State of the Art**  
Scott K. Nagle MD, PhD (Presenter): Stockholder, General Electric Company Research Consultant, Vertex Pharmaceuticals Incorporated

**SSQ16-02**  
**Morphological and Functional MR Imaging of the Lung in CF Patients with Exacerbations**  
Giovanni Morana MD (Presenter): Nothing to Disclose  
Silvia Bertolo: Nothing to Disclose  
Federica De Leo: Nothing to Disclose  
Mirco Ros MD: Nothing to Disclose  
Francesca Lucca: Nothing to Disclose  
Pierluigi Ciet MD: Nothing to Disclose  
Valentina Tavano: Nothing to Disclose

**PURPOSE**

Analysis of the information obtained in Patients with cystic fibrosis (CF) evaluated during exacerbation with MR, both with morphological and functional (DWI) imaging.

**METHOD AND MATERIALS**

50 patients with CF were enrolled: 26 with pulmonary exacerbations. Another group of 24 patients, matched for age and pulmonary function but without pulmonary exacerbations, to obtain comparative data. Each patient performed two RM examinations: pre and post antibiotic treatment for the case group, and before and after 2 weeks for the control group. MR examinations were performed on a 1.5-T Siemens Avanto 1. Breath hold HASTE sequences in the axial and in the coronal plane 2. DP Propeller (BLADE) sequences in the axial and in the coronal orientations, with navigator 3. EPI sequence with respiratory triggering for diffusion imaging with multiple b-values (0, 10, 20, 30, 50, 70, 100, 150, 200, 400, 800 sec/ mm²) BLADE images were scored with a Brody Score adapted to MRI. Qualitative analysis of DWI images were conducted on high values of b-value (b500 and b800). The areas of high signal intensity (hot spots) were compared with the signal produced by the spinal cord, used as a reference. Qualitative analysis of DWI images were conducted with Mathlab, with calculation of IVIM parameters. Statistical analysis was conducted using the following software: SPSS 13.0, Matlab2010 and Microsoft Excel 14.0.

**RESULTS**

The independent samples t-test (p < 0.05) shows a statistically significant difference between the averages of BRODY score between the exacerbation group and the stable group both at the first and second examination. Instead for the DWI score, the independent samples t-test (p < 0.05) show a statistically significant difference between the averages of DWI score between the exacerbation group and the stable group at the first examination but not at the second examination. The paired t-test (p < 0.05) show a statistically significant difference between the averages of IVIM coefficients between the first and second examination in the “exacerbation” group while not showing a statistically significant difference in the “stable” group.

**CONCLUSION**

MR is a feasible tool to follow CF patients with exacerbation

**CLINICAL RELEVANCE/APPLICATION**

MR is able to distinguish reversible lung changes from irreversible with DWI. It can enhance the management of CF patients with exacerbation.
SSQ16-03  
Lung-MRI in Children with Cystic Fibrosis (CF): Evaluation of Two Diagnostic-scores Concerning Interobserver Reliability and Valuation of Clinical Impact

Matthias Teufel: Nothing to Disclose, Katharina Schmidt: Nothing to Disclose, Ines Ketelsen: Nothing to Disclose, Ute Graepel-Mainka: Nothing to Disclose, Joachim Riethmüller MD: Nothing to Disclose, Juergen F. Schaefer MD (Presenter): Nothing to Disclose, Ilias Tsiflikas MD: Nothing to Disclose, Konstantin Nikolaou MD: Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG

PURPOSE
The aim of this retrospective analysis was the evaluation of the Helbich-BallaScore (HBS) - already reviewed in comparison to CT - and a self-developed MRI-Score (MRS) in reference to the interobserver reliability and the valuation of the clinical impact.

METHOD AND MATERIALS
A standardized lung MRI at 1.5 T and a pulmonary function test were performed in 51 patients (mean 11.4 y, SD 3.1 y) on the same day. The MRI was independently and blinded scored by three radiologists with different experience (1 highest, 3 lowest) using the non modified HBS system. Additionally the examinations were analyzed by the same readers with the MRS system that was adapted from the Crispin Norman Score (CNS). In difference to the CNS the MRS points were given on the basis of lung lobes, and the category "centrilobular nodules" was added. To evaluate interobserver reliability Pearson's correlation coefficient (R) was calculated. Scores were also correlated with forced expiratory volume in one second (FEV1). The possible prognostic value of the scores was estimated using ROC analysis for significant decrease of FEV1 (> 3%/year) over period of 2 years.

RESULTS
Both scores were reproducible (R = 0.85 to 0.88 for HBS and 0.85 to 0.90 for MRS). The scores correlated significantly with FEV1 (HBS: R= - 0.50 to -0.58 and MRS: -0.51 to -0.63, P<0.001). The highest value in both scores was achieved by reader 1. With a baseline FEV1 of 50% to 100% 7/30 patients showed a decrease >3%/year. In this group the mean AUC for centrilobular nodules and bronchiectases of the MRS was 0.96 and 0.87, and 0.84 for bronchiectases of the HBS.

CONCLUSION
The results indicate that both scores are reproducible and clinical useful. The MRS may have the higher prognostic performance.

CLINICAL RELEVANCE/APPLICATION
Application on thoracic/pulmonal MRI in patient suffering from cystic fibrosis for follow up and therapy monitoring. Detection and evaluation of the severity of pulmonal findings in cystic fibrosis and other pulmonary diseases.

SSQ16-04  
Humidifier Disinfectant-associated Children’s Interstitial Lung Disease: CT Features, Histopathologic Correlation and Comparison between Survivor and Non-survivor

Hee Mang Yoon MD (Presenter): Nothing to Disclose, Eun Lee: Nothing to Disclose, Jin Seong Lee MD: Nothing to Disclose, Kyung-Hyun Do MD: Nothing to Disclose, Se Jin Jang: Nothing to Disclose, Soo-Jong Hong: Nothing to Disclose, Young Ah Cho: Nothing to Disclose

PURPOSE
From 2006, epidemics of a fatal lung injury by inhalation of humidifier disinfectant (DI) in children were observed. The aim of this study was to report radiologic findings with pathologic correlation of the disease and to compare the CT findings between survivors and non-survivors.

