EDE008-b
Musculoskeletal Case of the Day

Participants
Moderator
William F. Conway MD, PhD: Nothing to Disclose
Russell William Chapin MD: Nothing to Disclose
Alexander Macrae Harvin MD: Nothing to Disclose
Matthew Richard Giliott MD: Nothing to Disclose
Robert Hedrick Hazelrigg MD: Nothing to Disclose
Patrick Ryan Mullin DO: Nothing to Disclose
Kevin Gabriel Garrett MD: Nothing to Disclose
Michael McDonald Davis MD: Nothing to Disclose

EDE100
Image Interpretation Exhibit in Digital Format

Participants
Jeffrey C. Weinreb MD: Nothing to Disclose

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

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

MKE001-b
Lipoma Arborescens in Swollen Joints: Histopathological and Multimodalitary Radiological Approach

Participants
Betul Kizildag MD: Nothing to Disclose
Emine Dagistan: Nothing to Disclose
Zeliha Cosgun: Nothing to Disclose
Siddika Halicioglu MD: Nothing to Disclose
Imran Fenjanchi MD: Nothing to Disclose
Safiye Gurel MD (Presenter): Nothing to Disclose

TEACHING POINTS
• Lipoma arborescens is a nonneoplastic uncommon synovial entity occuring in the lining of joints, bursae, and tendons causing recurrent painless joint swelling and effusion in a wide age range. • Diffuse replacement of subsynovial mature fatty cells associated with villous proliferation of synovium forming typical frond-like appearance is the major histopathologic finding in which MRI is the most effective method in radiologic aspect. • Lipoma arborescens should be included in the differential diagnosis of recurrent joint swelling and effusion among other synovial pathologies such as pigmented villonodular synovitis, synovial lipoma, rheumatoid arthritis, synovial hemangiomata, synovial chondromatosis. • Lipoma arborescens is a benign entity of which radiologists and pathologists should increase their familiarity about it and MRI is the problem solving tool before biopsy, arthroscopy or synoviectomy.

TABLE OF CONTENTS/OUTLINE
• Histopathological definition and incidence of lipoma arborescens • Multimodalitary imaging and histopathological findings of various cases • Differential diagnosis of lipoma arborescence among other synovial diseases

MKE002-b
A Pictorial Review of Bone Stress Injuries in Olympic Athletes

Education Exhibits
**Participants**

Monika Rowe MD, PhD (Presenter): Nothing to Disclose  
Adam W. Mitchell FRCR: Nothing to Disclose  
Sarah S. R. Bethapudi MRCP, FRCP: Nothing to Disclose  
Philip James O'Connor MBChB: Nothing to Disclose  
Justin Charles Lee MBBS, FRCR: Nothing to Disclose  
Jeremiah Christopher Healy MBCHIR, FRCR: Nothing to Disclose  
Richard Budgett MBBS: Nothing to Disclose  
Lars Engebretsen MD, PhD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To analyse the demographics and review the spectrum and distribution of bone stress injuries witnessed in Olympic Athletes: a) In different sporting categories. b) Based on anatomical body parts. 3. To review site-specific imaging findings of bone stress injuries in Olympic Athletes (including features on conventional radiography, CT, MRI). 4. To review commonly used MRI grading systems for site-specific stress injuries and discuss the correlation of MRI findings with time to return to sports activities.

**TABLE OF CONTENTS/OUTLINE**

1. Review of the definition and pathogenesis of bone stress injuries (bone stress response versus bone stress fracture). 2. Review of the presentation, demographics and distribution of bone stress injuries witnessed in a group of 40 Olympic Athletes: a) Analysis of bone stress injuries in different sporting categories. b) Analysis of bone stress injuries based on anatomical body parts. 3. Review of various site-specific injury patterns on imaging, including conventional radiography, CT and MRI (with sample cases including injuries to the spine, pelvis, femur, tibia, fibula, ankle, foot etc.). 4. Review of commonly used site-specific MRI grading systems (i.e., for pars interarticularis, tibial injuries) and their correlation with time to return to sports activities. 5. Summary.

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**MKE003-b**

**Let's Talk about Our Differences – Gender Variations in Musculoskeletal Radiology**

**Education Exhibits**

Location: MK Community, Learning Center

**Participants**

Vetana Seit MD (Presenter): Nothing to Disclose  
Corey K. Ho MD: Nothing to Disclose  
Kevin R. Math MD: Nothing to Disclose  
Douglas S. Katz MD: Nothing to Disclose

**TEACHING POINTS**

Numerous anatomical differences between males and females are evident on musculoskeletal imaging examinations. These morphological differences have important implications in both forensic medicine and in understanding the predisposition of males vs females to specific musculoskeletal injuries. The differences are primarily seen in the pelvis and in the upper and lower extremities, ranging from angular differences of the long bones to different patterns of calcification at the costochondral junctions. The purpose of this exhibit is therefore to demonstrate and review the differences in both normal and abnormal musculoskeletal imaging findings in males vs females.

**TABLE OF CONTENTS/OUTLINE**


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**MKE004-b**

**Bone Marrow Edema-like Lesions on MRI: An Analytical Approach for Differential Diagnosis**

**Education Exhibits**

Location: MK Community, Learning Center

**Participants**

Ustun Aydingoz MD (Presenter): Nothing to Disclose  
Fatma Bilge Ergen MD: Nothing to Disclose  
Zeynep Ozdemir MD: Nothing to Disclose  
Kemal Kosemehmetoglu: Nothing to Disclose

**TEACHING POINTS**

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

1. Explain why magnetic resonance imaging (MRI) is the single most effective radiological tool to detect bone marrow edema-like lesions (BMEL).  
2. List several constituents of BMEL on MR images.  
3. Ask several questions that would help to narrow down the differential diagnostic considerations with regard to BMEL on MRI.  
4. Describe several characteristic patterns of BMEL on MRI that can help in making specific diagnoses.  
5. Name several conditions where the temporal course of BMEL on MRI would be suggestive.

**TABLE OF CONTENTS/OUTLINE**

What is suggested by bone marrow edema-like lesions (BMEL) on magnetic resonance imaging (MRI)? Concepts of resolution in radiology and how they relate to bone marrow imaging MRI in showing BMEL: strengths and challenges. How to approach bone
marrow edema-like signal alterations on MRI?: asking relevant questions Temporal change in BMEL on MRI: diagnostic possibilities Take home messages

MKE006-b

The Rib in Medical Imaging- From A to BX

Education Exhibits
Location: MK Community, Learning Center

Participants
Nicholson Stephen  Chadwick  MD (Presenter): Nothing to Disclose
Curtis W.  Hayes  MD : Research Consultant, BioClinica, Inc Research Consultant, Pfizer Inc

TEACHING POINTS
Twenty percent of intradepartmental referrals to a tertiary medical center musculoskeletal radiology section involved osseous lesions of the rib. We aim to increase confidence, regardless of sub-specialty training, in the diagnostic workup of rib lesions. This exhibit offers: A multimodality review of benign and malignant entities that involve the rib An algorithm that utilizes characteristic imaging features to aid in diagnostic workup, with particular attention paid to benign mimics of malignancy Examples of rib biopsies with procedural tips and technique

TABLE OF CONTENTS/OUTLINE
Review of normal radiographic appearance of the rib and associated structures Entities presented include: Normal variants/Congenital: fused, bifid, extranumerary rib, rib notching Trauma: fractures (pathologic, healing, and stress), post-surgical presentations Neoplastic: primary malignancy (multiple myeloma, Ewing's sarcoma, lymphoma, chondrosarcoma) and metastatic (blastic vs lytic) Benign: enchondromas, bone island, fibrous lesions (non-ossifying fibroma and fibrous dysplasia), aneurysmal bone cyst Metabolic/Systemic: hyperparathyroidism, osteomalacia, osteopetrosis, Paget's, sickle cell disease, eosinophilic granuloma Management algorithm Rib biopsy technique and points to consider

MKE007-b

Diagnosing Shoulder Arthritis: Beyond DJD and HADD

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants
Eric  Hartman  MD (Presenter): Nothing to Disclose
Kirkland W.  Davis  MD : Nothing to Disclose
Jarrod D.  Dale  MD : Nothing to Disclose
Kevin  McKown  MD : Nothing to Disclose
Michael John  Tuite  MD : Nothing to Disclose
Humberto Gerardo  Rosas  MD : Nothing to Disclose
Jack Anthony  Porrino  MD : Nothing to Disclose

TEACHING POINTS
By viewing this exhibit the learner should be able to:
1. Recognize and describe the distinct imaging features of various types of shoulder arthritis.
2. Understand the clinical workup and management of various types of shoulder arthritis.

TABLE OF CONTENTS/OUTLINE
Review of each type of shoulder arthritis to include: Typical imaging features Distinguishing imaging characteristics Expected findings in other joints Clinical presentation, including HandP and relevant lab abnormalities Basics of management Emphasis will be given to: Osteoarthritides Rheumatoid arthritis Pyrophosphate arthropathy Hydroxyapatite deposition disease Neuropathic arthropathy Milwaukee shoulder juvenile idiopathic arthritis Septic arthritis Minor emphasis on: Post-traumatic Hyperparathyroidism Scleroderma

MKE008-b

Lurking Beneath the Surface: A Look at Strange but Common Musculoskeletal Fibrous Lesions

Education Exhibits
Location: MK Community, Learning Center

Participants
Thillai  Sekar  MD (Presenter): Nothing to Disclose
Cornelia B. C.  Wenokor  MD : Nothing to Disclose
Valerie  Fitzhugh  MD : Nothing to Disclose

TEACHING POINTS
Benign fibrous musculoskeletal lesions are surprisingly common, but not well understood or recognized. Their often complex clinical courses lend them an additional layer of mystery. This exhibit will: Introduce the viewer to the common benign musculoskeletal fibrous lesions as a group. What are they? Review the lesions one-by-one, including typical presenting histories and clinical courses. The focus will be on imaging characteristic (X-ray, ultrasound, CT, and MRI), centered on MRI, which is the typical end-point modality in the imaging evaluation of these lesions. Radiologic and microscopy images are sourced from our academic center. Summarize key imaging similarities and differences for these lesions. Provide the viewer with a list of take-home points so they will have familiarity when such lesions appear on their work queue.

TABLE OF CONTENTS/OUTLINE
1. Introduction to benign fibrous musculoskeletal lesions: what are they? 2. Lesion review, including clinical context and
**MKE009-b**

**Various Manifestations of Giant Cell Tumor According to Clinical Courses and Anatomical Locations: What the Radiologists Should Know?**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**

Wyong Lee (Presenter): Nothing to Disclose  
Ji Seon Park MD, PhD: Nothing to Disclose  
Kyung Nam Ryu MD, PhD: Nothing to Disclose  
Sohee Yoon MD: Nothing to Disclose  
So Young Park: Nothing to Disclose  
Wook Jin: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1) To review of typical radiological and clinical features of GCT of bone 2) To provide atypical manifestations of GCT according to clinical aggressiveness 3) To provide atypical manifestations of GCT according to the anatomical location

**TABLE OF CONTENTS/OUTLINE**

1) Introduction & purpose  
2) Typical radiological features and common clinical courses of GCT  
   - Sample cases (x-ray, CT, MRI)  
   - Differential diagnoses such as chondroblastoma, aneurysmal bone cyst, osteosarcoma (telangiectatic, giant cell-rich, fibroblastic types), clear cell chondrosarcoma, desmoplastic fibroma, and fibrous dysplasia  
3) Atypical manifestations of GCT according to clinical aggressiveness  
   - Recurrence / metastasis / direct invasion / malignant transformation / pregnancy-related condition  
4) Atypical manifestations of GCT according to the anatomical location and their differential diagnosis  
   - GCT of spine  
     - Differential diagnosis from chordoma, lymphoma, or metastasis  
     - GCT of short tubular bone  
     - Differential diagnosis from giant cell reparative granuloma or enchondroma  
   - GCT with intraarticular extension  
     - Pigmented villonodular synovitis / bursitis  
5) Conclusion

**MKE011-b**

**A Hard Look at Soft Tissue Tumors: A Systematic Approach to Imaging Diagnosis**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**

Esther Bilinsky MD, MS (Presenter): Nothing to Disclose  
Cornelia B. C. Wenokor MD: Nothing to Disclose

**TEACHING POINTS**

The imaging of soft tissue tumors is notoriously perplexing, largely owing to the significant overlap in imaging characteristics. We present a unique structured approach to the imaging evaluation of soft tissue tumors to aid in converting the often generic imaging appearance of soft tissue tumors into an appropriate differential diagnosis. Teaching points include: 1. An approach in which emphasis is placed on categorizing tumors by MR features (ie: vascular, lipomatous, cartilaginous...) to create a structured approach in identifying lesions and devising reasonable differential considerations. The viewer is given new perspective on how these tumors may be evaluated and categorized. 2. Supplemental CT and Xrays will be provided when they can be useful for further categorization. 3. Patient age, clinical history, location and number of lesions are integrated into the systematic approach we demonstrate to aid in arriving at the diagnosis and accurate differential considerations.

**TABLE OF CONTENTS/OUTLINE**


**MKE012-b**

**What Is That Tumor? Review of Imaging Findings of Talus Bone Tumors**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**

Ji Young Jeon (Presenter): Nothing to Disclose
TEACHING POINTS

1. Bone tumors involving talus are rare and a comprehensive review integrating the imaging findings of talus tumors has not been published yet. 2. By showing various talus bone tumors, characteristic imaging features of them could be suggested.

TABLE OF CONTENTS/OUTLINE

Our exhibition will be composed of 4 parts: 1. Displaying 19 bone tumors of the talus collected for 11 years in our institution: detailed pathologic diagnoses in Table 1. 2. Showing other talus tumors on previously reported literatures: osteoid osteoma, osteoblastoma, intrasosseous lipoma, epithelioid angiosarcoma. 3. Presenting representative imaging features of talus bone tumors (1) Giant cell tumor, chondroblastoma, chondromyxoid fibroma share similar MR morphology and unlike long bones, age of the patients and tumor locations are not helpful factors for differential diagnosis among them. (2) Circumscribed tumor margin regardless of size does not necessarily mean benignancy. 4. Presenting radiographic features that might suggest clues in differentiating malignancy from benignancy (1) Benign mass is likely to have noticeable cystic area or cystic/hemorrhagic degeneration. (2) Malignant mass tends to show nearby multiplicity, extrartalar soft tissue extension, or considerable increase in size on follow-up.

MKE014-b

FDG-PET/CT, CT and MR Imaging of Tenosynovial Giant Cells Tumors

Education Exhibits
Location: MK Community, Learning Center

Participants
Laurent Dercle MD (Presenter): Nothing to Disclose
Samy Ammari: Nothing to Disclose
Roland Chisin MD: Nothing to Disclose
Quentin Gillesbert: Nothing to Disclose
Laurence Vilcot: Nothing to Disclose
Martin Schlumberger: Nothing to Disclose
Clarisse Dromain MD: Nothing to Disclose
Frederic Courbon: Nothing to Disclose

TEACHING POINTS

- Diagnosis of the local extent of the disease (surgery): MRI and/or FDG-PET/CT - Malignant transformations - Response to targeted therapies: FDG-PET/CT

TABLE OF CONTENTS/OUTLINE

Introduction: Tenosynovial giant cells tumors [T-GCT] are benign but locally aggressive tumours with a high recurrence rate. The major challenges are the diagnosis of the local extent of the disease, of malignant transformations and to monitor the response to targeted therapies. Teaching Points: The definitive diagnostic is based on biopsy-obtained histopathology. The main imaging features are the presence of a soft tissue mass or hypertrophy in the synovium or bursa or tendon sheath (MRI, CT-scan or 18F-FDG-PET/CT); hemosiderin deposition (MRI); increased FDG-uptake (PET); extrinsic erosion of bone with well-defined sclerotic margins on CT-scan. MRI is the current reference-standard for the pre-operative with a pattern highly specific of hemosiderin deposition in the macrophages (low T2-signal intensity and blooming artefact with gradient-echo sequences). The differential diagnoses include synovial haemangioma and haemophiliac arthropathy. Targeted therapies are responsible for a late symptomatic improvement. MRI and RECIST fail to predict the response to treatment. As a contrary, FDG-PET/CT and PERCIST are good predictor of the response.

MKE016-b

US Findings of Musculoskeletal Complications in Diabetes: Based on Patient’s Symptoms

Education Exhibits
Location: MK Community, Learning Center

Participants
Kyung Nam Ryu MD, PhD (Presenter): Nothing to Disclose
Minho Park MD: Nothing to Disclose
Sung Eun Ahn: Nothing to Disclose
Ji Seon Park MD, PhD: Nothing to Disclose
Wook Jin: Nothing to Disclose
So Young Park: Nothing to Disclose
Sohee Yoon MD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the various MSK lesions which can be occurred in diabetic patients and be diagnosed by ultrasonography 2. To categorize the diabetes-related MSK diseases according to patient’s symptoms 3. To illustrate and describe the US findings of the above MSK lesions

TABLE OF CONTENTS/OUTLINE

1. Introduction and purpose 2. Review of diabetes-related MSK complications - Infectious diseases Cellulitis, pyogenic tenosynovitis, pyomyositis, necrotizing fasciitis, septic arthritis - Vascular disorders Medial arteriopathy, peripheral neuritis, carpal tunnel syndrome - Others involving muscles, tendon, and joints Adhesive capsulitis, Dupuytren’s contracture, flexor tenosynovitis, skeletal muscle infarction 3. Categorization of diabetes-related MSK diseases according to patient’s symptoms Cellulitis, pyogenic tenosynovitis, pyomyositis, necrotizing fasciitis, septic arthritis, diabetic foot Muscle infarction, muscle ischemia - Numbness, coldness, or discomfort of hand or foot Peripheral neuritis, carpal tunnel syndrome Medial arteriopathy - Limitation of motion or pain of joints or periarticular regions Adhesive capsulitis Flexor tenosynovitis in wrist Dupuytren’s contracture

MKE017-b
**A Pictorial Review of Wrist Injuries in the Elite Golfer**

*Education Exhibits*

**Location:** MK Community, Learning Center

**Participants**

Amit Kumar Bharath MBChB, FRCP (Presenter): Nothing to Disclose
Philip Robinson MBChB: Nothing to Disclose
Rob Campbell MBChB: Nothing to Disclose
Doug Campbell: Nothing to Disclose
Roger Hawkes: Nothing to Disclose
Philip O'Connor MBBS, FRCP: Nothing to Disclose

**TEACHING POINTS**

- This education exhibit will review the aetiology of common injuries encountered by the examining sports physician/radiologist in the elite golfer. The exhibit will include a discussion regarding the biomechanics of the golf swing and how this relates to the different osseous and soft tissue pathologies seen in the leading and trailing wrists of elite golfers.
- The imaging findings will be reviewed with a particular emphasis on ultrasound and MR. Static and dynamic ultrasound techniques will be discussed. The images are taken from elite professional golfers who sustained injuries on the European PGA tour. The wrist injuries will be classified anatomically; with radial sided, ulnar sided and dorsal wrist injuries.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- The Golf Swing biomechanics of the golf swing
- Injuries in the Professional Golfer epidemiology of wrist injuries in elite golfers
- Ulnar Sided Injuries (clinical and imaging review)
- ECU pathology
- Triangular Fibrocartilage Complex (TFCC) Injury
- Hamate Fracture
- Hypothenar Hammer Syndrome
- Radial Sided injuries
- De Quervain's Tendonitis
- Dorsal Injuries
- Dorsal rim impaction syndrome
- Carpal bossing
- Ganglia
- Summary

MKE020-b

**Femorotibial Cartilage Lesions: Diagnostic, Classification and Treatment**

*Education Exhibits*

**Location:** MK Community, Learning Center

**Participants**

Julian Francisco Forero MD: Nothing to Disclose
Jorge O. Suarez MD (Presenter): Nothing to Disclose
Jaime Martinez MD: Nothing to Disclose
Jorge Enrique Fuentes MD: Nothing to Disclose
Sara Garcia: Nothing to Disclose
Juan Guillermo Trujillo MD: Nothing to Disclose

**TEACHING POINTS**

- Describe classification of subchondral, chondral and osteochondral lesions, included the proposed by Bohndorf and Vellet.
- Discuss the importance of radiological assessment to guide appropriate treatment and describe the options as conservative, arthroscopic or open surgical procedures.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- MR assessment
- Pathogenesis of femorotibial cartilage lesions
- Description and classification of chondral lesions
- Treatment modalities
- Conclusions

MKE021-b

**Total Ankle Arthroplasty: A Radiologic Overview**

*Education Exhibits*

**Location:** MK Community, Learning Center

**Certificate of Merit**

**Participants**

Ka Young Chun (Presenter): Nothing to Disclose
Yun Sun Choi MD, PhD: Nothing to Disclose
Minchul Kim MD: Nothing to Disclose
Hollis G. Potter MD: Research support, General Electric Company
Jin Su Kim: Nothing to Disclose
Ki Won Yang: Nothing to Disclose
Yoon Young Jung: Nothing to Disclose

**TEACHING POINTS**

1. To review the imaging features of total ankle arthroplasty (TAA) in the treatment of end-stage ankle arthrosis
2. To provide optimized CT and MRI protocols
3. To familiarize the participant with multimodal imaging of complicated TAA
TABLE OF CONTENTS/OUTLINE

1. Review the clinical and imaging features of TAA
2. Identify complications and failures of TAA prostheses with a minimum of a 1-year follow-up
3. Optimized CT and MRI protocols
4. Review classifications of complications: high-grade versus medium-grade
5. Description of radiologic findings (radiograph, CT, MRI, 3 phase bone scan)
   - periprosthetic osteolysis, aseptic loosening, infection, tendon tear, fracture
6. Summary

MKE022-b

Business at Hand: Arm Transplant Imaging

Education Exhibits
Location: MK Community, Learning Center

Participants

Fritz Hofmann MD (Presenter): Nothing to Disclose
Martin Iglesias MD : Nothing to Disclose
Veronica Espinosa : Nothing to Disclose
Juan Eugenio Cosme MD : Nothing to Disclose
Jesus Antonio Higuera-Calleja : Nothing to Disclose
Jorge Vazquez-Lamadrid MD : Nothing to Disclose
Christian Escalon-Huerta MD : Nothing to Disclose
Enrique Miguel Cruz MD : Nothing to Disclose
Jose David Dosal Banuelos MD : Nothing to Disclose

TEACHING POINTS

1. To have a better understanding and familiarized with arm transplant procedure, follow up and outcome.
2. To be aware of the importance of the diagnostic imaging modalities and current technologies for proper patient selection, as well as its utility prior, during and after intervention.
3. To address patient self image and transplant overall integration

MKE024-b

Meniscal Allograft Transplantation: What the Radiologist Needs to Know

Education Exhibits
Location: MK Community, Learning Center

Participants

Hye-Larn Lee (Presenter): Nothing to Disclose
Min Hee Lee MD : Nothing to Disclose
Seong-I Bin : Nothing to Disclose
Sang Hoon Lee : Nothing to Disclose
Sun-Young Park MD : Nothing to Disclose
Hye Won Chung MD : Nothing to Disclose
Myung Jin Shin MD : Nothing to Disclose

TEACHING POINTS

1. Review the definition of meniscal allograft transplantation (MAT) and understand the surgical technique and indications.
2. Describe the normal appearance of postoperative MAT on plain radiograph and MR imaging immediately and at follow-up.
3. Recognize specific abnormal post-operative complications at immediate and serial follow-up MR imaging
4. Provide factors that may influence clinical outcomes of MAT

MKE025-b

Partial Thickness Tears of the Anterior Cruciate Ligament (ACL): Mechanism, Biomechanics and Imaging Appearances

Education Exhibits
Location: MK Community, Learning Center

Participants

Allanah Barker MBCh, MRCS (Presenter): Nothing to Disclose
Andoni Paul Toms FRCR, PhD : Nothing to Disclose
TEACHING POINTS
The purpose of the exhibit is to: • Illustrate the spectrum of appearances of partial thickness ACL tears using pictorial examples. The ACL is a common site of injury both in the general population and in elite athletes. Use of 3T MRI imaging with its superior spatial resolution enables improved recognition of partial ACL tears. • Review the mechanisms of injury that may result in this type of tear. Tears of the different ACL bundles arise from separate and specific mechanisms of injury. • Emphasise key findings affecting patient management: Early recognition of such tears can be difficult, but familiarity with the imaging features allows accurate image interpretation.