METHOD AND MATERIALS
Forty seven children were hospitalized with acute lung injury associated with DI inhalation (mean age=27.4±12.4 months) and divided into two groups: survivors (n=25) and non-survivors (n=22). CT findings including the presence and extent of consolidation and centrilobular ground-glass opacity (cGGO) were evaluated for hazard ratio (HR) in each group. Histopathologic correlation was performed in 25 patients.

RESULTS
CT scans showed the characteristic features according to the stage of disease progression. The early stage was characterized by patchy consolidation in bilateral basal lungs. In advanced stage, it evolved into cGGO involving the entire lung. In resolving stage, cGGO was resolved and slowly changed into the faint centrilobular nodules. Pathologic review revealed, in early stage, predominant denuded bronchiolar epithelium with bronchocentric fibroblast proliferation and intra-alveolar exudate. In advanced state, bronchial damage with fibroblastic proliferation was more profound. CT showing resolving stage does not exist in non-survivors. The time interval between the presentation of initial symptom and CT scan showing early stage was significantly shorter in non-survivors than in survivors (9days and 14days respectively, p=0.021). Consolidation over 30% of lung volume was the predictor of poor prognosis (p=0.014, HR=2.932) while cGGO over 30% of the lung was that of good prognosis (p<0.001, HR=0.124).

CONCLUSION
The distinctive CT feature was chronological changes from early consolidation to cGGO. In survivors, lesions eventually changed into the faint centrilobular nodules. It was correlated with histopathology. Wide area of consolidation in early stage results in the poor prognosis of disease.
This series of patients showed the inhalation injury caused by one kind of chemicals. Radiological understanding plays a pivotal role in management and prediction of outcome in chemical pneumonitis.

**Pulmonary MRI in the NICU: Initial Experience Imaging BPD and CDH with a Small-Footprint Scanner**

Laura Walkup PhD (Presenter): Nothing to Disclose, Jean A. Tkach PhD: Nothing to Disclose, Robert Thomen: Nothing to Disclose, Stephanie Merhar: Nothing to Disclose, Raouf S. Amin MD: Nothing to Disclose, Paul Kingma: Nothing to Disclose, Jason C. Woods PhD: Nothing to Disclose

**PURPOSE**

Neonatal pulmonary imaging poses difficulties because of small size, respiratory motion, and the delicate nature of moving infants to and from the NICU. While CT is the current clinical gold standard for diagnostic pulmonary imaging, it is not routine for the longitudinal evaluation of most neonatal pulmonary abnormalities within the NICU. Our goal was to use our institution's one-of-a-kind NICU MRI scanner to investigate the feasibility of performing pulmonary MRI in conditions that are present in our NICU (bronchopulmonary dysplasia [BPD] and congenital diaphragmatic hernia [CDH]), since they are poorly understood both physiologically and radiologically.

**METHOD AND MATERIALS**

Pulmonary MRI was performed on a small-footprint 1.5T MRI scanner developed for orthopedic use (marketed as GE Optima MR430s) that was modified and adapted for use in our institution's NICU. Free-breathing FrFSE (TE/TR 3000/11.8, ETL=5 or 11) and FGRE (TE/TR 1.9/6.8, 7-10° FA) images were obtained for a small group of non-sedated NICU patients (1 BPD, 2 CDH, 3 control). Images were evaluated qualitatively and a quantitative assessment of approximate lung density obtained by normalizing the lung signal to nearby soft tissues.

**RESULTS**

Both FrFSE and GRE images were generally of high (diagnostic) quality and demonstrated very few motion artifacts for quietly-breathing babies, with parenchymal SNR of around 5. Pulmonary abnormalities were visually apparent in many cases: pleural effusion, multiple local areas of atelectasis, alveolar simplification, and parenchymal opacities were all observed, with quantitative results that matched visual inspection. MR images for one CDH patient revealed regions of air-trapping undetected in chest x-ray.

**CONCLUSION**

We have demonstrated that free-breathing pulmonary MRI in the NICU is feasible and can produce diagnostic-quality images that may be used in detection and longitudinal assessment of various pulmonary abnormalities, including BPD and CDH. The MR images obtained were of diagnostic-quality, compared well to CT in the opinion of our clinical radiologist, and did not require sedation.

**CLINICAL RELEVANCE/APPLICATION**

Pulmonary MRI in the NICU provides diagnostic-quality images for the assessment of neonatal pathologies and will add to our knowledge of normal and aberrant lung development.

**MR Lung Perfusion in 2-year old Children After Congenital Diaphragmatic Hernia — Comparison of Children after ECMO-therapy and Children without ECMO-requirement**

Meike Weidner (Presenter): Nothing to Disclose, Frank G. Zoellner: Nothing to Disclose, Claudia Hagelstein MD: Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Katrin Zahn: Nothing to Disclose, Thomas Schaible: Nothing to Disclose, Wolfgang Neff MD, PhD: Nothing to Disclose

**PURPOSE**

In severe cases of congenital diaphragmatic hernia (CDH), extracorporeal membrane oxygenation (ECMO) therapy is required. Later on, lung morbidity defines development. Lung function measurement is therefore crucial but limited in 2-year old children. With MRI, lung perfusion can be measured and is known to be reduced on the ipsilateral side after CDH. In this study we investigated if 2-year old children after ECMO-therapy show reduced MR-perfusion values as a sign of more severe lung hypoplasia in comparison to children without ECMO-requirement.

**METHOD AND MATERIALS**

DCE-MRI was performed in 38 children (24.3±1.8 month; 15 with ECMO-therapy; 23 without ECMO-therapy) after CDH repair using a 3D TWIST sequence (temporal resolution 1.5 sec; voxel size: 2x2x2 mmCubed). 0.05 mmol/kg body weight of contrast agent (Dotarem, Guerbet, France) was administered. Pulmonary blood flow (PBF), pulmonary blood volume (PBV) and mean transit time (MTT) were calculated for both lung sides by placing 6 cylindrical regions of interest (ROI) in the apical, middle and basal lung respectively. Additionally, the ratio of contralateral to ipsilateral lung was calculated for all parameters.