TABLE OF CONTENTS/OUTLINE
• Pictorial review of the ACL using magnetic resonance imaging (MRI): Normal structure and function of the anteromedial (AMB) and posterolateral bundles (PLB) of the ligament in terms of the biomechanics of the knee and the influence of anatomical shape of the femoral condylar notch. • Pictorial illustration of isolated AMB and PLB tears and the common mechanisms of injury that lead to each, including characteristic flexion/extension and rotation injuries. • Pitfalls in imaging, including identifying normal anatomical variants such as the infrapatella plica, the anteromedial meniscofemoral ligament and the triple bundle ACL

MKE026-b
Happy Feet- A Simple Guide for the Radiological Review of Common Corrective Forefoot Surgeries
Education Exhibits
Location: MK Community, Learning Center

Participants
Elaine S. Gould MD : Nothing to Disclose
Hiten Bhaskar Patel MD : Nothing to Disclose
Kevin S. Baker MD (Presenter): Nothing to Disclose
Bernard Martin MD : Nothing to Disclose

TEACHING POINTS
After viewing this exhibit the learner should be be able to: Recognize common imaging abnormalities of the forefoot and toes in adults Understand basic principles and radiological measurements important in determination of bony and soft tissue deformity Discuss common corrective surgical options based on the deformity(or deformities). Recognize imaging appearance of various commonly utilized surgical procedures

TABLE OF CONTENTS/OUTLINE
Forefoot and toe deformaties in the adult with radiological appearance Radiographic assessment of basic forefoot alignment angles and measurements Biomechanics of deformity and principles of surgical correction Common corrective surgeries and imaging appearance Pre and post imaging examples of deformities with annotations Optimization of the radiological report- what should be included?

MKE028-b
X-linked Spondyloepiphyseal Dysplasia Tarda: Clinical and Radiological Findings in Mutation Confirmed Ten Patients
Education Exhibits
Location: MK Community, Learning Center

Participants
Sun-Min Jeong (Presenter): Nothing to Disclose
Ok Hwa Kim MD, PhD : Nothing to Disclose
Tae-Joon Cho MD : Nothing to Disclose
Yumie Rhee : Nothing to Disclose
Gye-Yeon Lim MD : Nothing to Disclose
Hae Ryong Song MD, PhD : Nothing to Disclose
Dong Kyu Jin : Nothing to Disclose

TEACHING POINTS
XL-SEDT affects male only. Vertebral endplates bony elevation (hump) is characteristically observed at lumbar area. Premature degenerative osteoarthritis of the hip joints TRAPPC2 gene mutation is responsible.

TABLE OF CONTENTS/OUTLINE
Introduction: X-linked spondyloepiphyseal dysplasia tarda (XL-SEDT) is a rare skeletal dysplasia, manifested with short stature and progressive back and/or hip joint pain. Unawareness of this disease may be a significant factor for delayed diagnosis. Materials and method:Ten patients (age range: 7-50 years) who had been undiagnosed/misdiagnosed were reassessed by an experienced radiologist in skeletal dysplasia. DNA sequencing of the TRAPPC2 gene was performed. Results: All patients were male and showed marked short stature (height in adult;137-152cm, < 3 p). Spine showed rectangular platyspondyly with hump-like elevations on the upper and lower endplates, predominantly the lumbar spine, rarely the thoracic spine, and not shown on the cervical spine. Pelvis showed relatively long ischium and pubic bones, resulted in vertically oblong shape of obturator foramina. Premature degenerative osteoarthrits of the hip joint was evident after age 30 years. Conclusion: Awareness of skeletal manifestations of XL-SEDT and recommendation of molecular confirmation can enhance the proper genetic counseling and clinical management.

MKE029-b
Magnetic Resonance Imaging of Sacrum Pathology
Education Exhibits
Location: MK Community, Learning Center

Participants
Jorge O. Suarez MD (Presenter): Nothing to Disclose
TEACHING POINTS

Review magnetic resonance imaging of common sacrum pathology including congenital lesions, inflammatory bone diseases, trauma, infection, benign and malignant neoplasms and post-operative changes. Discuss the utility of MRI particularly in lesions that may be easily missed on other imaging modalities. To explain useful classifications in congenital and inflammatory diseases of the sacrum. Describe the most common sacral bone neoplasms, considering benign lesions as giant cell tumor, aneurysmal bone cyst, osteoid osteoma and osteoblastoma and malignant lesions as metastases, chordoma, myeloma and sacroiliac joint invasion by other tumours. Recognize differential diagnosis of sacral nerve roots as ependymomas, meningiomas, schwannomas, and neurofibromas.

TABLE OF CONTENTS/OVERSEVIEW

Introduction MRI protocols Anatomy of the sacrum Congenital sacral lesions Inflammatory bone diseases Traumatic lesions Infectious lesions Benign bone tumors Malignant bone tumors Sacral canal neoplasms Post-operative Conclusions

MKE100

Calcification: Get Rid of This Rock in Your Shoe!

Education Exhibits
Location: MK Community, Learning Center

Participants
Marianne Lepage-Saucier MD (Presenter): Nothing to Disclose
Veronique Freire MD : Nothing to Disclose
Thomas Moser MD : Research Consultant, Horizon Sciences & Technologies Inc

TEACHING POINTS

1. Calcium hydroxyapatite crystal deposition disease can be treated by ultrasound-guided aspiration and cortisone injection. 2. Calcifications may be seen in arthritis: chondrocalcinosis in calcium pyrophosphate dihydrate deposition disease and calcinosis in connective tissue diseases. 3. Calcifications can be differentiated from ossifications by the absence of cortical and trabecular organizations. 4. Tumoral or tumor-like calcifications are divided in focal or diffuse soft tissue calcifications and osseous calcifications.

TABLE OF CONTENTS/OVERSEVIEW

The main objectives of this educational exhibit are: 1. To review the classification and investigation of multiple forms of calcifications in the soft tissues and bones 2. To discuss the treatment options of calcific tendinopathy Table of Contents/Outline: 1. Calcific tendinopathy a. Typical and atypical clinical presentations b. Imaging diagnosis including pitfalls c. Treatment options 2. Calcifications in arthritis a. Calcium pyrophosphate dihydrate deposition disease b. Connective tissue diseases 3. Tumoral and tumor-like soft tissue and bone calcifications a. Differentiation between calcifications and ossifications b. Soft tissue calcifications i. Focal ii. Diffuse c. Osseous calcifications

MKE101

How to Differentiate Psoriatic Arthritis from Other Inflammatory Arthritis Using Magnetic Resonance and Computed Tomography Imaging: The Use of Dynamic Contrast-Enhanced MRI Conventional and Dual-Energy CT

Education Exhibits
Location: MK Community, Learning Center

Participants
Augusto Guimaraes Altoe (Presenter): Nothing to Disclose
Clarissa Canella MD : Nothing to Disclose
Silvana Machado Mendonca : Nothing to Disclose
Pedro Henrique Rodrigues Martins MD : Nothing to Disclose
Bruno Baptista Hassel Mendes MD : Nothing to Disclose
Flavia Martins Costa MD : Nothing to Disclose

TEACHING POINTS

- Psoriatic arthritis frequently occurs in hand and wrist joints, mostly as monoarthritis or oligoarthritis, presenting a large spectrum of clinical and imaging findings. - MRI allows the visualization of bone marrow, soft tissue, articular and entheseal lesions, identifying subclinical arthritis and providing useful information regarding active inflammation. - New techniques such Dynamic Contrast-Enhanced MRI Conventional and Dual-energy CT can be used in the differentiation of others peripheral arthropathies.

TABLE OF CONTENTS/OVERSEVIEW

MR and CT imaging findings of psoriatic arthritis of peripheral articulations will be illustrate and discussed: • Synovitis • Enthesitis • Tendinitis • Dactylitis and soft tissue oedema • Bone erosions and bone oedema • Destructive and proliferative bony changes, subluxation, and ankylosis MR and CT imaging findings of other types of peripheral inflammatory arthritis that can simulate psoriatic arthritis will also be illustrated. Potential applications Dynamic Contrast-Enhanced MRI Conventional and Dual-energy CT for differential diagnosis of psoriatic arthritis and other inflammatory arthritis will be discussed.

MKE102

Imaging Evaluation of the Hip Prosthesis: Advances and New Concepts

Education Exhibits
Location: MK Community, Learning Center

Participants
TEACHING POINTS

Introduction: Total hip replacement is an option for patients with hip diseases that cause chronic discomfort and significant functional impairment as observed in advanced osteoarthritis. Most patients have a good prognosis with improvement in symptoms and physical function, however there is a risk of complications and these should be recognized. Methods: There were selected cases of monitoring patients to evaluate total hip replacement, by different imaging methods, especially by plain radiography.

TABLE OF CONTENTS/OUTLINE

Discussion: The normal appearance, with emphasis on specific anatomical landmarks and measures and possible complications were analyzed, as well as the materials of the prosthesis used. The initial evaluation of the prosthesis and its monitoring to detect subtle flaws were discussed. Conclusion: It is important that radiologists learn to recognize the good positioning of the prosthesis as well as the possible complications that can occur. Periodic monitoring with imaging is necessary to identify early evidences of prostheses failure, which can occur even in the absence of clinical symptoms.

MKE103

Imaging of Rapidly Destructive Arthropathies

Education Exhibits
Location: MK Community, Learning Center

Participants

Kimia Khalatbari Kani MD (Presenter): Nothing to Disclose
Hyojeong Mulcahy MD: Nothing to Disclose
Felix Sze-Kway Chew MD: Nothing to Disclose

TEACHING POINTS

1. Recognize rapidly destructive joint disease in a variety of clinical scenarios and formulate a differential diagnosis; 2. Describe the typical clinical and imaging features of idiopathic rapidly destructive arthropathies in the shoulder and hip joints; 3. Discuss the various theories described in the literature regarding etiology.

TABLE OF CONTENTS/OUTLINE

1. Definition of rapidly destructive arthropathy 2. Imaging, clinical presentation, evolution, and differentiating features a. septic arthritis b. neuroarthropathy c. crystal induced arthropathy d. post-traumatic synovitis e. ochronosis f. drug induced arthropathy g. amyloid arthropathy h. Sapho syndrome i. idiopathic rapidly destructive arthropathy 3. Proposed pathogenetic theories

MKE104

Magnetic Resonance Imaging in Psoriatic Arthropathy

Education Exhibits
Location: MK Community, Learning Center

Participants

Jose Antonio Narvaez MD (Presenter): Nothing to Disclose
Javier Narvaez MD: Nothing to Disclose
Javier Hernandez Ganan: Nothing to Disclose
Daniel Rodriguez Bejarano: Nothing to Disclose
Joan Miquel Nolla-Sole MD: Nothing to Disclose

TEACHING POINTS

MR imaging can detect inflammatory changes in peripheral and axial joints and entheses in PsA before the classic destructive and proliferative changes are detected on radiographs, improving the possibilities for early diagnosis and objective monitoring of the disease process. Identification of certain MR features can help to suggest a specific diagnosis of PsA in peripheral forms of the disease. Patterns of inflammation on MR imaging suggest that the different entheses are the primary target of inflammation in most of clinical forms of PsA.

TABLE OF CONTENTS/OUTLINE


MKE106

Oh, My Aching Back! A Review of Spinal Arthropathies

Education Exhibits
Location: MK Community, Learning Center

Participants

Kimberly Ruth Gardner MD (Presenter): Nothing to Disclose
TEACHING POINTS

1. Review the differences between syndesmophytes and osteophytes
2. Demonstrate the spectrum of imaging features of spinal arthropathies and imaging features that can be used to differentiate these entities from one another
3. Understand the pathophysiology and clinical course of each type of spinal arthropathy

TABLE OF CONTENTS/OUTLINE

Pertinent anatomy of the spine will be reviewed. The pathophysiology and clinical course of each type of arthropathy will be discussed with imaging findings demonstrated on radiographs and cross-sectional imaging. The disease entities to be discussed will include the following: I. Degenerative: a. Spondylosis Deformans b. Modic Changes c. Degenerative Disk Disease d. Diffuse Idiopathic Skeletal Hyperostosis e. Ossification of the Posterior Longitudinal Ligament II. Erosive a. Rheumatoid Arthritis b. Seronegative Spondyloarthropathies 1. Psoriatic Arthritis 2. Ankylosing Spondylitis III. Crystal Deposition Disease a. CPPD Arthropathy b. Gout IV. Pediatric a. Juvenile Idiopathic Arthritis b. Scheuermann Disease

MKE107

Search under the Cartilage: A Gamut of Subchondral Lesions

Education Exhibits
Location: MK Community, Learning Center

Participants

Shiri Farhana MBBS (Presenter): Nothing to Disclose
Masataka Uetani MD: Nothing to Disclose
Rafael Mursalin MBBS: Nothing to Disclose
Tetsuji Yamaguchi MD: Nothing to Disclose

TEACHING POINTS

1. The abnormalities in articular cartilage and subchondral bone are closely related to each other and should be regarded as a single unit in various disorders.
2. Subchondral bone marrow edema is a nonspecific finding, but it can be a major prognostic factor of articular damage.
3. Characteristic imaging findings and differential diagnosis in various subchondral lesions are presented.

TABLE OF CONTENTS/OUTLINE

1. Anatomy of subchondral bone - Subchondral trabecular bone structure on high resolution CT and MRI (Fig.1) - Normal and variations of subchondral bone marrow on MRI 2. Physiological relationship of cartilage and subchondral bone 
3. Pathological conditions of subchondral bone (Fig 2-5) - Trauma (e.g. subchondral fracture, osteochondral fracture, bone bruise) - Subchondral insufficiency fracture - Transient bone marrow edema syndrome - Osteonecrosis, osteochondritis dissicans - Various articular diseases (e.g. rheumatoid arthritis, osteoarthritis) - Tumors or tumor-like lesions (e.g. giant cell tumor, chondroblastoma)

MKE110

Anatomic Correlation of Forearm Nerve Ultrasound Anatomy at Sites of Entrapment in the Forearm

Education Exhibits
Location: MK Community, Learning Center

Participants

Kevin McGill MD, MPH (Presenter): Nothing to Disclose
Bisher Tarabishy MD: Nothing to Disclose

TEACHING POINTS

1) Peripheral nerve compression syndromes are a common ailment 2) The most common causes of peripheral neuropathy involve the median, ulnar, and radial nerves 3) Ultrasound is useful in diagnosing peripheral neuropathy 4) Ultrasound can also be helpful in treating peripheral neuropathy with ultrasound guided steroid injections

TABLE OF CONTENTS/OUTLINE

1) Gross anatomy of the median, ulnar, and radial nerves in the forearm 2) Ultrasound anatomy of the median, ulnar, and radial nerves in the forearm 3) Correlation of ultrasound anatomy with subsequent cadaver dissection 4) Evaluation of sites of peripheral nerve entrapment in the forearm

MKE113

Flick of the Wrist and You Are Done: Systematic Approach to the Radiographic Interpretation of the Wrist to Avoid Common Diagnostic Errors

Education Exhibits
Location: MK Community, Learning Center

Participants

Matthew R. Minor MD (Presenter): Nothing to Disclose
Liem Thanh Mansfield MD: Nothing to Disclose
TEACHING POINTS

Systematic checklist approach to the evaluation of wrist radiographs ensures detection of common and uncommon diagnoses. Evaluation of the carpal arcs helps to detect subtle cases of carpal dislocations.

Understanding the concept of carpal arcs of injuries enables the radiologist to detect the combination of injuries that is common in wrist trauma.

TABLE OF CONTENTS/OUTLINE


MKE115

Imaging of Chronic Wrist Pain

Education Exhibits

Location: MK Community, Learning Center

Certificate of Merit

Participants

Feng Poh MBBS, FRCR (Presenter) : Nothing to Disclose
Mon Ben Chow MD : Nothing to Disclose

TEACHING POINTS

1. To acquaint the reader with the selection of the appropriate imaging modality (including radiography, MRI, CT and ultrasound) in the evaluation of patients with chronic wrist pain based on the clinical scenario.
2. To discuss the etiologies in chronic wrist pain and their imaging features.
3. To describe a differential-based imaging approach in wrist pain and swelling with the use of case examples.
4. Brief discussion of the expanding role of advanced wrist imaging in inflammatory arthritides.

TABLE OF CONTENTS/OUTLINE


MKE116

Injuries of Dorsal Soft Tissues and Extensor Hood at the Metacarpophalangeal Joint in Closed Traumatism: Ultrasound and MR Imaging Evaluation with a Multilayer Approach

Education Exhibits

Location: MK Community, Learning Center

Participants

sonia hammoud (Presenter) : Nothing to Disclose
Raphael Campagna MD : Nothing to Disclose
Julien Rousseau : Nothing to Disclose
Eric Georges Pessis MD : Nothing to Disclose
Henri Guerrini MD : Nothing to Disclose
Jean-Luc Drape MD, PhD : Nothing to Disclose

TEACHING POINTS

-Ultrasound and MRI are able to assess the anatomy of dorsal soft tissues and extensor hood at the metacarpophalangeal joint
-A theorical superficial to deep multilayer approach is used to recognize each structure -US and/or MRI must be performed after a closed traumatism with normal XRay images -Dynamic evaluation with ultrasound can depict instabilities -Early depiction of injuries can change the treatment

TABLE OF CONTENTS/OUTLINE

1- Introduction / normal appearance with a multilayer approach 2- Static and dynamic imaging of dorsal soft tissues injuries at the metacarpophalangeal joint with a multilayer approach : i) Dorsal metacarpophalangeal bursitis ii) Tears of sagittal bands iii) Tears of intertendinous fibrous splits (of the V and II) iv) Tears of intertendinous connections (juncturae tendinum of the second, third and fourth intermetacarpal space) v) Capsular lesions 3- Conclusion

MKE117

Injuries of Hand and Wrist Tendons on MR Imaging

Education Exhibits

Location: MK Community, Learning Center

Certificate of Merit
Participants
Pushpender Gupta MBBS (Presenter): Nothing to Disclose
Bahram Kiani MD: Nothing to Disclose
Leon Lenchik MD: Nothing to Disclose
Scott David Wuertzer MD, MS: Nothing to Disclose

TEACHING POINTS
1. Injuries to the tendons of the hand and wrist may result from acute or chronic repetitive trauma. 2. MR imaging allows comprehensive evaluation of the tendons. 3. Familiarity with MR anatomy and appearance of various tendon injuries is essential for accurate diagnosis.

TABLE OF CONTENTS/OUTLINE

MKE118
Instability of the Elbow: Spectrum of Imaging Findings
Education Exhibits
Location: MK Community, Learning Center

Participants
Joao Paulo Oliveira Araujo MD (Presenter): Nothing to Disclose
Fernando Mesquita Lima: Nothing to Disclose
Douglas Leal: Nothing to Disclose
Hamilton Guidorizzi MD: Nothing to Disclose
Julio Brandao Guimaraes: Nothing to Disclose
Andre Yui Aihara MD: Nothing to Disclose
Carlos Henrique Longo MD: Nothing to Disclose

TEACHING POINTS
Objective.: The purpose of this presentation is to understand the biomechanics of the elbow joint and review the spectrum of imaging findings in instability. Technical overview The work will focus on evaluation of the elbow by magnetic resonance imaging.

TABLE OF CONTENTS/OUTLINE
Discussion: The instability of the elbow has been recognized as a spectrum ranging from a small lesion to frank dislocation. Between these two extremes, the more subtle instability is Posterolateral rotatory instability of elbow, which can cause functional impairment, but can be detected accurately only by radiographic study. Lesions of fibrous capsule and ligaments of the elbow usually progress in rotational direction from lateral to medial. Consequently, the dislocation occurs in the final stage of instability of the elbow with the coronoid process being located behind the humerus. We will demonstrate the key imaging features of elbow instability, particularly when evaluated by MRI. Conclusion: The knowledge of the various imaging findings of elbow instability may allow precise recognition of soft tissue injuries and bone structures, thereby assisting in patient treatment and surgical planning.