**RESULTS**

15 of 38 children (39%) required ECMO-therapy as neonates. In all children, PBF and PBV were significantly reduced on the ipsilateral side in comparison to the contralateral side (p always
CONCLUSION

2-year old children after ECMO-requirement as neonates show significantly reduced MR perfusion values on the ipsilateral lung in comparison to children without ECMO-requirement. Perfusion values of the contralateral lung are not significantly different. MR perfusion measurements therefore reflect the severity of lung hypoplasia and are helpful in follow-up investigations.

CLINICAL RELEVANCE/APPLICATION

MR-perfusion values reflect the severity of lung hypoplasia after CDH as children after ECMO-therapy show more reduced values. Therefore, MR-perfusion measurements are advisable for follow-up.

SSQ16-07

Validation of a Novel Parameter for the Evaluation of Pectus Excavatum: The Correction Index

Javier Vallejos MD, MBA (Presenter): Nothing to Disclose, Maria Eugenia Maccarone MD: Nothing to Disclose, Carlos Capunay MD: Nothing to Disclose, Marcelo Martinez Ferro: Nothing to Disclose, Patricia M. Carrascosa MD: Research Consultant, General Electric Company

PURPOSE

To validate the new correction index (CI) to determine severity in patients with pectus excavatum and discriminate from normal patients.

METHOD AND MATERIALS

Retrospective analysis of prospectively collected chest computed tomographic data in PE (N=87) and controls (N=24). We calculated HI in a standard fashion. For the CI, we drew a horizontal line across the anterior spine and measured two distances: the minimum distance between the posterior sternum and the anterior spine (D1) and the maximum distance between the line placed on the anterior spine and, the inner margin of the most anterior portion of the chest (D2). The difference between these two lines (D1 and D2) is the amount of defect the patient has in their chest. KCI formula was as follows: D2-D1/D2*100.

RESULTS

The mean age did not vary between both groups (19.5±9.3 years for PE and 22±2.9 for controls, p=0.92). In the table, we illustrate the HI and CI values from our study and St. Peters et al. In our study, 10/87 (11.4%) patients with PE had overlapped with controls (area under the ROC curve 0.48, p=0.67) compared to 47% in St. Peters et al. Using the CI, only 2/87 (2.3%) patients overlapped (area under ROC curve 0.99, p<0.001), while no overlap was reported.

CONCLUSION

The use of CI resulted in less overlap than with HI in both studies; however, overlap between PE and controls with HI depended on the baseline severity of the PE population.

CLINICAL RELEVANCE/APPLICATION

The Haller index (HI) is the most commonly used parameter to determine surgical candidacy in patients with pectus excavatum (PE). However, the use of the HI cannot discriminate between PE and normal patients. This new correction index expresses the percentage of thoracic depression represented by the sternal defect, demonstrating optimum discrimination between PE and controls.

SSQ16-08

High Resolution, Contrast Enhanced MR Angiography as the Sole Test for Evaluation of Broncho-Vascular Anatomy in Pediatric Patients with Suspected Vascular Rings

Elena Karavaeva MD (Presenter): Nothing to Disclose, M. Ines Boechat MD: Nothing to Disclose, Simon Gabriel MD: Nothing to Disclose, J. Paul Finn MD: Research Grant, Siemens AG Research Grant, Bracco Group

PURPOSE

to assess the feasibility of high resolution, 3D contrast enhanced MR Angiography (CEMRA) as a single test for complete evaluation of detailed vascular and proximal 3-dimensional airway anatomy in pediatric patients with suspected vascular rings.

METHOD AND MATERIALS

Forty-two consecutive pediatric patients (25 male, 17 female; mean age, 6.14 +/- 4.07 years, range 1m to 13 y) with a clinical suspicion of vascular rings underwent multiphase, high spatial resolution CEMRA at 3.0T (31 patients) or 1.5T (15 patients) with gadolinium-based contrast medium (Multihance, Bracco Diagnostics, N=38, 0.2 mmol /kg, or Ablavar, Lantheus Medical, N=3, 0.06 mmol /kg). Using a standardized scoring system 2 independent, board certified radiologists scored the studies for image quality, artifacts, the visibility of upper airways that were divided into 5 segments: trachea, right main stem bronchus, left main stem bronchus, right upper lobe bronchus and bronchus intermedius. Additionally, all studies were evaluated for the presence of pathology, including vascular rings and trachea-bronchial compression, by the same two radiologists and a third independent board certified radiologist. Correlation with chest X-ray findings was available in all patients and with chest CT in 12 patients.

RESULTS

All scans were scored as highly diagnostic with good or excellent image quality. Visualization of the trachea and bronchi was assessed as confident and very confident, the interobserver agreement was considered as ‘good’ and ‘excellent’ (Cohen’s kappa ranged from 0.607 to 0.846 depending on scored segment). A total of 10 vascular rings with tracheobronchial compression were detected with excellent interobserver agreement (Fleiss’ kappa = 1). The mean difference between MR and CT measurements of trachea diameter at 3 different levels was 0.45 +/- 0.3 mm.
CONCLUSION

High resolution CE MRA allowed for confident assessment of both vascular anatomy and relevant 3-dimensional trachea-bronchial anatomy in pediatric patients with suspected vascular rings. The complementary 3-D visualization of vascular and airway anatomy with CEMRA may make supplemental CT imaging unnecessary in appropriate patient groups.

CLINICAL RELEVANCE/APPLICATION

High resolution CEMRA can evaluate 3D vascular anatomy and relevant 3D airway anatomy in children suspected of tracheobronchial compression, obviating the need for CT scanning and radiation exposure.

Is It Worth Improving Temporal Resolution (TR) in Paediatric Chest CT?

**PURPOSE**

To evaluate the influence of optimized temporal resolution (TR) in pediatric standard chest CT imaging.

**METHOD AND MATERIALS**

93 consecutive children less than 4 years of age (mean age: 1 yr, mean weight: 7.73 kg) underwent a chest CT angiographic examination for non-cardiac indications on a dual-source CT system. No sedation was performed and no β-blocker used. The examinations were obtained with a non-ECG-gated dual-source, single-energy mode using the following parameters: collimation: 64x2x0.6 mm; rotation time: 0.28 s; 70 kVp and 80 mAs; pitch: 2.0. From each dataset, two series of images were systematically reconstructed on a prototype workstation: images with a TR of 140 ms (i.e., standard TR) (Group 1) and images with a TR of 75 ms (i.e., optimized TR) (Group 2). Using a 5-point scale, two radiologists independently analyzed the detection and sharpness of proximal and mid segments of the right (RCA) and left (LCA) coronary arteries (total number of coronary segments examined: n= 651). These anatomical structures, highly sensitive to motion artifacts in otherwise uncooperative patients, were chosen to analyze the impact of an optimized TR.

**RESULTS**

Interobserver agreement for coronary artery analyzability was excellent (Group 1: kappa=0.86 [95% CI: 0.82-0.89]) (Group 2: kappa=0.86 [95% CI: 0.83-0.90]). The mean rate of detection and grade of analyzability of all coronary segments were significantly higher in Group 2 than in Group 1 (p<0.001). The rate of detection of the proximal RCA (26/93; 28% versus 18/93; 19.35%; p=0.0114) and left main (LM) artery (60/93; 64.52% versus 54/93 ;58,06% p=0,0339) were significantly higher in Group 2 than in Group 1. Group 2 images provided the best image quality for 64.52% of LM (60/93) and 35.48% of proximal RCA (33/93) whereas Group 1 images were found to be the best reconstruction for only 5.38% of LM (5/93) and 1.08% (1/93) proximal RCA.

**CONCLUSION**

Optimized TR improves image quality in standard paediatric chest CT, still perfectible at 75 ms.

CLINICAL RELEVANCE/APPLICATION

Optimization of TR improves image quality of standard chest examinations in children.
As there is no generic information on broad demographics and contemporary dose estimates for pediatric CT, including gender and age, our aim was to investigate this using the ACR CT Dose Index Registry (DIR) as a resource.

**METHOD AND MATERIALS**

DIR data for 30 months (7/11-12/13) were extracted for 3 common CT scans: head without contrast (head), chest with contrast (chest), abdomen/pelvis with contrast (AP) by age (>0-<3, 3-<7, 7-<11, 11-<15, 15-18). Dose parameters of CTDI<sub>vol</sub> (16 cm head, 32 cm body), dose-length product, and size-specific dose estimate (SSDE, mGy) were determined. Gender, geographic and practice (e.g., community, pediatric specialized), and entry into DIR data were gathered.

**RESULTS**

Of 2,729,170 head, chest, and AP scans for all ages, 6% (161,864) of studies were in children: 8% of head, 5% of AP, and 2% of chest scans. 72% of AP, 63% of chest, and 56% of brain scans were performed on patients 11-18 years old, and the 15-18 group had the highest frequency (35% head, 43% chest, 48% AP) for all exams. Head CT represented the highest number of scans for all ages. There was a greater frequency of exams in males (54-61%) for all age groups and scan types, except for AP in 11-<15 (48%) and 15-18 (39%). Mean SSDE ranged from 8.8-19.0 for AP and 6.0-19.8 for chest scans, increasing with each age group. The AP SSDE was higher than the chest SSDE for every age group except for the 15-18 group. SSDE was higher than CTDI<sub>vol</sub> for body CT at all ages. Pediatric contributions to the DIR increased 353% from 2011 to 2012, and 65% from 2012 to 2013. Of note, 52% of scans were from community hospitals, 29% from children's hospitals, and 18% from academic programs.

**CONCLUSION**

Participation in the DIR provides an opportunity to validate trends and to set benchmarks for pediatric CT dose estimations. For example, based on SSDE, there are currently adjustments in scanning based on age and body region, and more frequent scanning occurs in teenage years. Such data can be a gauge of past impact and a guide for future efforts in dose management.

**CLINICAL RELEVANCE/APPLICATION**

The ACR CT Dose Index Registry is a valuable resource for assessment of pediatric CT demographics and dose estimations.

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**PDS254**

**Common Indications for Chest Radiographs in the Pediatric Population: Are We Adding Value or Radiation? (Station #2)**

Ann Packard MD (Presenter): Nothing to Disclose, Kristen Barry Thomas MD: Nothing to Disclose

**PURPOSE**

Reducing radiation exposure is an ongoing endeavor of both radiologists and clinicians, especially in the pediatric population. This retrospective study evaluated common indications for chest radiograph in the pediatric population and whether changed clinical management of the patient with the hope of guiding clinicians away from exposing a vulnerable population to unnecessary radiation.

**METHOD AND MATERIALS**

Previously acquired chest radiographs were reviewed from 2008-2014 in a pediatric population from birth to 17 years. Indications selected for evaluation included chest pain, syncope/presyncope, dizziness, postural orthostatic tachycardia syndrome (POTS), spells, and cyclical vomiting. A total of 719 chest radiographs were reviewed including limited clinical history: 377 for chest pain, 98 for syncope/presyncope, 21 for spells, 37 for POTS, 185 for dizziness, and 1 for cyclical vomiting. Eight-two were excluded for congenital or other known heart disease, prior illness for which they were being currently imaged (i.e. chest pain with known pneumonia), intubation, or postoperative.

**RESULTS**

No patients with radiographs for indications including syncope, spells, POTS, dizziness, or cyclical vomiting had any finding which affected patient management. Insignificant findings such as minor pectus excavatum or central lines in good position were considered negative. Forty-five of 330 (13.6%) chest radiographs for chest pain were positive; 17 (5.1%) for pneumonia (5 of the 17 included either fever or pneumonia in the indication), 12 (3.6%) for bronchial inflammation, 4 (1.2%) for atelectasis, 2 (0.6%) for trauma (12 total included chest pain and trauma in the indication), and 1 patient each (0.3%) for pleural effusion, pneumothorax, bronchiectasis, and foreign body (2 total had chest pain and foreign body). Seven patients had chest pain with a history of sickle cell anemia, none which were positive.

**CONCLUSION**

In our pediatric patient population, no findings on chest radiograph to alter patient management were found for indications including syncope/presyncope, dizziness, spells, POTS, and cyclical vomiting. Chest radiographs for chest pain were positive greater than 10% of the time, the most common finding being pneumonia.

**CLINICAL RELEVANCE/APPLICATION**

Nothing to Disclose

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**CLINICAL RELEVANCE/APPLICATION**

PDS254
Certain indications for chest radiograph may not add any benefit to the patient which should be shared with our clinical colleagues to reduce radiation exposure in a pediatric population.