MKE120
Radiological Imaging of Congenital Hand Anomalies - 6yr Single Centre Experience and What the Hand Surgeons Want to Know
Education Exhibits
Location: MK Community, Learning Center

Participants
Emma Gerety MBBCh, PhD (Presenter): Nothing to Disclose
Ian Grant: Nothing to Disclose
Melanie Ann Hopper MBBCh, FRCR: Nothing to Disclose

TEACHING POINTS
By viewing this exhibit, the learner will:
1. Appreciate the importance of congenital hand anomalies which, although rare, present a unique physical and emotional challenge for children and their parents.
2. Gain a basic understanding of the normal development of the upper limb and what goes wrong to cause hand anomalies.
3. Understand which congenital hand anomalies are most commonly imaged.
4. Appreciate the classification systems and important imaging issues for the more common congenital hand anomalies.

TABLE OF CONTENTS/OUTLINE
Introduction to congenital hand anomalies -normal development of the upper limb -genetic pathways involved in limb development -results of disruption of upper limb development Common congenital hand anomalies imaged at our centre and useful classification systems -thumb duplication -syndactyly -thumb hypoplasia and longitudinal arrest -transverse arrest -epiphyseal abnormality Syndromes including congenital hand anomalies Timing of imaging of congenital hand anomalies

MKE121
Soft Tissue Tumours and Tumour-like Lesions of the Hand and Wrist: A Pictorial Review
Education Exhibits
Location: MK Community, Learning Center
Participants
Lee Lian Chew MBBS (Presenter): Nothing to Disclose
Rupak Dutta FRCR: Nothing to Disclose
Ankit Anil Tandon FRCR: Nothing to Disclose
Krishna Mohan Gummalla DMRD: Nothing to Disclose
Matthew George FRCR, MMed: Nothing to Disclose

TEACHING POINTS
The aim of this educational exhibit is: 1. To describe MR appearance of common soft tissue tumours and tumour-like lesions of the hand and wrist. 2. To identify features on MR imaging to help differentiate benign from malignant lesions. 3. To formulate differential diagnosis based on anatomical location and MR appearance.

TABLE OF CONTENTS/OUTLINE

MKE122
The Luckless Lunate: Pre- and Postoperative Imaging of Kienbock Disease

Education Exhibits
Location: MK Community, Learning Center

Participants
Erika Nealey MD (Presenter): Nothing to Disclose
Jonelle Marie Petscavage-Thomas MD, MPH: Consultant, Medical Metrics, Inc
Felix Sze-Kway Chew MD: Nothing to Disclose
Alice S. Ha MD: Nothing to Disclose

TEACHING POINTS
Kienbock disease, or avascular necrosis of the lunate, is a progressive disease ultimately resulting in collapse, fragmentation, and end-stage arthrosis of the lunate. Symptoms include chronic pain, decreased wrist range of motion, and decreased grip strength. A recent systematic review of various surgical treatments of Kienbock disease showed none with a superior outcome; as such, different treatments remain in current clinical use. This educational exhibit is designed to describe the pre- and post-operative imaging appearances of Kienbock disease, beginning with anatomic antecedents, pathophysiology, stages of disease progression correlated with surgical treatments, normal and abnormal postoperative appearances, and appropriate use of imaging.

TABLE OF CONTENTS/OUTLINE
1.) Anatomic antecedents 2.) Pathophysiology 3.) Osteonecrosis (Stage 1) -Treatment - casting 4.) Sclerosis (Stage 2) -Treatment in setting of ulnar negative variance --Pedicled bone graft --Radial osteotomy --Capitate shortening 5.) Collapse and Fragmentation (Stage 3) -Treatment --Intercarpal arthrodesis --Lunate excision --Proximal row carpectomy 6.) End-Stage Arthrosis (Stage 4) -Treatment --Proximal row carpectomy --Carpal arthrodesis

MKE123
The TFCC - An Illustrated Review of Its Anatomy and Injury Patterns Based on the Palmer Classification

Education Exhibits
Location: MK Community, Learning Center
Cum Laude

Participants
Matthew Raymond Skalski DC (Presenter): Nothing to Disclose
Eric Allan White MD: Nothing to Disclose
Dakshesh Bhuabhai Patel MD: Nothing to Disclose
George Robert Matcuk MD: Nothing to Disclose
Aaron Schein MD: Nothing to Disclose
Deborah M. Forrester MD: Nothing to Disclose
Hector Riveramelos BS: Nothing to Disclose

TEACHING POINTS
The purpose of this presentation is to provide the viewer with: 1. A comprehensive review of the complex anatomy of the TFCC 2. An understanding of potential pitfalls in the accurate diagnosis of TFCC tears 3. A review of the pattern of TFCC tears as described by the Palmer classification using original illustrations and example cases.

TABLE OF CONTENTS/OUTLINE
Anatomy of the TFCC -Gross and sectional illustrations of anatomy, including ligamentous attachments Tear mimics -Normal recesses -Ligamentum subscutenum -Hyaline cartilage interface -Normal variations -Patient positioning Palmer Classification Class 1 - traumatic -Type A -Type B -Type C -Type D Class 2 - degenerative (ulnocarpal abutment syndrome) -Type A -Type B -Type C -Type D -Type E

MKE124
What's Goin' on in the Guyon's Canal?

Education Exhibits
Location: MK Community, Learning Center
Participants

Naveen Vasireddy MBBS, FRCR (Presenter): Nothing to Disclose
Syahminan Suut MBChB, FRCR: Nothing to Disclose
Mohammad Waseem: Nothing to Disclose
Jochen Fischer: Nothing to Disclose
Suresh Babu Amilneni Venkat MBBS, MD: Nothing to Disclose
Kelvin Choi MBChB: Nothing to Disclose
Rashpal Bassi: Nothing to Disclose

TEACHING POINTS

Introduction: The Guyon’s canal is a 4cm long fibroosseous tunnel which extends from palmar carpal ligament along the proximal pisiform bone edge to the aponeurotic arch of the hypothenar muscles. The tunnel of Guyon is clinically significant because of its contents, the ulnar artery, ulnar nerve, accompanying veins and fat. Lesions arising from these structures within the canal and pathology along the margins of the canal can lead to compression of ulnar nerve. Wrist is the second most common site for ulnar nerve entrapment after elbow, however, diagnosis of ulnar nerve compression in the Guyon’s canal is often delayed.

Teaching points: Our pictorial review aims to raise awareness of ulnar nerve compression in Guyon’s canal. Our case-mix includes pathology from fat, nerve and vascular origins ensuring that the reader is exposed to the whole gamut. Our cases include an interesting collection of intrinsic and extrinsic pathologies involving Guyon’s canal.

TABLE OF CONTENTS/OUTLINE

Table includes clinical presentation, diagnostic pathway, review of current literature and characteristic imaging findings of Guyon’s canal pathology as well as normal anatomy are included.

MKE126

Assessment Chronic Recurrent Multifocal Osteomyelitis (CRMO) Using Conventional MRI and DWI: Usual and Unusual Presentations

Education Exhibits

Location: MK Community, Learning Center

Participants

Flavia Martins Costa MD (Presenter): Nothing to Disclose
Clarissa Canella MD: Nothing to Disclose
Augusto Guimaraes Aloe: Nothing to Disclose
Silvana Machado Mendonca: Nothing to Disclose
Pedro Henrique Rodrigues Martins MD: Nothing to Disclose
Ierece Lins Aymore: Nothing to Disclose

TEACHING POINTS

- The purpose is to describe conventional (MR) imaging appearance of usual and unusual forms of CRMO and assess the role of DWI and whole-body DWI in diagnosis of disease, assessment in differential diagnosis, following treatment and correlation with clinical findings and laboratory data. - Chronic recurrent multifocal osteomyelitis (CRMO) is a non-infectious inflammatory bone disease of unknown origin and can be a challenging diagnosis. - Conventional MRI, together with DWI and WB-DWI MRI may contribute to the diagnosis and facilitate the follow-up of children with CRMO. This non-invasive, non-irradiating procedure will also allow depicting more precisely the natural history of bone and extra-osseous lesions in CRMO, can improve the diagnostic accuracy and assessment follow up treatment management.

TABLE OF CONTENTS/OUTLINE

1. To illustrate with conventional MRI, and correlate with DWI and WB-DWI images the usual and unusual forms of CRMO; 2-To illustrate the differential diagnosis (osteomyelitis, ewing sarcoma, leukemia, lymphoma, rhabdomyosarcoma, metastasis) with DWI and conventional images; 3-To correlate with radiologic and histopathologic findings; 4-The usefulness of these sequences in follow-up treatment management.

MKE126

Bug vs. Host Disease: Musculoskeletal Infections and Mimickers in Vulnerable Patient Populations

Education Exhibits

Location: MK Community, Learning Center

Certificate of Merit

Participants

Christopher E. Kim MD (Presenter): Nothing to Disclose
Tetyana A. Gorbachova MD: Nothing to Disclose
Charles B. Mulhern MD: Nothing to Disclose

TEACHING POINTS

- To present a multimodality review of the spectrum of musculoskeletal infections unique to patients with diabetes, end-stage renal disease, and otherwise immunocompromised states as well as post-arthroplasty patients. - To highlight key imaging features distinguishing population-specific manifestations of musculoskeletal infection as well as non-infectious mimickers. - To provide insight into these population-specific considerations while reinforcing the basic radiographic principles of musculoskeletal infection.

TABLE OF CONTENTS/OUTLINE

MKE127

Differentiating Benign versus Pathological Vertebral Compression Fractures in the Osteoporotic Spines: Causes and Concerns

Education Exhibits
Location: MK Community, Learning Center

Participants

Rupak Dutta FRCR (Presenter): Nothing to Disclose
Vasu Keshav Sharma MBBS, FRCR: Nothing to Disclose
Krishna Mohan Gummalla DMRD: Nothing to Disclose
Matthew George FRCR, MMed: Nothing to Disclose

TEACHING POINTS

Objectives: 1. Identifying benign from pathological fractures based on morphology. 2. DWI has high sensitivity with high PPV. 3. Signal intensity ratio (SIR) of STIR with in/opposed phase.

TABLE OF CONTENTS/OUTLINE

Ascertaining the cause of vertebral collapse in patients with no known malignancy is of paramount importance since it is a predictor of prognosis and outcome. Osteoporotic compression may be indistinguishable from malignant collapse. Vertebral fractures may be detected on radiographs, CT or nucleutide studies but so often is unable to distinguish between benign versus malignant collapse. A retrospective of the MRI spines with acute vertebral collapse from 2008 to 2013. MR features of malignant vertebral collapse includes multiple vertebral involvement, signal intensity, Gad enhancement, posterior cortex margins, paraspinal soft tissues, posterior element, DWI/ADC, Chemical shift ( dual echo). MRI has a sensitivity of 100 % and specificity of 64 %. DWI has 92% sensitivity, 90% specificity and 85 % accuracy in differentiating benign from malignant. PPV and NPV values of approx 78 and 90 % respectively. Close follow up/ PET scan and also bone biopsy had to be resorted to in the remaining patients with indeterminate causes.

MKE129

Side Effects of Drugs on Musculoskeletal System

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants

Julia Calatayud MD (Presenter): Nothing to Disclose
Maria Andreu Ruiz De Gopegui MD: Nothing to Disclose
Diana Exposito MD: Nothing to Disclose
Diego Pereira Boo: Nothing to Disclose
Beatriz Alvarez De Sierra Garcia MD: Nothing to Disclose
Javier Sanchez Hernandez: Nothing to Disclose

TEACHING POINTS

To provide an overview of the more frequent drug-induced musculoskeletal disorders. To illustrate the radiological findings of these effects by radiological techniques: Conventional radiology, computed tomography (CT) and Magnetic Resonance (MR).

TABLE OF CONTENTS/OUTLINE

Some drugs can have adverse effects on musculoskeletal system. Nowadays, the increasing use of a wide variety of drugs with side effects requires a thorough understanding by radiologist and the right approach in evaluating imaging techniques to detect these alterations. We reviewed the pathologic findings induced musculoskeletal drugs in our hospital in the last year. We reviewed the clinical and demographic data and have characterized these findings agree with bone, muscle and tendon manifestations mainly. Abnormalities such as insufficiency fractures induced by bisphosphonates, tendinopathy and myopathy induced by statins or quinolones, osteoporosis and avascular osteonecrosis caused by corticosteroids will be presented, evaluating the radiological findings with appropriate methods of image (RX, CT and RM). The adverse effects on musculoskeletal system are common and often undiagnosed. Familiarity with these commonly encountered side effects leads to a more accurate and precise diagnosis and is essential for proper clinical management.

MKE130

The Use of Whole-body MR Imaging in Rheumatic Diseases

Education Exhibits
Location: MK Community, Learning Center

Participants

Augusto Guimaraes Altoe (Presenter): Nothing to Disclose
Clarissa Canella MD: Nothing to Disclose
Silvana Machado Mendonca: Nothing to Disclose
Flavia Martins Costa MD: Nothing to Disclose
Pedro Henrique Rodrigues Martins MD: Nothing to Disclose
Evandro Miguelote: Nothing to Disclose

TEACHING POINTS

The purpose of this article is: - To demonstrate the usefulness of whole-body MR imaging in patients with autoimmune and inflammatory systemic disorders, as chronic recurrent multifocal osteomyelitis (CRMO), inflammatory miophaties, spondyloarthritits, helping the diagnosis, specially in multifocal and non symptomatic disease. - To describe imaging protocols, interpretation of imaging findings and initial experience with whole-body MR imaging in the evaluation of some rheumatic diseases. Also, the correlation with disease activity and some differential diagnosis will be discussed.
### Table of Contents/Outline

**MKE131**

**Unusual Forms of Presentation of Tuberculous Vertebral Osteomyelitis**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**

- **Pilar Marquez-Sanchez (Presenter):** Nothing to Disclose
- **Torcuato Garcia de la Oliva MD:** Nothing to Disclose
- **Juan de Dios Colmenero-Castillo MD, PhD:** Nothing to Disclose
- **Juan Diego Ruiz-Mesa:** Nothing to Disclose

**Teaching Points**

- The aim of this exhibit are: -To show unusual form of presentation of tuberculous vertebral osteomyelitis (TVO) as seen with CT and MRI. -To know the manifestations of this disorder to avoid underdiagnosis, leading to the possible development of complications.

**Table of Contents/Outline**

- To remember the normal presentation of TVO.
- In some patients, the form of presentation of TVO is often atypical. We want to show several examples of TVO with unusual locations and manifestations. • TVO infection confined to one vertebral body. • Multiple spinal lesions. • The cervical spine is often involved. • Lytic and sclerotic changes. • Involvement of the posterior elements of the vertebrae. • Exceptionally large abscess formation with calcification in the wall and fistulization. • Lack of involvement of the intervertebral disc.

### MKE133

**Association of a Thickened Suprapatellar Plica with Quadricipital Fat Pad Edema on Magnetic Resonance Imaging of the Knee**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**

- **Daniel Zimmermann Stefani MD:** Nothing to Disclose
- **Luciano Lerch Hoffmann MD (Presenter):** Nothing to Disclose

**Teaching Points**

1. To describe the anatomy of the fat pads and plicae of the knee
2. To review current concepts about the pathophysiology of the quadricipital fat pad edema and plicae diseases
3. To demonstrate MRI findings of quadricipital fat pad edema and plicae diseases
4. To discuss the association of a thickened suprapatellar plica and quadricipital fat pad edema and the clinical significance of these findings

**Table of Contents/Outline**

- Anatomy of the fat pads and plicae of the knee
- Current concepts about quadricipital fat pad edema and plicae diseases
- Review of the MRI findings of: - Quadricipital fat pad edema - Plicae diseases, focusing on the suprapatellar plica Relationship of a thickened suprapatellar plica and quadricipital fat pad edema

### MKE134

**Clinical Utility of CT in the Identification of Normal and Abnormal Anatomy of the Knee: Spectrum of Knee Pathology Identifiable on Dual Energy CT Scans**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**

- **Shamir Rai BSC (Presenter):** Nothing to Disclose
- **Patrick McLaughlin FFR(RCSI):** Nothing to Disclose
- **Savvas Nicolaou MD:** Nothing to Disclose

**Teaching Points**

1) Discuss scope, clinical presentation and rationale for screening of knee pathology 2) Discuss the imaging modalities and spectrum of imaging findings for diagnosing knee pathology, with a focus on dual energy CT, and illustrate with imaging examples with MRI correlation 3) Review the utility of imaging in management and diagnosis of knee pathology 4) Review novel imaging techniques for maximizing the identification of normal anatomy and pathology of the knee using CT

**Table of Contents/Outline**

- Review the pathophysiology, epidemiology and clinical presentation of knee injuries
- Discuss the imaging modalities and spectrum of imaging findings for diagnosing knee pathology, with a focus on dual energy CT, and illustrate with imaging examples with MRI correlation
- Review the utility of imaging in management and diagnosis of knee pathology
- Review novel imaging techniques for maximizing the identification of normal anatomy and pathology of the knee using CT

- Review the normal anatomy and important landmarks of the knee and supporting structures on CT and MRI
- Review the utility and limitations of imaging modalities used for the assessment of knee anatomy and pathology
- Demonstrate the spectrum knee injuries using imaging examples, including bone marrow edema, urate deposition, meniscal pathology, ligamentous pathology, and bony/cartilaginous pathology
- Discuss an imaging-based management algorithm for identification of knee pathology
- Discuss new imaging techniques and technology applicable for maximizing the identification of normal anatomy and pathology of the knee on CT
MKE136

Findings Imaging and Clinical Significance of Avulsion Fractures in the Knee

Education Exhibits

Location: MK Community, Learning Center

Participants

Joao Paulo Oliveira Araujo MD (Presenter): Nothing to Disclose
Fernando Mesquita Lima: Nothing to Disclose
Hamilton Guidorizzi MD: Nothing to Disclose
Julio Brandao Guimaraes: Nothing to Disclose
Andre Yui Aihara MD: Nothing to Disclose
Carlos Henrique Longo MD: Nothing to Disclose

TEACHING POINTS

Introduction: The knee joint has several tendinous and ligamentous structures, which makes it particularly vulnerable to complex trauma injuries. The aim of our study is to present in detail the general mechanisms of avulsion fractures and major findings in magnetic resonance study, with emphasis on the most common injuries. Materials and Methods: There were evaluated by 1.5 Tesla magnetic resonance study, between January 2011 and November 2012, 70 patients (57 males and 13 females) who developed severe knee injury, most during the practice of sport.

TABLE OF CONTENTS/OUTLINE

Discussion: A variety of avulsion fractures in the knee can occur during trauma, including capsuloligament avulsions like Segond fracture, reverse Segond fracture, avulsions of cruciate ligament and arcuate complex; tendon avulsions like avulsions of the femoral biceps, semimembranosus and quadriceps, and lastly, avulsions resulting from repetitive trauma, such as Sinding-Larsen-Johansson and Osgood-Schlatter traction osteochondritis. Conclusion: Although conventional radiography is usually the imaging modality performed at a first time, MRI is the ideal non-invasive method to assess the extent and severity of avulsion fractures of the knee, showing a significant impact on therapeutic management and prognosis.

MKE137

Iliotibial (IT) Tract/Band: Multimodality Imaging and Illustrative Review of Anatomy, Injuries, and Other Pathology

Education Exhibits

Location: MK Community, Learning Center

Participants

Giovanni Passanante MD (Presenter): Nothing to Disclose
George Robert Matcuk MD: Nothing to Disclose
Deborah M. Forrester MD: Nothing to Disclose
Dakshesh Bhulabhai Patel MD: Nothing to Disclose
Matthew Raymond Skalski DC: Nothing to Disclose
Eric Allan White MD: Nothing to Disclose
Aaron Schein MD: Nothing to Disclose

TEACHING POINTS

The Iliotibial tract (also known as Maissiat's band or IT band) and its associated muscles function to extend, abduct, and laterally rotate the hip, as well as aiding in the stabilization of the knee. A select group of associated injuries and pathologies are seen in man due to repetitive stress and direct trauma. The goal of this exhibit is to educate the radiologist about the clinical presentation, pathophysiology, and imaging findings of Iliotibial band anatomy and associated pathology. Using a case based format with multimodality imaging examples and illustrations, the radiologist will review Iliotibial band friction syndrome, iliobial bursitis, external snapping hip syndrome, Morel-Lavallée lesions, iliobial tears, and avulsion fracture of Gerdy’s tubercle. Clinical management will also be briefly discussed.

TABLE OF CONTENTS/OUTLINE

-Pictorial and imaging anatomy of the Iliotibial tract
-Mechanism of injury and clinical presentation of specific iliobial tract pathology
-Radiological imaging cases with multimodality examples and original pictorial illustrations of all discussed iliobial tract pathology
-Management of Iliotibial tract injuries and other pathology

MKE138

Infrapatellar Fat Pad of Hoffa: Imaging Findings

Education Exhibits

Location: MK Community, Learning Center

Participants

Georges Hayek (Presenter): Nothing to Disclose
Guillaume Mercy: Nothing to Disclose
Audrey Massein: Nothing to Disclose
Jerome Renoux MD: Nothing to Disclose
Delphine Zeitoun MD: Nothing to Disclose
Aziza Abi-Yaici MD: Nothing to Disclose
Jean-Louis Brasseur: Nothing to Disclose
Philippe A. Grenier MD: Nothing to Disclose

TEACHING POINTS

1- To know the anatomy of the infrapatellar fat pad of Hoffa.
2- To know the different aspects on imaging of the normal infrapatellar fat pad of Hoffa.
3- To know the main diseases that can affect the infrapatellar fat pad of Hoffa and their main imaging features.

TABLE OF CONTENTS/OUTLINE
1. Normal anatomy of the infrapatellar fat pad of Hoffa.
2. Normal imaging aspects of the infrapatellar fat pad of Hoffa.
   a. Radiography
   b. Ultrasonography
   c. CT-scan
   d. MRI
3. Main diseases:
   a. Mass syndrome:
      i. Cystic lesions
      ii. Ganglion cyst
      iii. Meniscal cyst
   b. Tissular lesions:
      i. Nodular synovitis
      ii. Metastasis
      iii. Primitive tumor
   c. Fibrotic lesions:
      i. Postarthroscopy or postsurgery fibrosis
      ii. Cyclops lesions
   d. Ossified or calcified lesions:
      i. Primary synovial osteochondromatosis
      ii. Secondary synovial osteochondromatosis
      iii. Intracapsular osteochondroma
      iv. Calcifications after infiltration
   e. Vascular lesion:
      i. Hemangioma
3. Infiltration:
   a. Femoropatellar friction syndrome
   b. Infrapatellar plicae
   c. Hoffa disease
   d. Infiltration near a fracture
   e. Septic, inflammatory or microcrystalline arthritis
   f. Tendinopathy or enthesopathy of the patellar ligament.