**P256**

**Pulmonary MRI in the NICU: Initial Experience Imaging BPD and CDH with a Small-footprint Scanner (Station #4)**

Laura Walkup PhD (Presenter): Nothing to Disclose, Jean A. Tkach PhD: Nothing to Disclose, Robert Thomen: Nothing to Disclose, Stephanie Merhar: Nothing to Disclose, Raouf S. Amin MD: Nothing to Disclose, Paul Kingma: Nothing to Disclose, Jason C. Woods PhD: Nothing to Disclose

**PURPOSE**

Neonatal pulmonary imaging poses difficulties because of small size, respiratory motion, and the delicate nature of moving infants to and from the NICU. While CT is the current clinical gold standard for diagnostic pulmonary imaging, it is not routine for the longitudinal evaluation of most neonatal pulmonary abnormalities within the NICU. Our goal was to use our institution's one-of-a-kind NICU MRI scanner to investigate the feasibility of performing pulmonary MRI in conditions that are present in our NICU (bronchopulmonary dysplasia [BPD] and congenital diaphragmatic hernia [CDH]), since they are poorly understood both physiologically and radiologically.

**METHOD AND MATERIALS**

Pulmonary MRI was performed on a small-footprint 1.5T MRI scanner developed for orthopedic use (marketed as GE Optima MR430s) that was modified and adapted for use in our institution’s NICU. Free-breathing FrFSE (TE/TR 3000/11.8, ETL=5 or 11) and FGRE (TE/TR 1.9/6.8, 7-10° FA) images were obtained for a small group of non-sedated NICU patients (1 BPD, 2 CDH, 3 control). Images were evaluated qualitatively and a quantitative assessment of approximate lung density obtained by normalizing the lung signal to nearby soft tissues.

**RESULTS**

Both FrFSE and GRE images were generally of high (diagnostic) quality and demonstrated very few motion artifacts for quietly-breathing babies, with parenchymal SNR of around 5. Pulmonary abnormalities were visually apparent in many cases: pleural effusion, multiple local areas of atelectasis, alveolar simplification, and parenchymal opacities were all observed, with quantitative results that matched visual inspection. MR images for one CDH patient revealed regions of air-trapping undetected in chest x-ray.

**CONCLUSION**

We have demonstrated that free-breathing pulmonary MRI in the NICU is feasible and can produce diagnostic-quality images that may be used in detection and longitudinal assessment of various pulmonary abnormalities, including BPD and CDH. The MR images obtained were of diagnostic-quality, compared well to CT in the opinion of our clinical radiologist, and did not require sedation.

**CLINICAL RELEVANCE/APPLICATION**

Pulmonary MRI in the NICU provides diagnostic-quality images for the assessment of neonatal pathologies and will add to our knowledge of normal and aberrant lung development.

**P257**

**Diffusivity of Retinoblastoma: 3D Turbo Field Echo with Diffusion-Sensitized Driven-Equilibrium Preparation Technique (DSDE-TFE) Compared to Echo Planar Imaging (Station #5)**

Akio Hiwatashi MD (Presenter): Nothing to Disclose, Osamu Togao MD, PhD: Nothing to Disclose, Koji Yamashita MD, PhD: Nothing to Disclose, Kazufumi Kikuchi MD: Nothing to Disclose, Makoto Obara: Employee, Koninklijke Philips NV, Takashi Yoshiura MD, PhD: Nothing to Disclose, Hiroshi Honda MD: Nothing to Disclose

**PURPOSE**

Compared to echo planar (EP) diffusion-weighted imaging (DWI), three-dimensional (3D) turbo field echo with diffusion-sensitized driven-equilibrium (DSDE-TFE) preparation DWI obtains images with higher spatial resolution and less susceptibility artifacts. The purpose of this study was to evaluate feasibility of DSDE-TFE to visualize retinoblastomas compared to EP imaging.

**METHOD AND MATERIALS**

This retrospective study was approved by our institutional review boards, and written informed consent was waived. Eight patients with retinoblastomas (five boys and three girls; age range 0-87 month old; median 21 month) were studied. For DSDE-TFE, motion probing gradients (MPGs) were conducted at one direction with b-values of 0 and 500 s/mm2. The other imaging parameters were as follows: TR/TE = 3000/57 ms, SENSE factor = 2.5, FOV = 230 mm, matrix = 160×128, slice thickness/gap = 3/0 mm, voxel size = 1.4×1.8×3 mm3, NSA = 2, and acquisition time = 2 min 12 s. The apparent diffusion coefficients (ADCs) of each lesion were measured. Statistical analyses were performed with Pearson R and linear regression analysis.

**RESULTS**

Intraocular lesions were clearly visualized on the DSDE-TFE without obvious geometrical distortion, whereas all showed deformity on EP images. On the DSDE-TFE, the ADCs of the lesions ranged from 0.83×10-3 mm2/s to...
2.93×10⁻³ mm²/s (mean ± SD; 1.73±0.73×10⁻³ mm²/s). On the EP images, the ADCs ranged from 0.53×10⁻³ mm²/s to 2.03×10⁻³ mm²/s (0.93±0.53×10⁻³ mm²/s). There was a significant correlation in ADC measurement between the DSDE-TFE and EP imaging (r = 0.81, p < 0.05).

CONCLUSION

With its insensitivity to field inhomogeneity and high spatial resolution, the 3D DSDE-TFE technique enabled us to assess diffusivity in retinoblastomas.

CLINICAL RELEVANCE/APPLICATION

Using DSDE-TFE technique, it was possible to evaluate diffusivity in retinoblastoma with high resolution and less susceptibility artifacts compared to echo planar diffusion-weighted imaging.

PDS258

Sub-millisievert Pediatric Chest CT: Implementation of Hybrid (ASIR) and Pure (MBIR) Iterative Reconstruction Techniques for Substantial Dose Reduction (Station #6)


PURPOSE

To assess lesion detection and image quality with hybrid (adaptive statistical iterative reconstruction [ASIR]) and pure (model-based iterative reconstruction [MBIR]) algorithms in pediatric chest CT examinations at submillisievert (SubmSv, <1 mSv) radiation dose.