**MKE140**

**Kinesiology of Knee Fat Pads - Normal Fat Pads Movements as Observed during Dynamic Ultrasound Examination**

**Education Exhibits**

Location: MK Community, Learning Center

**Certificate of Merit**

**Participants**

- Waqar Aslam Bhatti MBCh (Presenter): Nothing to Disclose
- Gulraiz Sarfaraz Ahmad MBChB: Nothing to Disclose
- Shahrukh Raees Ahmad: Nothing to Disclose
- Jawad Naqvi BSC, MBBS: Nothing to Disclose
- Reda Braham Chaouch MD: Nothing to Disclose
- Muhammad Mubashar MBBS, FRCR: Nothing to Disclose

**TEACHING POINTS**

- To review the anatomy, function, and normal dynamics of the knee fat pads during extension and flexion of the knee. To discuss the factors which disturb the normal dynamics and lead to the differing "fat pad impingement syndromes".

**TABLE OF CONTENTS/OUTLINE**

A. Anatomy and function of the knee fat pads.
B. Technique and tips for the assessment of fat pads.
C. Normal dynamics of the superior and lower portions of the Hoffa’s fat and complex interplay between the Quadriceps and the pre-femoral fat pad.
D. Factors contributing to abnormal dynamics and the Fat pad impingement syndrome.
E. Percutaneous management.

**MKE141**

**Magnetic Resonance Imaging of Anterior Cruciate Ligament Reconstruction**

**Education Exhibits**

Location: MK Community, Learning Center

**Participants**

- Giuseppe Peritore MD (Presenter): Nothing to Disclose
- Raffaello Sutera MD, PhD: Nothing to Disclose
- Domenico Messana: Nothing to Disclose
- Angelo Iovane MD: Nothing to Disclose
- Massimo Midiri MD: Nothing to Disclose

**TEACHING POINTS**

- To review the MRI imaging appearances of intact anterior cruciate ligament (ACL) graft and describe the assessment of impingement and postoperative complications.

**TABLE OF CONTENTS/OUTLINE**

- Traditional ACL reconstruction is performed with autograft; disadvantages of this technique are donor site morbidity and a long rehabilitation period. Allograft tendons are reported to have excellent clinical results, but these grafts bring the risk of infection.
- The most common indications for evaluating ACL reconstructions with MR imaging include: 1) Failure of ACL reconstruction to stabilize the knee; 2) Postoperative re-injury to the knee; 3) Postoperative stiffness especially extension (flexion contracture); 4) Preparation for revision of a failed ACL reconstruction. MRI is a non-invasive method for assessment of these problems, because it allows direct visualization of the graft, as well as the fixation devices, tibial and femoral tunnels or bioabsorbable cross pins. MRI shows if the bone tunnels are properly positioned. At long-term follow up MRI can detect intrasubstance ACL graft signal changes that represent a pathologic finding indicative of possible graft impingement, degeneration or partial tearing.

**MKE142**

**Meniscal Flap Tears and Flipped Fragments: Clues to Diagnosis, Where to Find Them, and Pitfalls in Diagnosis**

**Education Exhibits**

Location: MK Community, Learning Center

**Participants**

- Anthony Dennis Mohabir MD (Presenter): Nothing to Disclose
- Heiste Robyn Coopersmith MD: Nothing to Disclose
- Daniel M. Walz MD: Nothing to Disclose
- John S. O’Donnell MD: Nothing to Disclose
- Jarett Burak MD: Nothing to Disclose
- Michael Brown MD: Nothing to Disclose

**TEACHING POINTS**

- 1. Medial and lateral meniscal tears with flaps and flipped fragments are quite common and should be recognized by the radiologist.
- 2. Meniscal flaps and flipped fragments are usually found in one or more of several common locations. These
TABLE OF CONTENTS/OUTLINE
Meniscal Anatomy Overview and Overview of Potential Locations for Displaced Meniscal Tissue Clinical Cues to Displaced Meniscal Injury Imaging Clues to Displaced Meniscal Injury Displaced Meniscal Injury Examples (Flap Tears/Flipped Meniscal Tissue, Bucket Handle Tears, and Free Fragments in Common and Uncommon locations) Pitfalls in Diagnosing Displaced Meniscal Tissue Clinical Implications and Treatment Issues

MKE143
MRI Evaluation of Anatomic Variations of Menisci and Perimeniscal Ligaments Anatomy and Potential Related Pitfalls
Education Exhibits
Location: MK Community, Learning Center

Participants
Marcelo Novelino Simao MD, PhD (Presenter): Nothing to Disclose
Marcello Henrique Nogueira-Barbosa MD, PhD : Nothing to Disclose

TEACHING POINTS
Improve knowledge of meniscal anatomical variants and normal anatomy of perimeniscal ligaments; Contribute to accurate interpretation of menisci tears and avoid potential pitfalls;

TABLE OF CONTENTS/OUTLINE

MKE144
Peri-patellar Fat Impingement: Anatomy, Imaging and Significance
Education Exhibits
Location: MK Community, Learning Center

Participants
Luis Enrique Diaz MD (Presenter): Nothing to Disclose
William F. Arndt MD : Nothing to Disclose
Ajay R. Goud MD : Nothing to Disclose
Frank W. Roemer MD : Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC
Ali Guermazi MD, PhD : President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgaA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc

TEACHING POINTS
1. Review of anterior knee fat pads imaging anatomy 2. Description, imaging diagnosis, differential diagnosis and therapeutic relevance of fat pad impingement syndromes

TABLE OF CONTENTS/OUTLINE
1. Imaging anatomy of peripatellar fat pads and associated structures 2. Description of knee fat pad impingement syndromes and their clinical implications • Suprapatellar fat impingement • Preferemoral fat impingement • Infrapatellar fat impingement 3. Imaging review of fat impingement syndromes of the anterior knee 4. Discussion of differential diagnosis 5. Therapeutic implications

MKE147
The Infrapatellar Fat Pad of Hoffa: A Comprehensive Pictorial Review of Intrinsic and Extrinsic Pathology
Education Exhibits
Location: MK Community, Learning Center

Participants
Patrick Kobes DO (Presenter): Nothing to Disclose
Anthony Dennis Mohabir MD : Nothing to Disclose
Michael Brown MD : Nothing to Disclose
Daniel M. Walz MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the anatomy on MR imaging of the infrapatellar fat pad of Hoffa, as well as the adjacent structures. 2. To provide a pictorial review of the intrinsic and extrinsic pathology of Hoffa’s fat pad.
TABLE OF CONTENTS/OUTLINE
1. Anatomy of Hoffa’s fat pad and adjacent structures
2. Review of Imaging Findings
   a. Intrinsic Pathology
      i. shear injury
      ii. infrapatellar fat pad syndrome
      iii. synovial lipoma
      iv. focal pigmented villo-nodular synovitis
      v. intercapsular chondroma
      vi. deep infrapatellar bursitis
      vii. postsurgical and post-arthroscopic fibrosis
   b. Extrinsic Pathology
      i. synovial chondromatosis
      ii. synovial hemangioma
      iii. intra-articular malignancies
      iv. synovial/ganglion cyst
      v. fat pad impingement syndrome
3. Sample cases
4. Summary

MKE149
The Spectrum of Tibial Plateau Fractures

Education Exhibits
Location: MK Community, Learning Center

Participants
Ricki Upendra Shah MD (Presenter): Nothing to Disclose
Mital Kishor Patel MD : Nothing to Disclose
Andrew Lee Chiang MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. Review the classification systems of Tibial plateau fractures, including the Schatzker and AO classification system 2. Discuss the mechanisms of Tibial plateau injuries. 3. Describe the imaging findings and utility of CT and MRI with an emphasis on general management principles particularly focusing on operative vs non-operative management.

TABLE OF CONTENTS/OUTLINE
1. Anatomy and Classification systems
2. Mechanisms of Injury
3. Imaging findings on radiography, CT and MRI
4. Management principles
5. Sample Cases illustrating points 1-4

MKE150
Ultrasonography of the Patellar Tendon: The First-line Imaging

Education Exhibits
Location: MK Community, Learning Center

Participants
Guillaume Mercy (Presenter): Nothing to Disclose
Jean-Louis Brasseur : Nothing to Disclose
Audrey Massein : Nothing to Disclose
Philippe A. Grenier MD : Nothing to Disclose

TEACHING POINTS
The patellar tendon is the anatomical and functional extension of the quadriceps tendon. Ultrasound (US) is the first-line imaging of the patellar tendon. Advantages of US compared with MRI include better spatial resolution which helps characterize a lesion, dynamic study, easier detection of vascularity by Doppler. Direct expansions of the quadriiceps tendon on the tibia explain why the retraction of a disrupted patellar tendon can be missing. The location of a microtraumatic injury depends on the weakest point of the patellar tendon, which varies according to the age. In young athletes proximal tendinosis (jumper's knee) is the most frequent condition. US can help make the difference with physiological changes of the tendon and provides crucial data if surgery is considered.

TABLE OF CONTENTS/OUTLINE
Anatomy and function
Ultrasonography: how to proceed? US vs MRI?
Normal and pathological tendon
Microtraumatic injuries: -children and teenagers: Osgood Schlatter and Sinding Larsen Johansson diseases -young athletes: proximal (jumper's knee) or distal tendinosis -mature adults: diffuse tendinosis -impingements: lateral femoral condyle, ossifications, foreign bodies, devices
Traumatic injuries: ruptures
Other conditions: rheumatismal enthesitis, patella baja and alta, complications of surgery including tendon harvest

MKE151
Ultrasound and MRI Evaluation of the Extensor Mechanism

Education Exhibits
Location: MK Community, Learning Center

Participants
Kara Gaetke Udager MD (Presenter): Nothing to Disclose
Corinne Mariene Yablon MD : Nothing to Disclose
Deepa R. Pai MD : Nothing to Disclose
Qian Dong MD : Nothing to Disclose
Gandikota Girish MBBS, FRCR : Nothing to Disclose
Jon A. Jacobson MD : Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

TEACHING POINTS
After review of this exhibit, the viewer will be able to: 1. List common causes of pathology of the extensor mechanism 2. Explain the normal anatomy of the extensor mechanism including common anatomical variants 3. Describe the ultrasound and
MRI appearance of pathology of the extensor mechanism. Discuss the factors determining the utility of ultrasound vs. MRI in evaluating the extensor mechanism.

**TABLE OF CONTENTS/OUTLINE**

We aim to describe and illustrate the spectrum of imaging findings in the extensor mechanism on both ultrasound and MRI, including: - Quadriceps and patellar tendon tears, complete and partial - Patellar tendinosis - Patellar instability including jumper's knee and related entities of Osgood-Schlatter and Sinding-Larsen-Johansson syndromes - Patellar fracture - Patellofemoral osteoarthrosis - Patellar tracking abnormalities with fat pad abnormality - Bursal pathology - Normal variants and imaging pitfalls including dorsal defect of the patella, bipartite patella, and magic angle artifact.

### MKE153

**Achilles Tendon: MR Imaging Review of Anatomy and Pathology**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**
- Pushpender Gupta MBBS (Presenter): Nothing to Disclose
- Leon Lenchik MD: Nothing to Disclose
- Scott David Wuerzer MD, MS: Nothing to Disclose

**TEACHING POINTS**

1. There is a relationship between Achilles tendon anatomy and pathology. 2. MR imaging allows for accurate diagnosis of a wide range of Achilles tendon pathology.

**TABLE OF CONTENTS/OUTLINE**

Perspective: The Achilles tendon is the largest and strongest tendon in the body; however, it is the most commonly injured tendon, accounting for approximately 20% of all large tendon injuries. Review of pertinent anatomy: The Achilles tendon typically develops pathology in three different zones: the musculotendinous junction zone, the midsubstance zone approximately 4 cm proximal to the calcaneus, and the insertion zone at the calcaneus. This anatomy will be reviewed. Etiology and risk factors: Although the etiology for Achilles tendon pathology is often idiopathic, the most common pathologies are related to overuse and/or repetitive micro-trauma. Risk factors include systemic disorders including diabetes, hyperlipidemia, and hypertension. Examples: The MR imaging characteristics for common and uncommon pathology in the Achilles tendon will be discussed through case examples. Specifically, examples of insertional and non-insertional tendinosis, Haglund's syndrome, paratenonitis, paratendinitis, tendon tears, tendon avulsions, and an Achilles tendon xanthoma will be shown. Management: A brief discussion of current management recommendations.

### MKE155

**Ankle Impingement Syndromes: An Illustrative Review**

*Education Exhibits*

*Location: MK Community, Learning Center*

**Participants**
- Ronnie Chen MD (Presenter): Nothing to Disclose
- Daria Motamedi MD: Nothing to Disclose
- Kira Chow MD: Nothing to Disclose
- Shahla Modarresi MD: Nothing to Disclose

**TEACHING POINTS**

This exhibit will:

1. Review the definition and classification of the various impingement syndromes about the ankle joint. 2. Review the pertinent ligamentous anatomy of the ankle joint. 3. Provide an overview of the clinical presentations, common causes, and imaging manifestations of impingement at and about the ankle joint.

Main teaching points:

1. The ankle impingement syndromes are caused by entrapment of an anatomic structure of the ankle joint by pathologic soft tissue or bony conditions leading to chronic pain and restricted mobility.
2. MRI is best used to assess the soft tissue etiologies of impingement and radiography can be used to evaluate for osseous abnormalities.

**TABLE OF CONTENTS/OUTLINE**

Ankle Impingement Syndromes - Definition and Classification
- Review of ligamentous anatomy surrounding the ankle joint
- Clinical Presentation, Pathophysiology, and Imaging Findings
- Anteromedial Impingement
- Anterolateral Impingement
- Posterior Impingement
- Posteromedial Impingement
- Posterolateral Impingement
- Syndesmotic Impingement

### MKE156

**Ankle Trauma: What Radiology Residents Need to Know**
Participants
Pavani Adapa MD (Presenter): Nothing to Disclose
Melissa Nicole Manzer MD: Nothing to Disclose
Thomas Michael Cullen MD: Nothing to Disclose
Arash Kamali MD: Nothing to Disclose

TEACHING POINTS
Review the anatomy and biomechanics of the ankle joint and understand ligament and osseous injuries including osteochondral, Weber, triplane, talus and juvenile Tillaux.

TABLE OF CONTENTS/OUTLINE
Illustrate the anatomy and biomechanics of the osseous, myotendinous and ligamentous structures of the ankle joint, including the tibiotalar and distal tibio-fibular joints and the ankle mortise. Describe and demonstrate the classification of common injuries involving the ankle joint, including Weber classification of distal tibia and fibula injuries, osteochondral injury of the talus, pilon, triplane, lateral process talus and juvenile Tillaux, using radiographs, 2D and 3D MDCT and MRI. Discuss a practical approach to describing the findings, recognizing the pitfalls in imaging of ankle trauma and understand what not to miss when reporting findings to the clinicians.

MKE157
At the Forefront of Forefoot

Participants
Aarti Luhar MD (Presenter): Nothing to Disclose
Leanne Louise Seeger MD: Scientific Advisory Board, Amgen Inc
Benjamin David Levine MD: Nothing to Disclose
Benjamin Eric Plotkin MD: Nothing to Disclose
Kambiz Motamedi MD: Nothing to Disclose

TEACHING POINTS
Forefoot disorders are commonly encountered on radiographs of the foot. Understanding the natural history of each disorder is vital to directing management. Familiarity with their pre- and post-operative appearances is important to making accurate imaging diagnosis. The purpose of this exhibit is: 1) To give a brief overview of the natural history, complications and management of four common bony disorders of the forefoot. 2) To provide a primer emphasizing the the pre- and post-operative appearances of each disorder, with an emphasis on plain radiographic findings.

TABLE OF CONTENTS/OUTLINE
We will present the natural history of a) Hallux valgus deformity, b) Hallux sesamoid disorders, c) Hammertoe deformity, d) Long 2nd or 3rd metatarsal deformity. The discussion for each entity will be presented as follows: 1) Definition 2) Etiology 3) Presentation 4) Complications 5) Treatment a. Conservative therapy b. Indications for surgical management 6) Pre-operative appearance 7) Post-operative appearance

MKE158
Best Foot Forward! Ultrasound of the Foot and Ankle with MRI Correlation

Participants
Ami Gokli MD (Presenter): Nothing to Disclose
Steven Peti MD: Nothing to Disclose
Michael Coords MD: Nothing to Disclose
Ryan Logan Webb MD: Nothing to Disclose
Cheryl Hsuan Lin MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To provide a focused review of normal foot anatomy on ultrasound. 2. To present a variety of ultrasound cases on common foot and ankle pathology. 3. To illustrate excellent sonographic correlation with the contemporaneous MRI on the same patients. 4. To be aware of some pitfalls and inherent limitations of ultrasound on certain pathology and know when to pursue other imaging modalities.

TABLE OF CONTENTS/OUTLINE

MKE160
Calcaneal Cleavage Planes: Trabecular Lattice of the Calcaneus in Relation to Fracture Patterns
TEACHING POINTS

The major teaching points of the exhibit are: The calcaneus is made up of six trabecular patterns which form a lattice structure to support axial loading. The Neutral Zone of the calcaneus is an inherent weak point due to sparse trabeculation. Calcaneal fractures run along the planes of the trabecula, causing cleavage in predictable patterns that correlate to the Sander's Classification scheme. Insufficiency fractures can deviate from the normal cleavage plains due to weakening of the trabecular patterns via microfractures.

TABLE OF CONTENTS/OUTLINE

Calcaneal Anatomy  
Calcaneal Trabecula Orientation  
Neutral Zone Anatomy  
Mechanism of Injury  
Sander's Classification in Relation to Trabecular Patterns  
Insufficiency Fractures

MKE161

Carpal and Tarsal Coalitions: Typical and Atypical Locations with Diagnostic Pitfalls

TABLE OF CONTENTS/OUTLINE

1. Typical locations of carpal coalitions: lunotriquetral coalition and capitohamate coalition.  
2. Atypical locations of carpal coalitions: pisohamate coalition and scaphotrapezial coalition.  
3. Typical locations of tarsal coalitions: talocalcaneal coalition and calcaneonavicular coalition.  
4. Atypical locations of tarsal coalitions: talonavicular coalition, cubonavicular coalition, the first naviculocuneiform coalition, and lateral cuneiform-the third metatarsal coalition.  
5. Imaging modalities including radiography, CT, and MRI to detect the types of coalition such as osseous, fibrous, and cartilaginous in nature.

MKE162

Clinical and Radiological Management of the Acquired Adult Flatfoot

TABLE OF CONTENTS/OUTLINE

The adult acquired flatfoot (AAFF) is a relatively multifactorial common disorder characterized by findings as plantar flexion of the talus, medial arch collapse, valgus hindfoot and forefoot abduction. Although posterior tibial tendon (PTT) dysfunction is the most common cause of this entity we must consider that other structures can also bring it on (Spring and talocalcaneal interosseus ligaments). Therefore, the deformity may affect different zones around the foot and ankle (rearfoot, calcaneus, midfoot) in various ways and degrees in different patients. We exhibit the new classification of AAFF :RAM, wherein each level of deformity is assessed and graded independently of each other, both clinically and radiographically. MRI is an important tool in the evaluation of AAFF, providing valuable information to correctly classify and understand its pathogenesis. Furthermore, detection of the injured anatomical structures is essential for selecting an appropriate surgical treatment.

MKE163

Comprehensive Imaging Review of Metatarsalgia and Related Painful Conditions of the Forefoot
**Participants**

- Anthony Dennis Mohabir MD: Nothing to Disclose
- Adam Noah Rucker MD: Nothing to Disclose
- Michael Brown MD: Nothing to Disclose
- Jarett Burak MD: Nothing to Disclose
- Daniel M. Walz MD (Presenter): Nothing to Disclose

**TEACHING POINTS**

The Purpose of this Exhibit is:

1. To explain the clinical presentations of metatarsal and metatarsal phalangeal (MTP) joint pathology and the proper indications for various methods of imaging
2. To review normal anatomy of the metatarsals and MTP joints with a focus on magnetic resonance imaging.
3. To learn the imaging features of various pathologic conditions of the metatarsals and forefoot.

**TABLE OF CONTENTS/OUTLINE**

1. Normal Imaging Anatomy
   a. First and Lesser Metatarsals
   b. MTP Joints
2. Clinical Presentation
3. Imaging Techniques and Indications
4. Case Examples
   a. Stress Fracture
   b. Flexor and Extensor Tendon Pathology
   c. Plantar Plate Tears
   d. MTP Joint Instability
   e. Interdigital Neuroma
   f. Intermetatarsal Bursitis
   g. Hallux Valgus Deformity
   h. Degenerative and Inflammatory Arthrosis
   i. Systemic Disorders
5. Summary

**MKE165**

**Dynamic Evaluation with High-resolution Ultrasound of Ankle Retinacula: A Detailed Didactic Approach**

**Education Exhibits**

**Location:** MK Community, Learning Center

**Participants**

- Alessandro Muda MD: Nothing to Disclose
- Enzo Silvestri MD (Presenter): Nothing to Disclose
- Riccardo Sartoris MD: Nothing to Disclose
- Alice Arcidiacono: Nothing to Disclose
- Angelo Corazza MD: Nothing to Disclose
- Silvia Perugin Bernardi MChir: Nothing to Disclose
- Michela Pascale MD: Nothing to Disclose

**TEACHING POINTS**

The aim of our educational exhibit is to illustrate the normal anatomy and HR-US appearance of ankle retinacula, to produce detailed anatomical schemes with didactic purpose and to describe a systematic technique for HR-US evaluation of these structures.

Dynamic evaluation adds several important information about biomechanics of such superficial structures.

Knowledge of the normal anatomy and imaging appearance of these structures is essential for the depiction of their injuries.

**TABLE OF CONTENTS/OUTLINE**

The retinacula of the ankle are thickening structures of the crural fascia with a specific role in maintaining the tendon structures strictly closer to the underlying bone. Standard US protocol includes the evaluation of the extensor retinaculum, the peroneal retinaculum and the flexor retinaculum. For each retinaculum we will provide a dedicated 22 MHz HR-US scan, a detailed anatomic scheme and a practical guide on "how to do" the HR-US scan.

**MKE166**

**Dynamic High Resolution Ultrasonography (d-HRUS) of the Leg Muscles: A Detailed Didactic Approach**

**Education Exhibits**

**Location:** MK Community, Learning Center

**Participants**

- Alice Arcidiacono (Presenter): Nothing to Disclose
- Angelo Corazza MD: Nothing to Disclose
- Alessandro Muda MD: Nothing to Disclose
- Silvia Perugin Bernardi MChir: Nothing to Disclose
- Riccardo Sartoris MD: Nothing to Disclose
- Enzo Silvestri MD: Nothing to Disclose

**TEACHING POINTS**

The aim of our educational exhibit is to:

1. Illustrate the normal anatomy and normal d-HRUS appearance of the leg muscles;
2. Describe a systematic technique for d-HRUS evaluation of such structures;
3. Produce anatomical schemes with didactic purpose and show correlations with sonographic imaging.

**TABLE OF CONTENTS/OUTLINE**

The leg is best described in terms of compartmental anatomy. It is composed of four main compartments: anterior, superficial posterior, deep posterior and lateral. HRUS represents the first level imaging in muscles evaluation. For each of the following compartments we will provide a dedicated HRUS image, compared with a detailed anatomic scheme, and a practical guide on "how we do" a HRUS scan.

- **Anterior compartment**
  - Tibialis anterior m.
  - Extensor digitorum longus m.
  - Extensor hallucis
MKE167

Entrapment: Soft Tissue Injuries Accompanying Pilon Fractures of the Tibia

Education Exhibits
Location: MK Community, Learning Center

Participants
Xue Susan Bai MD (Presenter): Nothing to Disclose
Sana Parsian MD: Nothing to Disclose
Jonelle Marie Petscavage-Thomas MD, MPH: Consultant, Medical Metrics, Inc
Felix Sze-Kway Chew MD: Nothing to Disclose
Alice S. Ha MD: Nothing to Disclose

TEACHING POINTS
Pilon fractures are comminuted intraarticular fractures of the distal tibia sustained through vertical loading as the talus is driven into the plafond. Although postoperative outcomes depend on anatomic open reduction and internal fixation of the bony fragments, the status of the soft tissues often determines treatment and outcome. This exhibit will:
1) Review the radiologic morphology of Pilon fractures and the role of cross-sectional imaging
2) Discuss current surgical approaches for Pilon fractures
3) Illustrate common concomitant soft tissue injuries
4) Demonstrate postoperative complications and their imaging appearances

TABLE OF CONTENTS/OUTLINE
1) Review radiographic and cross-sectional anatomy related to Pilon fractures; 2) Outline surgical procedures to treat Pilon fractures with radiographic correlates; 3) Illustrate common concomitant soft tissue injuries including tendon impingement and nerve entrapment; 4) Demonstrate common postoperative complications and their imaging features including nonunion, infection, malunion, and osteoarthritis.

MKE168

Fascia Cruris Tears- A ‘New’ Injury- Clinical Presentation, Imaging and Treatment

Education Exhibits
Location: MK Community, Learning Center

Participants
Sophia Tincey MBBS (Presenter): Nothing to Disclose
Nicola Lindsay Robertson MBChB, MRCS: Nothing to Disclose
Hardi Madani FRCR: Nothing to Disclose
Amket N. Tavare MA, MBChB: Nothing to Disclose
Brian Joseph Holloway MBBS: Nothing to Disclose
Otto Chan MD: Nothing to Disclose
Nick Webborn MBBS, MSc: Nothing to Disclose

TEACHING POINTS
Appreciate the normal radiological anatomy of the fascia cruris. Describe the pathophysiology of fascia cruris tears. Classical clinical presentation and differences with Achilles tendinopathy symptomatology. Imaging characteristics on US and MRI of fascia cruris tears. Initial rehabilitation protocol. Describe novel approach using prolotherapy and rehabilitation boot. Emphasize the importance of a conditioning program.

TABLE OF CONTENTS/OUTLINE
The fascia cruris is a layer of deep fibrous connective tissue and is continuous above with the fascia lata and below with the fascia on the dorsum of the foot and the plantar aponeurosis at the sole. Injuries to this structure are not well understood but are not uncommon. We discuss the clinical presentation along with pathological correlation. Multi-modality illustrated examples outlining various types of tears. Evaluation of the limited treatment options available for these patients. Discussion of novel image guided interventions and their potential role in the management of tears.

MKE169

Foot for Thought: Metatarsalgia Imaging and Intervention

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants
Heba Almutairi MD (Presenter): Nothing to Disclose
Almamoon I. Justaniah MD, MA: Nothing to Disclose
Robert James French MD: Nothing to Disclose
Dmitry Elentuck MD: Nothing to Disclose

TEACHING POINTS
After reviewing this exhibit, the participant will: - Be familiar with the clinical presentations and differential diagnosis of extra-osseous causes of metatarsalgia as well as with the imaging modalities available to make the correct diagnosis. - Be able to recognize the findings of various painful forefoot pathologies on ultrasound and MRI. - Be up to date with the current role of...
the radiologist in treating some of these conditions under ultrasound guidance.

**TABLE OF CONTENTS/OUTLINE**


**MKE170**

**High Definition US-MRI Fusion Imaging of the Ankle: A Detailed Didactic Approach**

**Education Exhibits**

**Location:** MK Community, Learning Center

**Participants**

- **Riccardo Sartoris MD (Presenter):** Nothing to Disclose
- **Silvia Perugin Bernardi MChir:** Nothing to Disclose
- **Alice Arcidiacono:** Nothing to Disclose
- **Angelo Corazza MD:** Nothing to Disclose
- **Alessandro Muda MD:** Nothing to Disclose
- **Enzo Silvestri MD:** Nothing to Disclose
- **Giulio Ferrero:** Nothing to Disclose

**TEACHING POINTS**

Normal US anatomy of the ankle is complex and not immediate to comprehend it.

The accurate knowledge of this anatomy is essential for the understanding of district diseases.

Fusion imaging between US and MRI could represent a new frontier in musculoskeletal US teaching. The aim of our paper is to present some features of this new technique applied to the study of the ankle.

**TABLE OF CONTENTS/OUTLINE**

We have selected a volunteer and previously obtained a volumetric MR scan of the ankle. With an US equipment provided with a GPS-enhanced fusion system we have combined these techniques and obtained an extremely reliable tool for the teaching of correct US scan planes of this insidious anatomical region. The ankle can be subdivided in four compartments: each of those includes structures that are extremely important for ankle function. For each structure we will provide: dedicated HR-US image with MRI fusion imaging detailed anatomic scheme practical guide on ‘how to do’ the HR-US scan. With US-MR fusion imaging we have analyzed ankle compartments highlighting critical areas. A thorough knowledge of the anatomy is crucial to enable the musculoskeletal radiologist to make an accurate and useful diagnosis of ankle distractions. It seems that Fusion Imaging may improve and accelerate the comprehension of anatomy.

**MKE171**

**Illustration and MRI Atlas of the Ankle: 3D-MR Imaging at 3-Tesla of the Ligaments, Tendons, and Cartilage of the Ankle and Hindfoot, Accompanied by Detailed Original Medical Illustration of the Deltoid Ligamentous Complex**

**Education Exhibits**

**Location:** MK Community, Learning Center

**Participants**

- **Solomon Abay BS (Presenter):** Nothing to Disclose
- **Michael Silver BS, MA:** Nothing to Disclose
- **Kenneth Chung-Yi Wang MD, PhD:** Co-founder, DexNote, LLC
- **Filippo Del Grande MD, MBA:** Nothing to Disclose
- **John A. Carrino MD, MPH:** Consultant, BioClinica, Inc Consultant, Pfizer Inc Advisory Board, General Electric Company

**TEACHING POINTS**

The purpose of this exhibit is to: 1. Demonstrate the MR appearance of important ligamentous, tendinous, and cartilaginous structures on isotropic 3D images at 3-Tesla. This includes structures such as the ligaments of the sinus tarsi, as well as the components of the deltoid ligamentous complex. 2. Review the normal course and bony attachment sites of ligaments and tendons of the ankle. 3. Provide a strategy for identifying and evaluating these structures using isotropic 3D MR imaging.

**TABLE OF CONTENTS/OUTLINE**

Description of isotropic 3-Tesla 3D MR imaging protocol at the ankle and hindfoot. Review of anatomy and MR imaging findings for each of the following: Components of the deltoid ligamentous complex Spring ligament Ligaments of the fibular syndesmosis Anterior talofibular ligament Posterior talofibular ligament Sinus tarsi ligament Articular cartilage Tendons, nerves, vessels and retinacula Original illustrations of the deltoid ligamentous complex and its five component ligaments will also be presented with MR image correlation.

**MKE172**

**Imaging of Muscle Injuries: The Prognosis Impact of Connective Tissue Involvement**

**Education Exhibits**

**Location:** MK Community, Learning Center

**Participants**

- **Audrey Massein (Presenter):** Nothing to Disclose
- **Jerome Renoux MD:** Nothing to Disclose
TEACHING POINTS

The purpose of this exhibit is 1. To explain importance of intramuscular conjonctive structures 2. To illustrate the spectrum of lesions of connective tissue, with correlation between ultrasonography and MRI 3. To discuss the role of imaging to evaluate sole connective tissue lesions and their impact on return to play time in high-level soccer players 4. To discuss interest of imaging in the follow-up

TABLE OF CONTENTS/OUTLINE

1. Clinical features 2. Different locations on imaging: - epimysium - intramuscular conjonctive wall - intramuscular tendon extension - between two perimuscular conjonctive walls 3. Different severities on imaging: - blurred and limited thickening of an intramuscular conjonctive wall - diffuse thickening of an intra or perimuscular conjonctive component - rupture of a connective structure with muscle injury which is symmetrical around 4. Prognosis 5. Imaging in the follow-up

MKE173

Imaging Review of the Accessory Ossicles of the Foot

Education Exhibits

Location: MK Community, Learning Center

Participants

Josephina Anna Vossen MD, PhD : Nothing to Disclose
Jennifer Golia Pernicka MD : Nothing to Disclose
Laura Miller MD : Nothing to Disclose
Greg B. Marrinan MD : Nothing to Disclose
Martin Torriani MD (Presenter) : Nothing to Disclose

TEACHING POINTS

1. To review to spectrum of accessory ossicle and sesamoid bones in the foot.
2. To recognize pathology associated with accessory ossicle and sesamoid bones in the foot.
3. To suggest appropriate imaging modalities and discuss imaging pitfalls.

TABLE OF CONTENTS/OUTLINE

Anatomic variant accessory ossicles of the foot will be reviewed by radiograph, CT, and high resolution MR imaging, with sample cases including: os peroneum, os subfibulare, os subtibiale, os tibiale externum (accessory navicular), os trigonum, os calcaneus secundarius, and os intermetatarseum. Furthermore, potential pathology and pitfalls will be discussed.

MKE174

Insertional Achilles Tendinopathy – New Imaging and Treatment Strategies

Education Exhibits

Location: MK Community, Learning Center

Participants

Aniket N. Tavare MA, MBBCh : Nothing to Disclose
Sophia Tincey MBBS : Nothing to Disclose
Hardi Madani FRCR (Presenter) : Nothing to Disclose
Nicola Lindsay Robertson MBChB, MRCS : Nothing to Disclose
John King MD : Nothing to Disclose
Otto Chan MD : Nothing to Disclose
Brian Joseph Holloway MBChB : Nothing to Disclose

TEACHING POINTS

1. Review of the anatomy and function of Achilles tendon, the largest and strongest tendon in the body; in particular the insertional component. 2. Discussion of the aetiologies of insertional Achilles tendinopathy (IAT), a common cause of chronic pain and reduced function in both athletes and sedentary individuals 3. Outline of the diagnosis and assessment of IAT using ultrasound and MRI 4. Review of the differences in rehabilitation programmes between Achilles tendinopathy and IAT 5. Review of the established and innovative image-guided therapies for IAT available when conservative management is unsuccessful.

TABLE OF CONTENTS/OUTLINE


MKE175

Keep That Spring in Your Step: Review of Plantar Fascia Anatomy and Pathology

Education Exhibits

Location: MK Community, Learning Center

Participants
TEACHING POINTS

Heel pain is a common complaint in the primary care, orthopedic and podiatry clinics. It can lead to lost work time, decreased participation in sporting activities and long-term morbidity. In this exhibit, the learner will (1) review normal anatomy of the calcaneus, plantar fascia and associated structures and (2) learn to recognize common pathologic processes contributing to heel pain using a multi-modality approach.

TABLE OF CONTENTS/OUTLINE

- Illustrate normal anatomy of the calcaneus, plantar fascia and associated hindfoot soft tissues
- Diagnoses
- Radiographs
- Ultrasound
- MRI
Multimodality review of pathologic imaging findings - Plantar fasciitis - Achilles tendinosis/bursitis - Heel pad fat necrosis/rheumatoid nodules - Plantar fibromatosis - Nerve impingement - Stress fracture - Others
Sample cases
Summary

MKE176

MR Imaging of Intraarticular Ankle Impingement Lesions: A Pictorial Review

Education Exhibits
Location: MK Community, Learning Center

Participants
Monica Tafur MD (Presenter): Nothing to Disclose
Brady Kirk Huang MD: Nothing to Disclose
Eric Y. Chang MD: Nothing to Disclose

TEACHING POINTS

The purpose is to review the findings of the intraarticular ankle impingement lesions using an imaging-based approach. Illustrations will be used to explain the anatomic basis, pathophysiology and main features of each impingement lesion. The role of diagnostic imaging in the management of these entities and the differential diagnoses will be discussed. 1. Imaging findings may relate to a range of soft tissue or bony pathologies that can predispose to painful limitation of joint motion or impingement. Diagnosis of ankle impingement remains clinical, however is aided by radiological findings. 2. Knowledge of the pathophysiology and the anatomy of the regions involved in each syndrome is important to understand the imaging findings. 3. Post-traumatic synovitis, intraarticular fibrous scar tissue, capsular scarring and bone abnormalities are frequently associated with this pathology. 4. Knowledge of the imaging findings and the differential diagnoses for the various ankle impingement syndromes is essential to avoid misdiagnosis that may delay the patient's treatment.

TABLE OF CONTENTS/OUTLINE

1. Definition and general features
2. Anatomy, demographics, pathophysiology, clinical findings, imaging findings, differential diagnoses and management of each ankle impingement syndrome (anterior, posterior, anterolateral, anteromedial and posteromedial)

MKE178

Painless Plantar Fasciitis Ultrasound Guided Injections Using Posterior Tibial Nerve Block- Why and How

Education Exhibits
Location: MK Community, Learning Center

Participants
Mark Leung Hsin Tie MBCh (Presenter): Nothing to Disclose

TEACHING POINTS

1. Learn the anatomy of the plantar fascia. 2. Learn the pathophysiology of plantar fascial disease. 3. Learn the technique of US guided plantar fascial injections. 4. Learn the anatomy of tibial nerve at the ankle and how to anaesthetise it for plantar fascial injections.

TABLE OF CONTENTS/OUTLINE

A: Anatomy of the plantar fascia and tibial nerve at the ankle B: Pathophysiology C: Diagnostic Imaging and US anatomy D: Contraindications E: Technique of anaesthesia injection F: Technique for plantar fascial injection G: Aftercare and complications

MKE179

Pathologies Mimicking Achilles Tendinopathy

Education Exhibits
Location: MK Community, Learning Center

Participants
Aniket N. Tavare MA, MBCh (Presenter): Nothing to Disclose
Nicola Lindsay Robertson MBChB, MRCS: Nothing to Disclose
Sophia Tincey MBBS: Nothing to Disclose
Hardi Madani FRCP: Nothing to Disclose
Nicola Maffulli: Nothing to Disclose
Otto Chan MD: Nothing to Disclose
Tom Crisp MD: Nothing to Disclose
Brian Joseph Holloway MBCh: Nothing to Disclose
TEACHING POINTS

Achilles tendinopathy is a common cause of chronic posterior heel and calf pain in both athletes and non-exercising individuals. We will review: 1. The anatomy and biomechanical function of the posterior calf 2. The wide differential diagnosis encompassing other disorders of the Achilles tendon complex and a variety of non-Achilles conditions affecting the surrounding bones, joints, muscles and nerves. 3. The imaging findings of each of these disorders on plain radiography, ultrasound (US) and MRI and will highlight discriminatory features.

TABLE OF CONTENTS/OUTLINE


MKE180

Plantar Heel Pain: A Comprehensive Multimodality Review and Update of Common and Uncommon Imaging Findings and Treatment Options

Education Exhibits
Location: MK Community, Learning Center

Participants

Amanda Weiss MD : Nothing to Disclose
Anthony Dennis Mohabir MD (Presenter) : Nothing to Disclose
Daniel M. Walz MD : Nothing to Disclose
John S. O’Donnell MD : Nothing to Disclose
Michael Brown MD : Nothing to Disclose

TEACHING POINTS

1. Plantar heel pain is one of the most common indications for ankle/foot imaging studies. 2. Knowledge of the anatomy along the plantar aspect of the hindfoot is essential to guide imaging studies and make accurate diagnoses. 3. Some causes of heel pain that can be identified on imaging studies include calcaneal stress fractures, plantar fasciitis, plantar fascial tears, plantar fibromas, Baxter’s neuropathy, painful os peroneum syndrome, short and long plantar ligament degeneration/partial tears, and lateral plantar vein thrombosis. 4. Treatment options for the varying causes of plantar heel pain include conservative measures, image guided procedures, and surgery.

TABLE OF CONTENTS/OUTLINE


MKE182

Radiographic Measurements and Angles of the Ankle and Foot: What Every Radiologist Should Know

Education Exhibits
Location: MK Community, Learning Center

Participants

Juliana Oggioni Gaioiti MD (Presenter) : Nothing to Disclose
Felipe Damasio de Castro MD : Nothing to Disclose
Luana Belusso MD : Nothing to Disclose
Fabiano Nassar Cardoso MD : Nothing to Disclose
Carolina Luisa Martins De Jesus : Nothing to Disclose
Maira Costa Nunes Andrade Leite MD : Nothing to Disclose
Carlos Henrique Longo MD : Nothing to Disclose
Andre Yui Aihara MD : Nothing to Disclose
Hamilton Guidorizzi MD : Nothing to Disclose
Eduardo Jose Mariotoni Bronzatto : Nothing to Disclose

TEACHING POINTS

Importance of the radiographic analysis of the foot and ankle. Changes in bone alignment and angles of the foot, and pathologies arising from them. A practical step-by-step guide to measure radiographic foot angles.

TABLE OF CONTENTS/OUTLINE

Over the past 15 years, too much emphasis has been given to more "advanced" imaging, such as CT-scan and MRI exams, while conventional radiography has been neglected. However, radiographic measurements of the foot and ankle in the weight-bearing position can provide plenty of information regarding the biomechanics and pathogenesis of common foot disorders, which cannot be granted by other imaging techniques. Besides, a solid and comprehensive knowledge of the anatomy and biomechanics of the foot is essential to properly understand and analyze a multitude of complex radiographic findings, which may be intimidating to the less experienced. Certain lines and angles plotted on weight-bearing radiographs are useful in revealing subtle deformities and malalignment of the foot, such as hallux valgus, flat foot, cavus foot, etc. With that in mind, the purpose of this article is to highlight the importance of these measurements in daily practice, and to establish a step-by-step guide to obtain them accurately.

MKE183

Sonographic Evaluation of Chronic Pain after Lateral Ankle Sprain: It Is not Only Lateral Ligament Complex Lesion
**Education Exhibits**

**Location:** MK Community, Learning Center

### Participants

- **Sara Sanchez Bernal MD (Presenter):** Nothing to Disclose
- **Elena Gallardo MD, PhD:** Nothing to Disclose
- **Eduardo Torres Diez:** Nothing to Disclose
- **Rosa Maria A. Landeras MD:** Nothing to Disclose
- **Angelica Lamagrande Obregon:** Nothing to Disclose
- **Gerardo Lopez Rasines MD:** Nothing to Disclose

### TEACHING POINTS

1. To illustrate the normal sonoanatomy of the structures that can be injured in a lateral ankle sprain.
2. To propose a systematic scanning technique for the evaluation of such structures.
3. To describe the most important bone and soft-tissue lesions associated to a lateral ankle sprain.

### TABLE OF CONTENTS/OUTLINE


**MKE185**

### The Road to Pes Planovalgus

**Education Exhibits**

**Location:** MK Community, Learning Center

### Participants

- **Adam Daniel Singer MD (Presenter):** Nothing to Disclose
- **Paul David Clifford MD:** Nothing to Disclose
- **Abhijit Datir MD:** Nothing to Disclose
- **Joshua Zeidenberg BA, MD:** Nothing to Disclose
- **Ty Kanyn Subhawong MD:** Nothing to Disclose
- **Jean Jose MS, DO:** Nothing to Disclose

### TEACHING POINTS

2. Several important structures support the plantar arch.
3. Failure of the arch may result in other deformities such as hindfoot valgus and subfibular impingement.
4. Available treatment strategies range from conservative to surgical.
5. Radiologist plays a key role in diagnosis.

### TABLE OF CONTENTS/OUTLINE

- Anatomy and mechanism of support: static and dynamic stabilizers.
- Epidemiology: Adults (primary focus).
- Children Clinical manifestations: Types Rigid versus flexible.
- Associated systemic processes: Degenerative. Tarsal coalition.
- The role of imaging: Radiographs, CT, US, and MRI.
- Achilles tendinopathy. Management: Conservative/Surgical approaches.
- Indications and contraindications for surgery.