METHOD AND MATERIALS

This IRB-approved study included 180 examinations for 97 patients who underwent routine chest CT on 64-slice MDCT (750HD Discovery, GE Healthcare). Sub-mSv (n, 90 CT exams; 9±5 years, 61% boys; median weight 24kg) and controls (size-matched with an estimated effective dose ≥1 mSv; n, 90; 9±6 years 54% boys; median weight 28kg) were assessed for lesion detection, conspicuity, diagnostic confidence and diagnostic acceptability for lesion characterization. Sub-mSv CT exams were reconstructed with ASIR60% (n, 60 CT) and MBIR (n, 30) whereas control CT exams were reconstructed with ASIR30%-60%. Independent and blinded evaluation for subjective image quality was performed for image noise, contrast, presence of artifacts and visibility of small structures. Data were analyzed with ANOVA and multiple-paired t tests.

RESULTS

Radiation dose between control-CT (mean SSDE, 3.8 mGy [~2.5 mSv]) and Sub-mSv CT (mean SSDE, 2.4 mGy [~0.6 mSv]) were statistically different by 76% (P < 0.0001). A total of 199 lesions were identified in controls (n, 61), Sub-mSv-ASIR (n, 99) and Sub-mSv-MBIR exams (n, 39). Lesions on both control- and Sub-mSv-exams (ASIR and MBIR) were well seen with sharp margins. The diagnostic confidence and acceptability were equal in control and Sub-mSv exams. There was no difference in the subjective image noise evaluation in control and Sub-mSv ASIR/MBIR exams (P = 0.9). Sub-mSv exams had both excellent visibility of small structures and image contrast comparable to control-ASIR exams (P = 0.9). Streak and beam hardening artifacts were present in both Sub-mSv-ASIR and control-ASIR exams without interfering with diagnostic decision making.

CONCLUSION

Implementation of hybrid (ASIR) and pure model iterative reconstruction technique (MBIR) successfully enabled submillisievert radiation dose for pediatric chest CT while maintaining image quality and diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

ASIR- and MBIR-enabled indication-based CT protocols allow optimal clinical evaluation in submillisievert pediatric chest CT examinations.

PDE134

Contrast Enhanced Voiding Urosonography with Intravesical Administration of US Contrast Agent in Children: How to Do! (Station #7)

Aikaterini Ntoulia MD, PhD (Presenter): Nothing to Disclose, Frederica Papadopoulou MD: Nothing to Disclose, Susan Jane Back MD: Nothing to Disclose, Martin Stenzel MD: Nothing to Disclose, Kassa Darge MD: Nothing to Disclose

TEACHING POINTS

To demonstrate step-by-step how to perform contrast enhanced Voiding Urosonography (ceVUS) with intravesical administration of an US contrast agent for diagnosis of vesicoureteric reflux in children.

TABLE OF CONTENTS/OUTLINE


PDS-THB

Pediatric Thursday Poster Discussions

Scientific Posters

PD

AMA PRA Category 1 Credits™: .50
Thu, Dec 4 12:45 PM - 1:15 PM Location: S101B

Sub-Events

PDS259 Voiding Urosonography Phantom Study: Intravenous Iodinated and Gadolinium-based Contrast Agents May Cause False-negative Results in Assessment of Pediatric Vesicoureteral Reflux (Station #1)

Simon Veldhoen MD (Presenter): Nothing to Disclose, Alexander Sauer MD: Nothing to Disclose, Tobias Gassenmaier MD: Nothing to Disclose, Bernhard Petritsch: Nothing to Disclose, Stefan Marco Herz MD: Nothing to Disclose, Philipp Blanke MD: Nothing to Disclose, Thorsten Derlin: Nothing to Disclose, Thorsten Alexander Bley MD: Nothing to Disclose, Clemens Wirth MD: Nothing to Disclose

PURPOSE

To assess the diagnostic performance of voiding urosonography (VUS) for detection of pediatric vesicoureteral reflux (VUR) when following other procedures requiring application of intravenous contrast.

METHOD AND MATERIALS

Iodinated (Iomeprol, Iopamidol) and gadolinium-based (gadoterate meglumine) contrast agents were diluted to bladder concentration and injected into balloons filled with saline solution. MDCT scans were performed to assess the contrast distribution in these phantoms. Regions of interest were placed at the top and bottom side of each balloon and Hounsfield units (HU) were measured. Three other balloons were filled with saline solution and contrast media likewise. An ultrasound contrast agent (UCA) was subsequently added and its distribution in the phantoms was assessed using sonography.

RESULTS

MDCT scans showed a separation of two liquid layers in all bladder phantoms with the contrast layers located at the bottom and the saline solution at the top. Significant differences of the HU measurements at the top and bottom side were observed (p<.001-.007). Following injection of UCA, ultrasound revealed its distribution exclusively among the saline solution at the top of the phantom.

CONCLUSION

UCA is supposed to be unable to reach the ureteric orifices located at the posterior/inferior bladder wall if excreted contrast material accumulates at the bottom of the bladder. False-negative results of VUS have to be considered if it is performed shortly after imaging procedures requiring intravenous contrast.

CLINICAL RELEVANCE/APPLICATION

Evaluation of VUR utilizing VUS should be performed prior to other procedures requiring intravenous contrast agents.

PDS260 Optimization of Pediatric Craniosynostosis CT with Model-based Iterative Reconstruction (VEO): Phantom Study (Station #2)

Touko Kaasalainen (Presenter): Nothing to Disclose, Kirsi Palmu MSc: Nothing to Disclose, Anniina Lampinen: Nothing to Disclose, Vappu Reijonen PhD: Nothing to Disclose, Junnu Leikola: Nothing to Disclose, Riku Kivisaari: Nothing to Disclose, Mika Karel Kortesniemi PhD: Nothing to Disclose

PURPOSE

To evaluate the possibility of using ultralow-dose CT protocols with model-based iterative reconstruction technique for craniosynostosis imaging.