**MKE186**

### Topographic Relationship and Compression Syndromes of the Plantar Nerves: MR and US with Anatomical Correlation

**Education Exhibits**

**Location:** MK Community, Learning Center

- Certificate of Merit
- Selected for RadioGraphics

### Participants

- **Michel De Maeseneer MD (Presenter):** Nothing to Disclose
- **Stefaan Marcelis MD:** Nothing to Disclose
- **Johan De Mey:** Research Grant, General Electric Company
- **Maryam Shahabpour MD:** Nothing to Disclose
- **Erik Cattrysse:** Nothing to Disclose

### TEACHING POINTS

1. Describe topographic relationships of the plantar nerves relative to tendons and muscles along the plantar aspect of the foot.
3. Discuss compression areas and syndromes related to this anatomy.

### TABLE OF CONTENTS/OUTLINE

- Branches of the posterior tibial nerve: -Medial calcaneal nerve. - Inferior calcaneal nerve.
- Medial and lateral plantar nerves.
- Topographic relationships of the medial plantar nerve (assessed systematically in 6 levels).
- Sustentaculum tali.
- Between abductor hallucis and quadratus plantae.
- Knot of Henry level ("triangle sign").
- Between flexor brevis tendons, abductor hallucis.
- Between flexor tendons and flexor digitorum brevis muscle.
- Between flexor tendons. Topographic relationships of the lateral plantar nerve (assessed systematically in 5 levels).
- Between abductor hallucis and quadratus plantae.
- Between flexor brevis and quadratus plantae.
- Between flexor brevis and abductor digiti minimi.
- Between peroneus longus, flexor brevis and abductor digiti minimi.
- Between flexor tendons. Interdigital nerves (assessed in 2 levels).
- Superficial to transverse ligament at web space.
Ultrasoundography of the Deltoid Ligament of the Ankle

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

**Participants**
- Guillaume Mercy (Presenter): Nothing to Disclose
- Audrey Massein: Nothing to Disclose
- Jean-Louis Brasseur: Nothing to Disclose
- Philippe A. Grenier MD: Nothing to Disclose

**TEACHING POINTS**

The deltoid ligament (also called medial collateral ligament) is a complex, crucial stabilizing structure of the hindfoot and midfoot. It can be basically divided into a superficial layer and a deep layer. The ligament can also be theoretically divided into three functional parts: anterior, middle, and posterior. Both anatomy and function explain pathological findings after a sprain:
- Injury of the deep layer often occurs as it is pinched between medial malleolus and talus during a varus sprain.
- Injury of one of the three functional parts results from ligament stretching during a valgus sprain and depends on the degree of flexion of the ankle during the trauma. Ultrasonographic study of each part of the ligament in a tensioned position is necessary to avoid missing any injury after a sprain. The normal incidental absence of the anterior part of the ligament and the normal stacked appearance of the deep layer are the most common pitfalls. Ultrasonography is helpful to identify a healing complication including impingement and instability.

**TABLE OF CONTENTS/OUTLINE**

- Anatomy
- Biomechanics
- Ultrasonography: achievement, normal aspects and pitfalls
- Ultrasonographic pathological aspects:
  - sprain
  - delayed complications including impingement and instability
- Advantages of ultrasonography versus other modalities including MRI

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Ultrasound Findings in Injury and Healing of the Most Common Muscle Injuries of the Lower Limb. An Imaging Review

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

**Participants**
- Alejandro Garcia de la Oliva MD (Presenter): Nothing to Disclose
- Luis S. Cueto MD, PhD: Nothing to Disclose
- Begona Fernandez MD: Nothing to Disclose
- Francisco Javier Fernandez: Nothing to Disclose
- yolanda marin lapeira: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:
1. To review the echographic characteristic imaging features in acute tear
2. To review the echographic findings in muscle scar
3. To describe the list of potential problems after muscle tear
4. To explain some keys to do a muscle ultrasound successfully
5. To discuss the role of Ultrasound and MRI in the diagnosis of muscle tear: strengths and weaknesses

**TABLE OF CONTENTS/OUTLINE**

- Pathophysiology of muscle injury
- Equipment, software and method
- Review the imaging findings in:
  - Acute muscle injury
  - Fibrous scar
  - Potencial problems
- Same cases and mimics
- Discuss ultrasound Versus MRI
- Summary

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"Walking on Pins and Needles": Arthrodesis of the Foot and Ankle and Its Complications

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

**Participants**
- Hussan Mohammed MD (Presenter): Nothing to Disclose
- Dakshesh Bhalabhai Patel MD: Nothing to Disclose
- George Robert Matcu MD: Nothing to Disclose
- Timothy Charlton MD: Nothing to Disclose
- Aaron Schein MD: Nothing to Disclose
- Deborah M. Forrester MD: Nothing to Disclose
- Eric Allan White MD: Nothing to Disclose

**TEACHING POINTS**

Foot and ankle arthrodesis, also known as fusion surgery, is the mainstay surgical approach to relieve disabling foot and ankle pain/deformity. An understanding of how to interpret postoperative arthrodesis films is critical in musculoskeletal radiology practice. The purpose of this exhibit is to describe the clinical issues surrounding foot and ankle arthrodesis, to review the expected postoperative appearance, and to illustrate the imaging findings of arthrodesis complications in a case-based format.

**TABLE OF CONTENTS/OUTLINE**

- Description of the clinical issues surrounding foot and ankle arthrodesis, including indications and contraindications,
types of surgical approaches, and outcomes.

- Review of the relevant anatomy and the normal radiographic findings after arthrodesis, such as what to expect in the early postoperative period and when to expect bridging of bony trabeculae across the joint.
- Pictorial essay and description of the various complications that may occur using illustrative cases from our institution. This includes nonunion, malalignment, loosening of fixation screws/plates, hardware fracture, hardware migration, infection, and development of arthritis at joints adjacent to those fused.
- Protocolling pearls and pitfalls will be highlighted throughout the exhibit, including techniques to minimize metal artifacts on CT and MRI.

MKE192
Bone Densitometry: A Resident’s Guide to Common Pitfalls and How to Avoid Them

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants
Stephane Desouches DO (Presenter): Nothing to Disclose
Wasfia Alikhan: Nothing to Disclose
Jessica Lea Sanchez MD: Nothing to Disclose
Margaret Aarons Stull MD: Nothing to Disclose

TEACHING POINTS
Dual-energy x-ray absorptiometry (DXA) is the most commonly employed imaging modality for evaluating bone mineral density. Precise measurements are necessary to accurately diagnose osteopenia and osteoporosis in asymptomatic people, to predict individual risk of fragility fractures, and to guide treatment by the referring physician. Standardized measurements must be consistent and reproducible in order to ensure legitimate comparison of serial studies. The purpose of this exhibit is to illustrate technically correct DXA scans along with common imaging pitfalls and how to avoid them.

TABLE OF CONTENTS/OUTLINE
Examples of commonly encountered pitfalls in the interpretation of DXA scans are illustrated in a case-based format. Suggestions on how to avoid and overcome these problems are provided. Cases will include: - Patient positioning - Degenerative disease and scoliosis - Paget’s disease and bony metastases - Adjacent or superimposed gastrointestinal contrast - Post-surgical and post-traumatic changes - Soft tissue calcifications - Metallic implants and external metal

MKE193
Bones on Drugs: Imaging of Drug-Related Changes in Bone

Education Exhibits
Location: MK Community, Learning Center

Cum Laude

Participants
Tyson Steven Chadaz MD: Nothing to Disclose
Brett S. Talbot MD (Presenter): Nothing to Disclose
Johnny Uzoma Valmon Monu MD: Nothing to Disclose

TEACHING POINTS
The purpose of this educational exhibit is to: 1. Reiterate awareness of unsuspected and unexpected effect of drugs on patients’ bones. 2. Demonstrate a series of challenging musculoskeletal cases with common and uncommon medication-related changes. 3. Review the pertinent literature on adverse medication effects on bone.

TABLE OF CONTENTS/OUTLINE
Specific cases include: Osteonecrosis of the jaw associated with zoledronic acid Bisphosphonate associated femur fractures Osteosclerosis associated with numerous agents. Bone marrow changes associated with granulocyte-colony stimulating factor Demineralization associated with numerous agents including: -Glucocorticoids -Inhaled corticosteroids -Heparin -Selective serotonin reuptake inhibitors/tricyclic antidepressants -Chemotherapeutic agents -Aromatase inhibitors -Thiazolidinediones -Antiepileptic drugs -Cyclosporine -GnRH agonists/antagonists -Loop diuretics

MKE194
Effectiveness of Digital Tomosynthesis in the Detection of Radiographically Occult Bisphosphonate-Related Fragility Fractures of the Femur

Education Exhibits
Location: MK Community, Learning Center

Participants
Andrew Michael Petraszko MD (Presenter): Nothing to Disclose
Dhanwada Sudhaker Rao MD: Nothing to Disclose

TEACHING POINTS
1. Review the risk factors and underlying biochemical mechanisms that contribute to the development of bisphosphonate fragility fractures (BPFF). 2. Review the imaging appearance of BPFF and diagnostic features of BPFF on radiographs and tomosynthesis. 3. Demonstrate the increased sensitivity of tomosynthesis for detection of discrete fracture lines, and its ability
to increase diagnostic confidence when radiographs are equivocal. 4. Review the clinical management of BPFF, and the significance of imaging in the diagnostic algorithm.

TABLE OF CONTENTS/OUTLINE

Risk Factors for Developing Bisphosphonate-Related Fragility Fractures (BPFF) Radiographic Technique Radiographic Appearance of BPFF Tomographic Technique Findings of BPFF on Radiographs and Tomosynthesis -Several Cases of BPFF on Radiographs and Tomosynthesis showing Increased Accuracy of Tomosynthesis -Pretreatment/Posttreatment showing fracture healing on tomosynthesis -Rims of BPFF Data Demonstrating Increased Accuracy of Tomosynthesis vs Radiographs Clinical Implications of Tomosynthesis in BPFF

MKE195
MRI of Metabolic Bone Changes

Education Exhibits
Location: MK Community, Learning Center

Participants
Pedro Henrique Ramos Quintino Silva (Presenter): Nothing to Disclose
Hugo Pereira Costa MD : Nothing to Disclose
Felipe Boschin Valimo MD : Nothing to Disclose
Alexandre Castillo Valim : Nothing to Disclose
Marcelo Bordalo-Rodrigues MD : Nothing to Disclose
Giovanni Guido Cerri PhD : Nothing to Disclose

TEACHING POINTS

1. Review the literature on metabolic bone disease (MBD) and its differential diagnosis on imaging findings. 2. Compare the imaging of different diseases with emphasis on magnetic resonance imaging (MRI). 3. Illustrate the differences, challenges / pitfalls and similar features among them, for a better diagnosis.

TABLE OF CONTENTS/OUTLINE

MBD is very important in musculoskeletal diagnostic image, due to many differential diagnoses and their importance as bone diseases or as manifestation of systemic pathologies. However, the majority of studies are based on RX, and there is lack of studies focuses on MRI features. Therefore, we will consolidate the imaging findings of MRI, comparing the differential diagnosis of MBD: Paget’s disease, renal tubular acidosis, primary biliary cirrhosis, osteomalacia, osteoporosis, inflammatory bowel disease/ celiac disease, phosphaturic mesenchymal tumor, secondary hyperparathyroidism , osteogenesis imperfecta, osteopetrosis, Dent’s disease.

MKE196
Musculoskeletal Manifestations of Sickle Cell Disease

Education Exhibits
Location: MK Community, Learning Center

Participants
Atabak Allaei MD (Presenter): Nothing to Disclose
Glenn Erski MD : Nothing to Disclose
Ryan Braun MD : Nothing to Disclose
Scott Alan Lehto MD : Nothing to Disclose
Srinivas Kolla MD : Nothing to Disclose

TEACHING POINTS

Patients with sickle cell disease (SCD) suffer from intermittent, often severe episodes of pain which often will require hospitalization. These patients have a high number of hospitalizations with a presenting complaint of pain. These painful episodes are usually secondary to bone and joint sequelae of vaso-occlusive processes which include osteonecrosis, osteomyelitis and septic arthritis. Given the high morbidity of bone and joint sequelae in sickle cell disease, we will review imaging characteristics such that the viewer will become more familiar with:

1. Pediatric bone and joint manifestations of SCD and long term sequelae.
2. Imaging characteristics of dactylitis, osteonecrosis, septic arthritis, osteomyelitis in the setting of SCD.
3. Progression of osteonecrosis.
4. Soft tissue infarctions.

TABLE OF CONTENTS/OUTLINE


MKE197
Quality Improvement in Dual X-ray Absorptiometry (DXA): Approach to Artifacts

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants
Philip Joel Benfield MD (Presenter): Nothing to Disclose
Scott David Wuertz MD, MS : Nothing to Disclose
Bahram Kiani MD : Nothing to Disclose
Leon Lenchik MD : Nothing to Disclose
TEACHING POINTS
1. Artifacts are commonly seen on DXA images.
2. DXA artifacts may be internal or external to the patient.
3. It is important to recognize which internal artifacts influence BMD measurement.
4. Some artifacts may be eliminated by reanalysis of the scans by the technologists.
5. Reporting of artifacts should be standardized.

TABLE OF CONTENTS/OUTLINE

MKE199
Abnormal Signal Intensity in the Bone Marrow at MR Imaging: Pattern Recognition, Pearls, and Pitfalls

Education Exhibits
Location: MK Community, Learning Center

Participants
Mustafa Mohamed Alikhan MD (Presenter): Nothing to Disclose
Liem Thanh Mansfield MD: Nothing to Disclose

TEACHING POINTS
1. On MR, abnormal signal in bone marrow has wide differential diagnosis.
2. Recognition of pattern to signal abnormality helps to narrow differential diagnosis.
3. The common patterns of bone marrow abnormality are subtendinous, subligamentous, subchondral, subphyseal, endosteal, periosteal, kissing bone contusions, double line sign, penumbra sign, fat containing, fluid-fluid level, and multiplicity.

TABLE OF CONTENTS/OUTLINE

MKE200
Absent Findings at Musculoskeletal Imaging: It Can Be Hardest to See What's Not There!

Education Exhibits
Location: MK Community, Learning Center

Participants
Brandon Murti (Presenter): Nothing to Disclose
George Robert Matcuk MD: Nothing to Disclose
Eric Allan White MD: Nothing to Disclose
Dakshesh Bhulabhai Patel MD: Nothing to Disclose
Aaron Schein MD: Nothing to Disclose
Deborah M. Forrester MD: Nothing to Disclose
Linda Anne Vachon MD: Nothing to Disclose
Christopher Joseph Gottsegen MD: Nothing to Disclose
Sulabha Masih MD: Nothing to Disclose

TEACHING POINTS
1. Identify common and uncommon reasons why normally present structures may be absent on musculoskeletal imaging studies.
2. Review the differential diagnoses of these various absent findings.

TABLE OF CONTENTS/OUTLINE
Categories Bones: Congenital (e.g. thrombocytopenia-absent radius syndrome, proximal focal femoral deficiency) vs. Acquired (e.g. Gorham disease, trapeziectomy) Joint spaces (e.g. coalition, ankylosis) Radiologic signs (e.g. absent bow tie and ghost meniscus signs, winking owl sign) Miscellaneous (e.g. Poland syndrome) Abnormal locations (e.g. tendon tears or dislocations, ulnar nerve transposition) Conclusion Absent musculoskeletal findings may be difficult to identify, but awareness can make the radiologist more cognizant and more likely to include commonly missed absent findings in their search patterns. Knowledge of these absent findings and their differential diagnoses is important and helpful to clinicians and patients. Although some of these findings may be obvious, the differential diagnostic considerations of their etiology may not be Sometimes it is hardest to see the things that aren't there.

MKE202
Bad to the Bone: Musculoskeletal Complications of Solid Organ Transplantation

Education Exhibits
Location: MK Community, Learning Center
Participants
Lindsey Minshew MD (Presenter): Nothing to Disclose
Daniel Edward Wessell MD, PhD: Research Consultant, Biomedical Systems

TEACHING POINTS
1. To review the most common MSK complications of solid organ transplantation, their pathophysiology and epidemiology. 2. To discuss the key imaging findings in common MSK complications of solid organ transplantation recipients. 3. To explain the utility of various imaging modalities (e.g. DXA, radiographs, CT, bone scintigraphy and MR) in the diagnosis of these complications. 4. Illustrate the utility of the various imaging modalities through the presentation of example cases.

TABLE OF CONTENTS/OUTLINE
- Review the most common MSK complications of solid organ transplantation, their pathophysiology and epidemiology.
- Decreased Bone Mineral Density
- Fractures
- Infection (Osteomyelitis, Septic Arthritis)
- Soft Tissue Infections
- Osteonecrosis
- Other: Neoplasm, Inflammatory conditions

MKE203
Basic Anatomy Concepts for Understanding Nerve Entrapments in the Upper Limb

Participants
Joao F. Costa MD (Presenter): Nothing to Disclose
Cesar Santos: Nothing to Disclose
Filipe Caseiro Alves MD, PhD: Consultant, Bayer AG
Antonio Bernardes MD, PhD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to describe and illustrate the complex anatomy of the upper limb nerves, most affected by nerve entrapment, using cadaveric dissections, schematic drawings and multimodality imaging (ultrasound, CT and MRI). This exhibit will be a core learning tool for the residents and radiology physicians.

TABLE OF CONTENTS/OUTLINE
Overview Relevant anatomy and pathophysiology of the most affected upper limb nerves: - median nerve, - radial nerve, - ulnar nerve, - axillary nerve, - suprascapular nerve

MKE206
Clavicle Fractures: A Review of Imaging, Treatment, and Complications

Participants
Christina Ma MD (Presenter): Nothing to Disclose
Benjamin Eric Plotkin MD: Nothing to Disclose
Benjamin David Levine MD: Nothing to Disclose
Leanne Louise Seeger MD: Scientific Advisory Board, Amgen Inc
Kambiz Motamedi MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: (1) To review the classification of clavicle fractures based on Allman and Neer classification system (2) To illustrate the techniques developed to fixate these fractures (3) To highlight the expected postoperative appearance and potential complications.

TABLE OF CONTENTS/OUTLINE
Allman and Neer Classification
Medial clavicle fractures
- Most are minimally displaced and managed nonoperatively
- Posterior displacement with neuromuscular injury
Midshaft clavicle fractures
- Nonoperative management
- Complications: nonunion and malunion
- Operative management: dynamic compression plates, precontoured anatomic plates, intramedullary nailing, other fixation methods
- Complications: malunion and nonunion, hardware complications
Distal clavicle fractures
- Nonoperative management: Type I and III
- Operative management: Type II displaced distal clavicle fractures
- Complications: delayed union and nonunion, hardware complications

In summary, classification, surgical treatment, and complications of clavicle fractures are reviewed. It is critical that the radiologist be familiar with current clinical management of clavicle fractures so that they understand complications and can help guide appropriate treatment planning.
MKE207
Gas-containing Periarticular Cysts: Imaging Appearance and Clinical Significance

Education Exhibits
Location: MK Community, Learning Center

Participants
Vivek Kalia MD, MPH (Presenter): Nothing to Disclose
Jesse Myers MD: Nothing to Disclose
Diego F. Lemos MD: Nothing to Disclose

TEACHING POINTS
1. To review the clinical settings in which gas may be found in the periarticular soft tissues, with particular emphasis on gas-containing periarticular cysts. 2. To describe the imaging findings of air within parameniscal and paralabral cysts and their association with meniscal and labral tears. 3. To emphasize the importance of recognition of air within periarticular cysts to avoid misdiagnosis and unnecessary additional workup.

TABLE OF CONTENTS/OUTLINE
Objectives of Exhibit Introduction, including differential diagnosis for gas in periarticular soft tissues Illustrative Examples of gas-containing periarticular cysts (CT, MR) - Shoulder - Knee - Hip Discussion Conclusions References

MKE208
High Resolution Ultrasound for Evaluation of Nail Dystrophy: A Feasibility Study

Education Exhibits
Location: MK Community, Learning Center

Participants
Elena Gallardo MD, PhD (Presenter): Nothing to Disclose
Rosa Maria A. Landeras MD: Nothing to Disclose
Angelica Lamagrande Obregon: Nothing to Disclose
Vanessa Gomez Dermit: Nothing to Disclose
Gerardo Lopez Rasines MD: Nothing to Disclose

TEACHING POINTS
1. Illustrate the normal sonoanatomy and its variability with age and gender. 2. Show the most relevant sonographic findings of those entities that can cause nail dystrophy. 3. Propose a systematic sonographic evaluation and standardized report.

TABLE OF CONTENTS/OUTLINE
-Sonoanatomy of the nail unit -Main normal measurements of the nail unit -Sonographic features and clinical view of most frequent causes of nail dystrophy: onychomycosis, psoriasis, subungual tumors, systemic disorders, repetitive traumatism -Standardized report

MKE209
Imaging from Stem to Sternum: Sternal, Sternocostal and Sternoclavicular Joint Disease

Education Exhibits
Location: MK Community, Learning Center

Participants
Joseph Cardwell Fuller MD (Presenter): Nothing to Disclose
Kurt Friedrich Scherer MD: Nothing to Disclose
Felix Sze-Kway Chew MD: Nothing to Disclose
Alice S. Ha MD: Nothing to Disclose

TEACHING POINTS
The sternum functions as both a scaffold for proper function of the chest wall and upper extremities as well as a protector of intra-thoracic contents. The sternum, sternocostal and sternoclavicular joints are an unemphasized site of disease in musculoskeletal radiology. Our goal is to demonstrate that the broad subcategories of musculoskeletal disease such as arthritis, infection, trauma and tumor have unique entities within the sternum. Sample diagnoses include sternoclavicular hyperostosis, septic arthritis, rhomboid ligament sprain, and hemangioma, respectively.

TABLE OF CONTENTS/OUTLINE
1) Review radiologic and cross-sectional anatomy of the sternum, sternoclavicular joints and costochondral junctions, including relevant muscular and ligamentous attachments. 2) Describe variant anatomy of the sternum. 3) Describe the patterns of degenerative and inflammatory arthritides affecting the sternoclavicular joints. 4) Describe benign/malignant primary and secondary tumors of the sternum. 5) Describe the causes and mechanisms of traumatic injury to the sternum and potentially life-threatening associated injuries. 6) Describe imaging patterns of sternal infection and the role of imaging in diagnosis and treatment.

MKE210
Imaging Review: Running Injuries, Hip to Toe

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit
Participants
Burke Morin DO (Presenter): Nothing to Disclose
Brett S. Talbot MD: Nothing to Disclose
Gary M. Hollenberg MD: Nothing to Disclose
Valeriy Kheyfits MD: Nothing to Disclose

TEACHING POINTS
1. Provide an overview of osseous and soft tissue injuries encountered in long-distance runners, which are not complicated by other recent trauma.
2. Describe clinical presentation and pertinent biomechanical factors associated with these conditions.
3. Illustrate characteristic radiographic and MR imaging features of these conditions in a systematic fashion.

TABLE OF CONTENTS/OUTLINE

MKE212
Key Sonographic Signs in Lesions of the Nail

Education Exhibits
Location: MK Community, Learning Center

Participants
Ximena Loreto Wortsman MD (Presenter): Nothing to Disclose

TEACHING POINTS
- To provide basic knowledge on the key sonographic signs for diagnosing lesions of the nail and periungual region

TABLE OF CONTENTS/OUTLINE
Nail sonography has emerged as a diagnostic tool for studying lesions of the nail. This imaging technique provides detailed anatomical information on the echostructure, dimensions, location and blood flow of nail conditions. This educational exhibit is composed of the technical requirements, the examination technique, the normal anatomy and 20 cases of histologically proven lesions of the nail. The lesions are classified according to their origin, into ungual and periungual. Location and growth alterations (i.e. onychocryptosis, onychomadesis, retronychia), inflammatory diseases (i.e. psoriasis, subungual fluid collections, median canaliform dystrophy), tumors and pseudotumors (i.e. glomus tumor, fibrous tumor, onychomatricoma, granuloma, wart, myxoid cyst and subungual exostosis) are demonstrated. The key sonographic signs are illustrated through drawings, and clinical, sonographic, surgical and histological images. Summary Nail sonography can provide valuable anatomical information for the clinician. Knowledge of the key sonographic signs in lesions of the nail may facilitate the performance and interpretation of ungual sonographic examinations.

MKE213
Lions and Tigers and Bears, Oh My!: The Zoo of Signs in Musculoskeletal Radiology

Education Exhibits
Location: MK Community, Learning Center

Participants
Ryan Braun MD (Presenter): Nothing to Disclose
Abraham Haimed: Nothing to Disclose
Glenn Erski MD: Nothing to Disclose
Atabak Alaii MD: Nothing to Disclose
Srinivas Kolla MD: Nothing to Disclose
Scott Alan Lehto MD: Nothing to Disclose

TEACHING POINTS
Musculoskeletal imaging is a "species" of radiology well known for its varied and diverse eponymous findings and classification schemes. While many of these eponyms are related to the physician who first characterized the pathology on imaging, a subset of descriptions based upon an animal or part of an animal that the finding resembles, continue to thrive in modern interpretation. This presentation will provide a biographical background on the animal descriptors, a comparison of the classic imaging finding to its namesake and a discussion of the clinical importance of each finding.

TABLE OF CONTENTS/OUTLINE
Many eponymous animal findings related to musculoskeletal imaging are presented on radiograph, CT and/or MRI. Biographical background, illustrative images and the pathophysiology behind the image characteristics accompany each eponym. The animalistic signs to be discussed include: Head and Neck Leontiasis Ossea (Fibrous Dysplasia of the Facial Bone) Spine Fishmouth Vertebra Vertebral Scallopin Winking Owl (vertebral metastases) Butterfly Vertebra Butterfly Fracture Scotty Dog (visualization of normal vertebral anatomy) Extremities Fishtail Deformity of the Elbow Gull Wing (erosive osteoarthritis) Swan Neck Deformity (rheumatoid arthritis) Talar Beaking Anteater Nose (calcaneonavicular coalition)

MKE214
Looking for Uncommon Orthopedic Postoperative Complications

Education Exhibits
Participants
Sandra Baleato Gonzalez MD (Presenter): Nothing to Disclose
Joan C. Vilanova MD, PhD: Nothing to Disclose
Xavier Tomas-Batlle MD: Nothing to Disclose
Luis Cerezaal MD: Nothing to Disclose
Maria Cruz Ageitos Casais MD: Nothing to Disclose
Gabriel Carlos Fernandez MD: Nothing to Disclose

TEACHING POINTS
Postoperative imaging is critical for the prompt recognition of postoperative complications in order to minimize adverse patient outcomes. However, imaging identification of these complications is sometimes a radiologic challenge. The aim of this exhibit is:
1. To understand and illustrate several uncommon complications related to orthopedic surgical procedures.
2. To discuss the appropriate selection of imaging modalities to provide optimal patient evaluation in these entities.
3. To review their characteristic and imaging findings and recognize their typical signs.

TABLE OF CONTENTS/OUTLINE
Illustrate unusual complications after orthopedic surgery: - vascular - displacement; - storage (metallosis, cobalt intoxication) -
neurologic - capsular contracture after prostesis, and others... Advantages and limitations of each imaging technique for diagnosis these complications and a proper algorithm will be provided. Summary

MKE215
MR and Ultrasound Imaging of Musculoskeletal Injuries in Professional Male Soccer Players

Education Exhibits
Location: MK Community, Learning Center

Participants
Claudia Fontan MD: Nothing to Disclose
Lidianne Sousa Andrade Medina MD: Nothing to Disclose
Adonis Manzella MD (Presenter): Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To discuss the most common musculoskeletal injuries in professional male soccer players, emphasizing the role of each method in the diagnosis of such lesions.
2. To illustrate using ultrasound and MR imaging musculoskeletal lesions found in 26 cases collected in our institution.
3. To provide a brief review of the physiopathology of these types of injuries.

TABLE OF CONTENTS/OUTLINE
Soccer is one of the most popular sports in the world. Musculoskeletal injuries are common findings in this activity and represent a critical challenge for radiologists and medical teams staffs. Both ultrasound and magnetic resonance represent effective techniques not only to detect indirect injuries but also to accurately determine severity, location, and, consequently, the prognosis. This presentation will include:
1. Introduction/background
2. Physiopathology of musculoskeletal injuries in soccer players
3. Muscle injuries
4. Tendon lesions
5. Spine injuries
6. Meniscal tears
7. Other lesions

MKE216
MRI-Neurography: Why Is It Necessary to include a Diffusion-weighted Imaging Approach?

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

Participants
Teodoro Martin MD (Presenter): Nothing to Disclose
Antonio Luna MD: Nothing to Disclose
Jordi Broncano MD: Nothing to Disclose
Jose Pablo Martinez Barbero MD, PhD: Nothing to Disclose

TEACHING POINTS
1. Review the main MRI neurography techniques for the evaluation of brachial and lumbar plexi as well as peripheral nerves.
2. Define the technical adjustments necessary to obtain high resolution neurographic sequences based on diffusion weighted and diffusion tensor imaging.
3. Illustrate with practical examples the utility of DWI and DTI-neurography for evaluation of both normal and pathological peripheral nerves and its advantages over morphological MRI-neurography techniques.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Morphological MRI-neurography techniques: T2-TSE, STIR, 3D isotropic T1 and T2-weighted sequences
3. Functional MRI neurography a. DWI neurography b. DTI neurography
5. Brachial and lumbar plexopathy
6. Carpal tunnel syndrome
7. Pyramidal syndrome
8. Peripheral nerve tumors

SUMMARY The use of DWI based neurographic sequences allow not only a morphological approach to study nerve structures but also provides functional information. DWI and DTI parameters derived such as ADC, mean diffusivity or fractional anisotropy may be used as potential biomarkers of axonal nerve integrity.

MKE217
Musculoskeletal Applications in Dual Energy CT

Education Exhibits
Location: MK Community, Learning Center
### TEACHING POINTS

1. To understand the principles of dual energy CT.
2. To review the indications, diagnostic imaging, potential benefits and limitations of Dual energy CT in musculoskeletal disorders.

### TABLE OF CONTENTS/OUTLINE

- A. Definition of dual energy CT
- B. Physics
- C. Types of dual energy CT scanners
- D. Advantages and disadvantages
- E. CT image acquisition
- F. Beam-attenuating artifacts reduction
- G. Urate deposits in gout
- H. Outcomes - Conclusions

### MKE219

**Neurogenic Thoracic Outlet Syndrome: An Overview of Anatomy, Diagnosis, and Treatment with Emphasis on MRI Findings and Image-guided Interventions**

**Education Exhibits**

**Location:** MK Community, Learning Center

#### Participants

- **John Nicholas Morelli MD (Presenter):** Nothing to Disclose
- **Ying Wei Lum MD:** Nothing to Disclose
- **Kendall Likes:** Nothing to Disclose
- **John A. Carrino MD, MPH:** Consultant, BioClinica, Inc Consultant, Pfizer Inc Advisory Board, General Electric Company
- **Jonathan S. Lewin MD:** Nothing to Disclose
- **Jan Fritz MD:** Research Grant, Siemens AG Research Consultant, Siemens AG

#### TEACHING POINTS

1. Neurogenic thoracic outlet syndrome (TOS) comprises the vast majority of TOS cases.
2. In addition to clinical features, high resolution MRI and MR neurography of the brachial plexus can be useful in rendering the diagnosis.
3. Percutaneous procedures performed under sonography, CT and MRI guidance can aid in both the diagnosis and treatment of neurogenic thoracic outlet syndrome.

#### TABLE OF CONTENTS/OUTLINE

- Predisposing and Causative Factors
- Normal anatomy
- Trauma
- Anatomic variations predisposing to TOS (cervical ribs, anomalies of the costoclavicular and retropectoral space)
- Clinical Evaluation - History and physical examination (Adson’s test)
- Electrodagnostic studies Imaging
- Image-Guided Diagnosis - MR neurography technique and findings - Scalene muscle injections: Principles - Scalene muscle injections: Techniques and pitfalls with MRI, CT, and Ultrasound guidance - Pectoralis minor injections: Treatment - Surgical indications and therapy (scalenectomy vs. first rib resection with scalenotomy) - Image guided botulinum toxin injection: Principles and techniques

### MKE220

**Radiographic Findings in Joint Effusion with MRI and/or CT Correlation - A Pictorial Essay**

**Education Exhibits**

**Location:** MK Community, Learning Center

#### Participants

- **Marcus Ghuman MBChB:** Nothing to Disclose
- **Clinton Henry Pinto MBChB:** Nothing to Disclose
- **Damien Richard Hoon FRANZCR, MBChB (Presenter):** Nothing to Disclose

#### TEACHING POINTS

- Knee joint lipohaemarthrosis results from intra-articular or patella fracture, with tibial plateau fracture being the fracture most commonly associated with this finding. The majority of tibial plateau fractures will however, manifest with a haemarthrosis - which appears radiographically as a simple effusion. • An ankle joint effusion manifests radiographically as anterior displacement of the pretalar fat pad and posterior displacement of the juxta articular fat pad. An ankle joint effusion of 13mm or more has a positive predictive value of 82% for occult fracture. • The incidence of occult fracture with elbow joint effusion is high. In children, the associated injury may be supracondylar (the traditional teaching) but lateral condyle and radial head fractures are not uncommon, and are often overlooked. Radial head injury is the most common associated injury in adults. • Displacement of the pronator quadratus and scaphoid fat stripes are unreliable signs of occult distal radius and scaphoid fracture, respectively.

#### TABLE OF CONTENTS/OUTLINE

- Plain radiographic images of effusions of large joints (e.g. knee, elbow, ankle etc) and selected small joints, with cross sectional imaging correlation. Discussion of the key plain radiographic imaging findings, underlying anatomy, and salient clinico-radiologic anecdotes.

### MKE221

**Rock Climbing Injuries – Acute and Chronic Repetitive Trauma**

**Education Exhibits**

**Location:** MK Community, Learning Center

#### Participants

- **Certificate of Merit**
TEACHING POINTS

1. As indoor and outdoor rock climbing becomes an increasingly popular sport, it is important to be familiar with the type of injuries that can occur. 2. Climbing injuries occur in up to 82% of participants, and most commonly involve fingers, ankles, elbows, and shoulders. 3. Injuries are secondary to both acute trauma and chronic repetitive trauma/overuse, with the lower extremity having more acute traumatic injuries and the upper extremity having more overuse injuries.

TABLE OF CONTENTS/OUTLINE


MKE222

Roentgenography Hot Seat: Congenital Disorders and Anomalies of the Musculoskeletal System

Education Exhibits

Location: MK Community, Learning Center

Participants

Swati Deshmukh MD (Presenter): Nothing to Disclose
William Wallace Scott MD: Nothing to Disclose

TEACHING POINTS

A broad spectrum of congenital anomalies, disorders, and malformations have musculoskeletal manifestations. Recognition and accurate identification of characteristic findings on plain radiographs can be challenging, especially when dealing with rare or unusual diagnoses. The purpose of this exhibit is to expose radiologists to a series of stimulating and fun cases in order to help improve the radiologist's accuracy when facing congenital musculoskeletal lesions.

TABLE OF CONTENTS/OUTLINE

The cases will be presented in a quiz format. Key findings and pertinent differential diagnostic points will be highlighted in the discussion of each case. The list of cases includes: Chondrodysplasia punctata Spondyloepiphyseal dysplasia Neurofibromatosis Nail-Patella syndrome Sprengel’s deformity Osteopoikilosis Club feet Melorheostosis Calcaneonavicular coalition Pseudoarthrosis Multiple hereditary exostosis Tuberous Sclerosis Poland Syndrome Osteogenesis Imperfecta Maffucci syndrome

MKE226

Soft Tissue Hemangioma: Variable Imaging Feature according to Their Different Component

Education Exhibits

Location: MK Community, Learning Center

Participants

Se Kyoung Park (Presenter): Nothing to Disclose
In Sook Lee: Nothing to Disclose
Jang Ho Suh MD: Nothing to Disclose

TEACHING POINTS

Soft tissue hemangioma has mixed components, which are composed of vascular element, fat, smooth muscle, fibrous tissue, hemosiderin, calcification and thrombus. Therefore, soft tissue hemangiomas can have various imaging features according to their different component.

The purpose of this exhibit is to analyze imaging features of soft tissue hemangioma with their different component in these cases.

TABLE OF CONTENTS/OUTLINE

Definition and nomenclature of soft tissue hemangioma
Component of soft tissue hemangioma
Imaging feature of soft tissue hemangioma according to their different component
Sample cases and mimics
Differential diagnosis
Summary

MKE227

Triathlon Injuries: Trauma and Overuse Injuries of the Upper and Lower Extremities

Education Exhibits

Location: MK Community, Learning Center

Certificate of Merit

Participants

Daichi Hayashi MBBS, PhD (Presenter): Nothing to Disclose
TEACHING POINTS

To describe epidemiology of triathlon injuries To illustrate types and mechanisms of acute and chronic injuries of the upper and lower extremities in triathletes To review importance of multimodality imaging, including x-ray, ultrasound, MRI and angiography in clinical management.

TABLE OF CONTENTS/OUTLINE

1. Epidemiology of triathlon injuries 2. Pictorial review of triathlon injuries including illustration of each pathology and explanation of injury mechanisms Shoulder: subacromial bursitis; biceps tendinopathy; AC joint arthritis; supraspinatus tendinitis; biceps tendinopathy; Paget-Schroetter syndrome Elbow/wrist: De Quervain's tenosynovitis; intersection syndrome Thigh/hip/groin: hip bursopathy; snapping hip syndrome; piniformis syndrome; osteitis pubis Knee: jumper's knee; patellofemoral stress syndrome; iliotibial band friction syndrome; meniscal tears; plica syndrome; popliteal artery entrapment syndrome; cystic adventitial disease; Morel-Lavallee syndrome Calf: stress fractures; medial tibial stress syndrome; chronic exertional compartment syndrome; delayed onset muscle soreness Ankle/foot: metatarsalgia, Achilles tendinopathy, retrocalcaneal bursitis, calcaneal stress fracture, plantar fasciitis, sural nerve entrapment 3. Role of multimodality imaging for treatment decisions and conclusion.

MKE228

Utility of PET-MRI in Musculotskeletal Imaging

Education Exhibits

Location: MK Community, Learning Center

Participants

Ammar Ahmed Chaudhry MD (Presenter): Nothing to Disclose
Samantha D. Glass MD: Nothing to Disclose
Kevin S. Baker MD: Nothing to Disclose
Mingqian Huang MD: Nothing to Disclose
Robert Matthews MD: Nothing to Disclose
Dinko Franceschi MD: Nothing to Disclose
Elaine S. Gould MD: Nothing to Disclose

TEACHING POINTS

1. Review physical principles and techniques of PET-MRI (positron emission tomography-magnetic resonance imaging).
2. Discuss clinical utility of using functional information obtained from a PET scan and structural information obtained from MR imaging in evaluating musculoskeletal pathology.

TABLE OF CONTENTS/OUTLINE

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

MKE229

Varus to Valgus: A Hip to Ankle Review of Abnormal Angulations within the Lower Extremity

Education Exhibits

Location: MK Community, Learning Center

Participants

Ian Amber MD (Presenter): Nothing to Disclose
Woojin Kim MD: Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd

TEACHING POINTS

1. Understand how to characterize coxa vara and coxa valga, along with potential complications and surgical indications.
2. Understand how to characterize genu varum and genu valgum, along with their most common etiologies and complications.
3. Understand the normal angular measurements of the foot, along with the altered anatomy and morphology of talipes equinovarus, as well as the potential long term effects of treatment.

TABLE OF CONTENTS/OUTLINE

I. Describe the etiology and characterization of coxa vara, along with its associated complications. Discuss indications for surgery as well as the most common valgus-inducing femoral osteotomy procedures. II. Describe the characterization of coxa valga. Discuss potential complications and surgical indications. III. Describe the expected physiologic changes of knee angulation, along with the characterization of genu varum and genu valgum. Briefly discuss the differential considerations for each of the above described deformities, followed by potential complications. IV. Describe the normal angular measurements of the foot, along with the abnormalities associated with talipes equinovarus. Discuss the role of operative and non-operative treatment, as well as the risk of long term arthritic complications.

MKE231

‘Imaging the Groin beyond a Hernia’ - The Spectrum of Pathology Encountered in Musculoskeletal Radiology
**MKE232**

**Don’t Get Stressed Out about Stress Fractures: Pattern Recognition of Atypical Fractures in Patients Using Long-Term Bisphosphonate Therapy**

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

**Participants**

- Rehan Riaz MD (Presenter): Nothing to Disclose
- Shehbaz Shaikh MD: Nothing to Disclose
- Matthew Brennan O'Brien MD: Nothing to Disclose
- Ishani B. Dalal MD: Nothing to Disclose

**TEACHING POINTS**

1. Review the revised definition, epidemiology and characteristics of atypical femoral fractures.
2. Recognize the pattern of subtrochanteric fractures associated with bisphosphonate therapy and the appearance on radiographs, scintigraphy and MR imaging.
3. Increase awareness in the role of the Radiologist in early diagnosis and reducing patient morbidity.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Bisphosphonates as a Drug
2. Mechanism of atypical subtrochanteric femur fractures vs stress fractures
3. Revised case definition by American Society of Bone and Mineral Research (ASBMR)
4. Epidemiology of atypical femur fractures
5. Characteristic appearance using multimodality examples
6. Case Examples
7. Brief overview of current literature and evidence for prophylactic nailing improving patient outcomes
8. Conclusion

**MKE235**

**Imaging Characteristics of the Normal and Torn Ligamentum Teres on Hip MR Arthrography**

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

**Participants**

- Rachel Shields MD (Presenter): Nothing to Disclose
- Brian Giordano MD: Nothing to Disclose
- Valeriy Kheyfits MD: Nothing to Disclose

**TEACHING POINTS**

1. To illustrate the imaging characteristics of normal versus torn ligamentum teres on MR hip arthrography via a case based approach.
2. To provide the learner with a background on the clinical significance and current clinical approach related to ligamentum teres injuries.

**TABLE OF CONTENTS/OUTLINE**

- Normal MRI anatomy of the ligamentum teres on hip arthrography.
Vibhor Wadhwa MBBS: Nothing to Disclose
Avneesh Chhabra MD: Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc

TEACHING POINTS
1. Learn normal imaging anatomy of the sciatic plexus and nerve in the pelvis and its regional neuromuscular variations. 2. Gain knowledge of imaging appearances of various causes of sciatic neuropathy in the pelvis, apart from the more common piriformis syndrome. 3. Learn the systematic diagnostic approach towards the evaluation of such lesions.

TABLE OF CONTENTS/OUTLINE
1. Normal imaging anatomy of sciatic nerve and regional musculature on MR Neurography. 2. Table outlining various causes of pelvic sciatic neuropathy apart from piriformis syndrome, such as traumatic and iatrogenic (including thermal) injuries, sacral neuropathy, ischemia, infection, endometriosis, nerve sheath tumors including perineuroma, hereditary neuropathy, reverse ischiofemoral impingement, perineural cyst, amyloidosis, and heterotopic ossification. 3. Relevant case examples on MR Neurography with short discussion in a quiz format. 3. Outline a diagnostic algorithm approach towards the evaluation of such lesions.

MKE237
MRI of Hip Arthroplasty

Education Exhibits
Location: MK Community, Learning Center

Magna Cum Laude

Participants
Oscar Luis Casado Verdugo (Presenter): Nothing to Disclose
Estrelia Prieto PhD: Nothing to Disclose
Maria Jose Ereno Ealo MD: Nothing to Disclose
Patricia Ruiz: Nothing to Disclose
Teresa Salinas: Nothing to Disclose

TEACHING POINTS
1. To discuss an appropriate MR protocol with tips to reduce susceptibility artefacts caused by metallic components. 2. To explain limitations and usefulness of MRI in assessing complications of hip arthroplasty. 3. To review the pathophysiology of the appearance of wear-synovitis, induced periprosthetic resorption and osteolysis. 4. To show the MR imaging findings of complications of hip arthroplasty.

TABLE OF CONTENTS/OUTLINE
Tips to reduce susceptibility artefacts caused by metallic components. Proposed MRI protocol for hip arthroplasty. Pathophysiology of the appearance of wear-synovitis, induced periprosthetic resorption and osteolysis. MRI findings of complications of hip arthroplasty including periprosthetic bone resorption and osteolysis with and without loosening, wear-induced synovitis, infection and abscesses, mechanical overload changes, periprosthetic collections / ALVAL lesions, heterotopic ossification, bursal and tendinous abnormalities. Value of intravenous contrast injection in the MRI diagnosis of complications associated to hip arthroplasty.