METHOD AND MATERIALS

Two anthropomorphic phantoms, corresponding pediatric newborn and 5-year-old patients, were scanned with 64-slice CT scanner using different low-dose protocols. Organ doses in the head region were measured with MOSFET dosimeters, and doses of low-dose scans were compared to routine protocols of hospital for
craniosynostosis. Additionally, organ doses, as well as effective doses, were also determined by simulations. Image quality was evaluated objectively and subjectively using ASIR30%, ASIR50% and VEO reconstructed images. Image noise and contrast were determined from the CT number histograms of different tissues. Subjective image quality was evaluated in a blinded manner using a Likert scale by two experienced physicians.

RESULTS
In the newborn phantom, mean organ dose was reduced up to 83% compared to routine protocol when using ultralow-dose scanning settings (80 kVp and fixed 10 mA tube-current). Similarly, in the 5-year-old phantom, the greatest radiation dose reduction was up to 88% compared to our routine protocol. The simulations supported the findings with MOSFET measurements. According to objective and subjective image quality analysis, the image quality remained adequate with VEO reconstruction even with the lowest dose level.

CONCLUSION
Craniosynostosis CT with VEO could be performed in our study by approximately 20 μSv effective dose for the patient, corresponding to the radiation exposure of plain skull radiography, without compromising adequate image quality.

CLINICAL RELEVANCE/APPLICATION
Radiation doses of craniosynostosis patients, who are exposed to repeated CT scans, can be reduced significantly using model-based iterative reconstruction without compromising adequate image quality for diagnosis and treatment.

PDS261 Bone Mineral Density in Children: Total Body Less Head, or Lumbar Spine Measurements or Both? (Station #3)
Reza  Vali  MD (Presenter):  Nothing to Disclose , MANDY  KOHLI :  Nothing to Disclose , Etienne  Sochette :  Nothing to Disclose , Amer  Shammas  MD :  Nothing to Disclose

PURPOSE
In children over the age of five, it is recommended that both lumbar spine and total body less head (TBLH) be measured. We have been performing both of these measurements since 2009. The clinical utility of obtaining both measurements remains unclear. The aim of this retrospective study in which both measurement of lumbar spine and TBLH had been obtained in individual cases was to determine whether the relationship between lumbar and TBLH BMD will permit for a more limited scanning protocol.

METHOD AND MATERIALS
A retrospective review was conducted for all results of Dual energy X-ray Absorptiometry (DXA) studies (Lunar Prodigy) (3128 studies) from 2010.01.01 to 2013.06.30 in patients (n=2005) who had both TBLH and lumbar assessment. DXA studies were interpreted as reduced BMD when the Z-score of either lumbar spine or TBLH or both were equal or less than -2.0. The clinical indications for the patients were categorized into 14 major groups including: metabolic, endocrine, cancers (leukemia,…), steroid therapy, kidney disease, gastrointestinal problems, inflammatory disease (vasculitis,…), restricted diet (anorexia nervosa,…), on medication (Coumadin,…), primary bone disorder (osteogenesis imperfecta,…), post-transplantation, immobility (cerebral palsy,…), history of multiple fracture and others (developmental disorders, genetic syndromes,…).

RESULTS
272 of the 2005 patients showed reduced BMD in at least one of their DXA studies. 100 patients showed reduced BMD only in the lumbar spine, 37 only in the TBLH and 135 in both. In those (n=37) who had reduced BMD only in TBLH, the Z-score in the lumbar spine was between -1.0 to -2.0 in 32 and between 0 to -1.0 in 5 patients. All 5 patients who had a reduced BMD on TBLH and lumbar Z score between 0 to -1.0 belonged to the immobility (non-ambulatory) group. There was no case in which TBLH was reduced with a lumbar Z-score equal or more than zero.

CONCLUSION
The frequency of reduced BMD only on TBLH is very low if the lumbar spine Z score is greater than -1.0. In order to minimize imaging time and decrease radiation exposure, it may be suggested to start with a lumbar spine BMD assessment and to proceed with TBLH evaluation only if the lumbar Z-score is less than -1.0 or if the patient has a history of immobility including cerebral palsy.

CLINICAL RELEVANCE/APPLICATION
This study reviews the most common indications of DXA scan in children and suggest a more cost effective technique.

PDS263 Posterior Reversible Encephalopathy Syndrome in Children: Is It Really So Reversible? (Station #5)
Ignacio  Delgado  MD (Presenter):  Nothing to Disclose , Chae Bong  Whang :  Nothing to Disclose , Angel  Sanchez-Montanez :  Nothing to Disclose , Miquel  Raspall :  Nothing to Disclose , Alfons  Macaya :  Nothing to Disclose , Elida  Vazquez  MD :  Nothing to Disclose

PURPOSE
Posterior reversible encephalopathy syndrome (PRES) consists of vasogenic edema in the posterior circulation territories. Although usually considered benign and reversible, characteristics of this syndrome in pediatric patients remain obscure. The purpose of this study is to evaluate which clinical and magnetic resonance imaging
(MRI) findings can help to predict the prognosis of PRES and whether or not there is difference between PRES in children and adults.

METHOD AND MATERIALS

We retrospectively evaluated MRI and clinical findings from children with PRES between 2007 and 2013. All patients were studied by MRI. Follow-up MRI was performed on most of the children. We assessed the MRI features, clinical data, and the patients’ outcomes.

RESULTS

A total of 20 pediatric patients with PRES were included into this study. Mean age was 7.7 years and 55% were males. Recurrence of PRES was observed in one patient. Most common predisposing causes were renal and hematologic diseases, frequently associated with endotheliotoxic medication (cyclosporine A 10/20, tacrolimus 5/20, mycophenolate 3/20, corticoids 3/20). Presenting symptoms were seizures in 85%, altered mental status in 65%, visual disturbance 25% and headache in 15%. Arterial hypertension was present in 16/20 of patients. The parieto-occipital regions were the most commonly involved in MRI (19/20), followed by the frontal and temporal lobes. 9/20 showed restriction of diffusion (DWI) on initial MRI, 2 patients showed hemorrhagic changes. Follow-up MRI was performed on 14 patients and in 6/14 residual lesions were found. Six patients developed epilepsy, two patients ataxia, one patient had a persistent mydriasis, 1 hypotonia and 1 learning disability. Six of the patients with sequelae had hemorrhage or DWI lesions on initial MRI.

CONCLUSION

PRES should be recognized and trigger agents must be discontinued to prevent long-term sequelae. Recurrence is infrequent. PRES has not a so good long-term prognosis in children. Epilepsy is the most frequent sequela. DWI restriction is a marker of non-reversible edema and indicates poor prognosis. Presence of hemorrhagic changes on initial MRI is also linked with a worst patient’s outcome.

CLINICAL RELEVANCE/APPLICATION

Chemotherapy, immunosuppressors and other endotheliotoxic medication play an important role in the pathophysiology of pediatric PRES.

MRI based on DWI and GRE T2 or SWI may help to predict the prognosis.
PDE136

Extravesical Ectopic Ureters in Children: The Spectrum of MR Urography (fMRU) Findings (Station #7)

Aikaterini Ntoulia MD, PhD (Presenter): Nothing to Disclose, Maria Alejandra Bedoya Velez MD: Nothing to Disclose, Melkamu Dessie Adeb MD: Nothing to Disclose, Dmitry Khrichenko: Nothing to Disclose, Kassa Darge MD, PhD: Nothing to Disclose

TEACHING POINTS

To demonstrate the utility of fMRU to accurately detect the insertion site of extravesical ectopic ureters (EEUs) in children and evaluate the function of associated moieties.

TABLE OF CONTENTS/OUTLINE

Procedure:

A. f MRU performance:
   1. Post-contrast sequences
   2. Contrast administration
   3. Post-processing
   4. Post-contrast sequences

B. Extravesical ectopic ureters: insertion sites
   1. In girls: urethra vagina vestibule uterus fallopian tube Gartner’s duct rectum
   2. In boys: prostatic urethra ejaculatory duct seminal vesicle vas deferens rectum

C. fMRU diagnostic value:
   1. Anatomical details duplex systems ureteric course ureteric [ectopic] insertion
   2. Functional information poorly/non-functioning moieties renal bud [dysmorphic]
   3. Early diagnosis of ureteral ectopia in the majority of patients to infancy, prior to development of clinical symptoms.

SPDL51

RSNA Diagnosis Live™: Musculoskeletal/Pediatric/Interventional Radiology

Special Courses

PD TR MK
AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 0

Thu, Dec 4 3:00 PM - 4:00 PM Location: E451B

Participants

Neety Panu MD, FRCPC (Presenter): Nothing to Disclose
Kate Ann Feinstein MD (Presenter): Nothing to Disclose
Brian S. Funaki MD (Presenter): Nothing to Disclose

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.

RC713

Pediatric: Neuro II

Refresh/Informatics

PD ER OB NR
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Thu, Dec 4 4:30 PM - 6:00 PM Location: S102AB

Sub-Events

RC713A

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.

RC713B

Hypoxic Ischemic Injury/Perinatal Stroke
**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.

**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.
1) Understand the imaging of residual structural and functional abnormalities that occur after the repair of Congenital Heart Disease. Tetralogy of Fallot and Transposition of the Great Arteries will be emphasized.

**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

**Fri, Dec 5 10:30 AM - 12:00 PM  Location: N229**

**Participants**

**Moderator**
Jeremy York Jones  MD : Nothing to Disclose

**Moderator**
Susan Palasis  MD : Nothing to Disclose

**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.

**SST12-02** 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.

SST12-03

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
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 for patients with HII or perinatal infection. For unknown diagnosis, 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

SST12-06
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) and as a subtype of CNS tumors, EBLs are histologically defined by “ependymoblastic rosettes”. Due to its rarity, little is known about its natural history and management. 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.

**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 = 0.03). Imaging findings (ultrasound and MRI) and anatomopathological findings after enucleation; (3) to evaluate whether rsfMRI can be used as a reliable predictor of vision loss and a marker for early treatment in this population.

**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 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.

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**MRI Characteristics of Ependymoblastoma: Results from 22 Centrally Reviewed Cases**

**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) (PNET), EBL is histologically defined by “ependymoblastic rosettes”. Due to its rarity, little is known about its natural history and management. 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.
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.

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**SPFR61**

**Friday Imaging Symposium: A Guided Tour for Managing Incidental Findings: Adnexal, Thyroid, Pediatric, Adrenal and Chest**

**Special Courses**

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AMA PRA Category 1 Credits™: 2.50
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Fri, Dec 5 12:30 PM - 3:00 PM  Location: E253CD

**Participants**

Moderator
Lincoln L. Berland MD: Consultant, Nuance Communications, Inc Stockholder, Nuance Communications, Inc

**LEARNING OBJECTIVES**

1) Appreciate the scope, variety and nature of the problem of incidental findings on imaging studies in multiple contexts and the special challenges each present. 2) Better apply a system for managing incidental adnexal lesions, including when to follow or further evaluate lesions based on their features, size and on patient factors. 3) Apply criteria for diagnosing and following incidental adrenal lesions, including when and how to reference information from an ACR White Paper addressing this topic. 4) Assess how new knowledge and techniques developed since publication of the Fleischner criteria in 2005 will lead to changes for managing incidental pulmonary lesions.

**Sub-Events**

**SPFR61A**

Chest
Reginald F. Munden MD, DMD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPFR61B**

Adnexal
Susan M. Ascher MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
SPFR61C  Adrenal
William W. Mayo-Smith MD (Presenter): Author with royalties, Reed Elsevier Author with royalties, Cambridge University Press

LEARNING OBJECTIVES
View learning objectives under main course title.

SPFR61D  Thyroid Nodules
Edward G. Grant MD (Presenter): Research Grant, Bracco Group Research Grant, General Electric Company Medical Advisory Board, Nuance Communications, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

SPFR61E  Pediatrics
R. Paul Guillerman MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize common or vexing incidental findings encountered in pediatric body imaging, such as lymphoid hyperplasia, brown fat, ectopic thymus, pulmonary nodules, small bowel intussusceptions, duodenal inversum, intraperitoneal free fluid, infantile ovarian cysts, urachal remnants, renal cysts, renal collecting system ectasia, neonatal adrenal masses, testicular microlithiasis, osteochondral irregularities, and hypercellular marrow. 2) Understand the clinical implications of these incidental findings to distinguish which of them can be dismissed and which of them warrant additional investigation or follow-up