MKE239
Pain in the Butt: A Review of Extra-Articular Hip Pain

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants
Roger J. Bartolotta MD (Presenter): Nothing to Disclose
Alice S. Ha MD: Nothing to Disclose

TEACHING POINTS
While fracture and arthritis are important initial considerations for acute and chronic hip pain, respectively, several extra-articular etiologies for ‘hip’ pain should be considered. This purpose of this exhibit is to: 1. Review the normal complex musculotendinous and bursal anatomy about the hip on magnetic resonance imaging. 2. Examine the pathophysiology and imaging appearance of several common extra-articular causes of pain about the hip and buttock.

TABLE OF CONTENTS/OUTLINE
1. Gluteus: Anatomy, Calcific Tendinosis, Injury, Bursitis
2. Iliopsoas: Anatomy, Internal Snapping Hip Syndrome, Bursitis
3. Hip Adductors: Anatomy, Athletic Pubalgia
5. Osseous: Sacroiliitis, Stress/Insufficiency Fracture

MKE240
Piriformis Syndrome: What Are We Imaging? A Review of Primary and Secondary Causes

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit
**Participants**

Ellie Song-Yi Kwak MD (Presenter): Nothing to Disclose  
Jonathan Kheodoor Kazam MD: Nothing to Disclose  
Tony T. Wong MD: Nothing to Disclose

**TEACHING POINTS**

1. Understand anatomy of the sciatic nerve and greater sciatic foramen  
2. Identify the anatomic causes in primary piriformis syndrome  
3. Recognize various secondary causes of piriformis syndrome

**TABLE OF CONTENTS/OUTLINE**

1. Pre-test questions  
2. Anatomy Review - Sciatic nerve anatomy - Greater sciatic foramen anatomy - Variations in the exit of the sciatic nerve out of the pelvis  
3. Clinical features of piriformis syndrome  
4. Primary causes of piriformis syndrome - Piriformis muscle hypertrophy - Intramuscular nerve roots - Accessory muscle slips - Anomalous origin of piriformis muscle  
5. Secondary causes of piriformis syndrome - Myositis ossificans - Sacral schwannoma - Abscess from adjacent osteomyelitis - Soft tissue neoplasms - Gluteal hematoma - Post traumatic scarring  
6. Answers and review of pre-test questions

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**MKE241**

**Ultrasound Evaluation of Athletic Pubalgia**

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

**Participants**

Nicholas Morley MD (Presenter): Nothing to Disclose  
Thomas Howard Grant DO: Nothing to Disclose  
Kevin John Blount MD: Nothing to Disclose  
Imran Muhammad Omar MD: Nothing to Disclose

**TEACHING POINTS**

1. Describe the anatomy of the pubic symphysis and its ultrasound appearance  
2. Discuss the scanning techniques and protocol for a tailored athletic pubalgia exam at ultrasound  
3. Describe the findings seen in athletic pubalgia and its differential diagnosis at ultrasound

**TABLE OF CONTENTS/OUTLINE**

- Athletic pubalgia, also commonly called "sports hernia," is a painful groin condition usually seen in athletic patients performing quick acceleration and side to side cutting. It represents a spectrum of injuries around the pubic symphysis, often resulting from a rectus abdominis-adductor longus aponeurosis tear. Previous studies have described the MRI appearance of athletic pubalgia, however advantages of diagnosis at ultrasound include high resolution imaging and ability to direct imaging to the exact area of patient pain. The aim of this educational exhibit is to detail our institutional experience diagnosing athletic pubalgia at ultrasound. This includes an overview of the complex sonographic appearance of pubic symphysis anatomy, our institutional scanning protocol for an athletic pubalgia exam, and to detail the findings of athletic pubalgia and its differential diagnoses. Suggestions for optimizing image acquisition while maintaining patient comfort are also included.

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**MKE242**

**What the Radiologist Needs to Know about Hip Resurfacing Arthroplasty: Indications, Normal Radiologic Findings and Detection of Complications**

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

**Participants**

Carolina Luisa Calvo Corbella MD (Presenter): Nothing to Disclose  
Pablo Cendrero Cendrero: Nothing to Disclose  
Ana Sanchez Martin MD, PhD: Nothing to Disclose  
Begona Garcia Castano Gandiaga: Nothing to Disclose

**TEACHING POINTS**

After reviewing the presentation, the radiologist should be able to: - know which patients with hip disease could be appropriate candidates for hip resurfacing arthroplasty. - evaluate conventional radiographs of the patient with normal and normal hip resurfacing arthroplasty. - detect the presence of complications specifically related to the hip resurfacing procedure in conventional radiographs, - indicate and detect presence of certain complications in the periprosthetic tissues in other techniques of imaging, such as MRI, CT or even US. - diagnose general complications associated with any type of hip arthroplasty.

**TABLE OF CONTENTS/OUTLINE**

- Indications of the Hip Resurfacing Arthroplasty. Review of Imaging Findings: - Conventional radiographs: Normal and abnormal positioning of both the femoral and acetabular components of the prosthesis. Complications specifically related to the hip resurfacing procedure: femoral neck notching, areas of stress shielding and neck fractures; avascular necrosis, loosening, osteolysis and metallosis. - Conventional MRI: Metastasis (seudotumors, particle induced synovitis...). CT, US: general complications associated with any type of hip arthroplasty, such as dislocation, deep vein thrombosis and thromboembolic disease, vascular and neural damage. Sample cases

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**MKE244**

**Broken Wings: Preoperative Imaging Indications for Open Reduction Internal Fixation of Scapular Fractures**

*Education Exhibits*  
*Location: MK Community, Learning Center*
Participants

Alan Matthew Ropp MD (Presenter): Nothing to Disclose
Denk L. Davis MD : Nothing to Disclose

TEACHING POINTS

1. Describe the function of the scapula as a dynamic stabilizer at the shoulder girdle.
2. Discuss the imaging, injury mechanism, classification, and management of complex intra-articular glenoid fractures requiring open reduction internal fixation (ORIF).
3. Recognize signs of trauma to the superior shoulder suspensory complex (SSSC) that result in uncommon unstable floating shoulder injuries.
4. Define rare isolated extra-articular scapular fractures that require ORIF.

TABLE OF CONTENTS/OUTLINE

- Biomechanics of the scapula at the shoulder girdle
- Brief review of common indications for ORIF following scapular fracture
- Management, classification and imaging examples of complex intra-articular glenoid fracture - Isolated
- Combined intra-articular + extra-articular scapular fracture patterns
- Associated shoulder dislocation injuries Review of uncommon unstable floating shoulder injuries
- Scapular neck + clavicle fractures
- Scapular fracture + ligamentous injury
- Double SSSC injuries with associated intra-articular fracture
- Double SSSC injuries with associated scapular developmental anomalies
- Case examples of rare isolated extra-articular scapular fracture
- Severely displaced acromion process fracture
- Angled acromion process fracture with impingement on rotator cuff

Education Exhibits

Location: MK Community, Learning Center

Participants

Waqar Aslam Bhatti MBCh (Presenter): Nothing to Disclose
Gulraiz Sarfaraz Ahmad MBChB : Nothing to Disclose
Shahrukh Raees Ahmad : Nothing to Disclose
Braham Chaouch Reda : Nothing to Disclose
Muhammad Mubashar MBBS, FRCR : Nothing to Disclose
Jawad Naqvi BSC, MBBS : Nothing to Disclose

TEACHING POINTS

1. To review current understanding and role of ABER. 2. To describe its importance in the assessment of post traumatic instability, rotator cuff and biceps tendon disease. 3. The role of ABER in micro-instability, glenohumeral alignment, capsular insertion type and inferior capsular morphology including the description of the delta sign and crescent sign in relation to instability.

TABLE OF CONTENTS/OUTLINE

- A. Anatomy of the glenohumeral joint in the ABER position
- B. Technique for performing the ABER position and tips in the evaluation.
- C. Existing uses for the ABER in the evaluation of the IGHL and the rotator cuff.
- D. New role of the ABER position in the assessment of micro-instability - the crescent and the delta signs.
- E. ABER in the assessment of biceps and labral pathology
- F. Pitfall in evaluation of the ABER sequences.

Education Exhibits

Location: MK Community, Learning Center

Participants

Erin Flaherty MD (Presenter): Nothing to Disclose
Gregg William Bean MD : Nothing to Disclose
Melissa Mei Chen MD : Nothing to Disclose
Deborah Stedman MD, MBA : Nothing to Disclose
Rebecca A. Loredo MD : Nothing to Disclose

TEACHING POINTS

Glenohumeral osteoarthritis results in considerable disability, and affected patients have significant pain with acitivities and loss of motion. Shoulder arthroplasty is the mainstay of operative treatment when conservative measures fail. Good or excellent pain relief and restoration of function has been reported in 80% of those who have undergone hemiarthroplasty, and greater than 90% of patients with total shoulder arthroplasty. Preoperative planning for shoulder arthroplasty with cross-sectional imaging is critical in selecting the correct prosthesis for long-term success. With this exhibit, the learner should gain knowledge of:

1. Introduction to shoulder osteoarthritis
2. Review of the types of shoulder arthroplasties
3. Familiarization of the pathologic findings that influence the choice of arthroplasty and their CT and MR imaging findings
4. Pre-operative evaluation of the glenoid axis using 3D and 2D images through the true scapular axis

Education Exhibits

Location: MK Community, Learning Center

Participants

Erin Flaherty MD (Presenter): Nothing to Disclose
Gregg William Bean MD : Nothing to Disclose
Melissa Mei Chen MD : Nothing to Disclose
Deborah Stedman MD, MBA : Nothing to Disclose
Rebecca A. Loredo MD : Nothing to Disclose

TEACHING POINTS

Glenohumeral osteoarthritis results in considerable disability, and affected patients have significant pain with acitivities and loss of motion. Shoulder arthroplasty is the mainstay of operative treatment when conservative measures fail. Good or excellent pain relief and restoration of function has been reported in 80% of those who have undergone hemiarthroplasty, and greater than 90% of patients with total shoulder arthroplasty. Preoperative planning for shoulder arthroplasty with cross-sectional imaging is critical in selecting the correct prosthesis for long-term success. With this exhibit, the learner should gain knowledge of:

Important glenohumeral and rotator cuff pathologies/findings as demonstrated on CT and MRI that result in the need for or contribute to the success of shoulder arthroplasties Different types of arthroplasties and what imaging findings help determine which prosthesis will be used.

TABLE OF CONTENTS/OUTLINE

1. Introduction to shoulder osteoarthritis
2. Review of the types of shoulder arthroplasties
3. Familiarization of the pathologic findings that influence the choice of arthroplasty and their CT and MR imaging findings
4. Pre-operative evaluation of the glenoid axis using 3D and 2D images through the true scapular axis
Imaging of Anterior Glenohumeral Instability: What the Orthopedist Wants to Know

Education Exhibits
Location: MK Community, Learning Center

Participants
William J. Reed MD (Presenter): Nothing to Disclose
Joseph Michael Bestic MD: Nothing to Disclose
Hillary Garner MD: Nothing to Disclose
Jeffrey James Peterson MD: Nothing to Disclose
Daniel Edward Wessell MD, PhD: Research Consultant, Biomedical Systems

TEACHING POINTS
After viewing this exhibit the reader will be able to: 1. Explain the pathophysiology of anterior glenohumeral joint instability 2. Accurately quantify the extent of glenoid bone loss using Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) 3. Understand the clinical ramifications associated with the extent of glenoid bone loss 4. Understand the multiple reconstructive surgical techniques for correcting anterior glenohumeral instability with emphasis on the Latarjet procedure (coracoid transfer to glenoid) and its normal and abnormal postoperative imaging appearance.

TABLE OF CONTENTS/OUTLINE

MKE250
Imaging of the Acromioclavicular Joint: A Comprehensive Multimodality Review of Normal Anatomy, Pathology and Variants

Education Exhibits
Location: MK Community, Learning Center

Participants
Adam Noah Rucker MD: Nothing to Disclose
Anthony Dennis Mohabir MD: Nothing to Disclose
Jarett Burak MD: Nothing to Disclose
Michael Brown MD: Nothing to Disclose
Daniel M. Walz MD (Presenter): Nothing to Disclose

TEACHING POINTS
The Purpose of this Exhibit is:
1. To explain the role imaging plays in diagnosing various post-traumatic, degenerative, inflammatory and developmental conditions.
2. To allow the viewer to gain an understanding of the important clinical implications and treatment options related to various pathologic conditions of the AC joint and how a correct imaging diagnosis can lead to more focused and effective therapy.
3. To review variant and pathologic developmental anatomy of the AC joint.

TABLE OF CONTENTS/OUTLINE

MKE252
MR Imaging of Rotator Cuff Repair: Pearls and Pitfalls

Education Exhibits
Location: MK Community, Learning Center

Participants
Anthony Samir Tadros MD (Presenter): Nothing to Disclose
Karen Chi-Lynn Chen MD: Nothing to Disclose
Brady Kirk Huang MD: Nothing to Disclose
Eric Y. Chang MD: Nothing to Disclose

TEACHING POINTS
1. MR appearance of the repaired rotator cuff varies with time. 2. Patterns of rotator cuff repair failure are highly dependent on repair techniques. 3. Postoperative rotator cuff tears may not correlate with clinical outcomes.

TABLE OF CONTENTS/OUTLINE

MKE253
Postoperative Imaging after Shoulder Surgery: Spectrum of Normal and Abnormal Findings

Education Exhibits
Location: MK Community, Learning Center

Participants
Jung-Ah Choi MD (Presenter): Nothing to Disclose
Joo Han Oh MD : Nothing to Disclose
Daehyun Hwang MD, PhD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the spectrum of normal postoperative imaging findings after shoulder surgery, including rotator cuff surgery, labrum surgery, and arthroplasty 2. To review typical abnormal postoperative imaging findings, after shoulder surgery, such as recurrent cuff tear, recurrent labral tear, periprosthetic complications and infection

TABLE OF CONTENTS/OUTLINE
Spectrum of normal postoperative findings after rotator cuff surgery, labrum surgery, total and reverse total shoulder replacement arthroplasty - Radiography - MR imaging/MR arthrography - CT arthrography - ultrasound Spectrum of abnormal postoperative imaging findings after rotator cuff surgery, labrum surgery, shoulder arthroplasty - recurrent rotator cuff tear, labral tear - periprosthetic complications: breakage, loosening - infection Summary/Conclusion

MKE254
Scapulothoracic Bursitis and Snapping Scapula Syndrome

Education Exhibits
Location: MK Community, Learning Center

Participants
Walter Alan Osias MD (Presenter): Nothing to Disclose
Eric Allan White MD : Nothing to Disclose
Matthew Raymond Skalski DC : Nothing to Disclose
Aaron Schein MD : Nothing to Disclose
Dakshesh Bhulabhai Patel MD : Nothing to Disclose
George Robert Matcuk MD : Nothing to Disclose
Deborah M. Forrester MD : Nothing to Disclose
George Hatch MD : Nothing to Disclose

TEACHING POINTS
This project aims to provide a thorough and current review of scapulothoracic bursitis and the snapping scapula syndrome and educate the radiologist about imaging findings, diagnosis, and management.

TABLE OF CONTENTS/OUTLINE
-Review the anatomy of the scapulothoracic articulation including its major components; the bony structure, muscular anatomy, scapulothoracic bursae, and neurovascular anatomy. -Describe the different causes of STB and snapping scapula syndrome, and their appearances on radiography, CT, MRI and ultrasound. -Discuss the clinical manifestations of STB and snapping scapula syndrome including crepitus and specific neuromuscular deficits. -Examine treatment options including ultrasound or CT guided aspiration and/or injection, resection of osseous lesions such as osteochondromas, superomedial angle scapular resection, and bursectomy.

MKE255
Shoulder Arthroplasty, from Indications to Complications: What the Radiologist Needs to Know

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

Participants
Dana Lin MD (Presenter): Nothing to Disclose
Tony T. Wong MD : Nothing to Disclose
Jonathan Khedoori Kazam MD : Nothing to Disclose

TEACHING POINTS
1. Review the major clinical indications for shoulder arthroplasty and their key imaging features.
2. Understand the role of preoperative imaging and review the normal imaging appearance of different shoulder arthroplasties.
3. Understand the role of multimodality imaging for evaluation of postoperative complications.

TABLE OF CONTENTS/OUTLINE
1. Pre-test questions
2. Review of clinical indications and key imaging features
   - Osteoarthrosis
   - Inflammatory Arthritis
   - Rotator Cuff Arthropathy
   - Proximal Humerus Fractures
   - Avascular Necrosis
Failed Prior Shoulder Arthroplasty

3. Preoperative imaging and normal postoperative appearance of shoulder arthroplasties with key imaging features

- Total Shoulder Arthroplasty
- Hemiarthroplasty
- Resurfacing Arthroplasty
- Reverse Total Shoulder Arthroplasty

4. Multimodality imaging of postoperative complications including ultrasound and metal reduction MRI

- Loosening
- Instability
- Rotator Cuff Tear
- Periprosthetic Fracture
- Infection
- Deltoid Dysfunction

5. Answers and review of pre-test questions

MKE256

Subscapularis: All about the Forgotten Rotator Cuff Tendon

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants

Maria Jose Ereno Ealo MD (Presenter): Nothing to Disclose
Alberto Sanchez Sobrino: Nothing to Disclose
Oscar Luis Casado Verduco: Nothing to Disclose
Rosa Monica Rodrigo Del Solar: Nothing to Disclose
Eva Llopis MD: Nothing to Disclose
Silvia Martin MD: Nothing to Disclose

TEACHING POINTS

1. To review the anatomy and pathophysiology of the subscapularis (SSC) tendon. 2. To describe the role of different imaging techniques in the evaluation of the pathology of the SSC. 3. To correlate the point of view of radiologists and arthroscopists before and after treatment.

TABLE OF CONTENTS/OUTLINE

The subscapularis (SSC) is the largest of the 4 rotator cuff muscles. However, SSC tendon lesions are difficult to find, especially partial ones, and many authors call them "hidden lesions". We analyze these issues: - The anatomic footprint of the SSC tendon. Function and role in the stability of the shoulder. - Pathophysiology of SSC tendon tears - Relationship of SSC tendon tears to other shoulder lesions - Diagnosis of SSC dysfunction - The physical examination maneuvers * Review of imaging findings * Ultrasonography (US) * Computed Tomography (CT) * Conventional and arthro-MRI - New aspects of treatment of the SSC. Correlation radiology-arthrography. Images and videos. - Cases

MKE259

The Scapula: What Every Radiologist Needs to Know

Education Exhibits
Location: MK Community, Learning Center

Participants

Parisa Mazaheri (Presenter): Nothing to Disclose
Laura Marie Fayad MD: Nothing to Disclose
Shadpour Demehri MD: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to: 1. Review the clinically relevant anatomical and embryological features of the scapula and their implications. 2. Describe clinical features of scapular pathologies. 3. Highlight the radiographic characteristics of a wide spectrum of pathologies involving the scapula. 4. Characterize and highlight the value of cross-sectional imaging in detection of various pathologies of the scapula, which otherwise could be challenging to characterize using plain radiography. 5. Provide examples of CT and MR images for various pathologies. 6. Discuss the differential diagnosis and overlap features, and how not to misdiagnose the lesions.

TABLE OF CONTENTS/OUTLINE

- Anatomy of the scapula
- Review of imaging findings of a wide spectrum of scapular pathologies and sample cases

MKE260

Total Assessment of Shoulder Arthroplasties: What the Surgeon Looks for Preop, Intra-op, and Post-op

Education Exhibits
Location: Mk Community, Learning Center

Participants
Nicholas Marc Beckmann MD (Presenter): Nothing to Disclose
Manickam Kumaravel MD, FRCS : Nothing to Disclose
Susanna Claire Spence MD : Nothing to Disclose

TEACHING POINTS
1. Preoperative factors that affect shoulder arthroplasty type and placement. 2. How surgeons determine adequate hardware positioning of shoulder arthroplasties. 3. Common intra-operative and post-operative complications of shoulder arthroplasties.

TABLE OF CONTENTS/OUTLINE

MKE262
Atypical MR Findings of Early Spondylodiscitis Mimicking Other Lesions

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

Participants
Hie Bum Suh MD (Presenter): Nothing to Disclose
In Sook Lee : Nothing to Disclose
You Seon Song : Nothing to Disclose
Jong Woon Song : Nothing to Disclose

TEACHING POINTS
Early presentation of spondylodiscitis may have an atypical MR findings mimicking neoplasm or acute inflammatory conditions or traumatic conditions. In the iatrogenic infectious conditions, atypical imaging findings at unusual sites may be seen. To avoid delay diagnosis of spondylodiscitis, radiologists should be familiar with atypical MR findings of early spondylodiscitis and it is important to differentiate from other lesions with similar findings.

TABLE OF CONTENTS/OUTLINE
Only thin epidural enhancement - differentiation from non-specific inflammatory conditios Single vetebral body involvement - mimicking neoplasm Similar Modic changes, especially type I Similar acute Schmorl's node - extensive bone marrow edema Similar acute compression fractures -paraspinal signal intensity obliterating fat plane Facet joint or linear back muscle enhancement - iatrogenic infection

MKE264
Extraspinal Incidental Findings on MRI of the Cervical, Thoracic, and Lumbar Spine for the Musculoskeletal Radiologist

Education Exhibits
Location: MK Community, Learning Center

Participants
Elisabeth Garwood MD (Presenter): Nothing to Disclose
Daria Motamedi MD : Nothing to Disclose
Cameron H. Gates DO : Nothing to Disclose
Joshua J. Leeman MD : Nothing to Disclose
Brian MacNeill Everist MD : Nothing to Disclose
Lynne S. Steinbach MD : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to review a series of incidental findings on spine MRI with the goal of demonstrating: 1. Incidental findings on spine MR are common and demonstrate variable clinical significance. 2. Incidental findings may only be present on the localizer sequence, partially imaged in the narrow field of view, obscured by saturation bands, or incompletely characterized. 3. Incidental findings may be easy to miss if a structured approach is not employed.

TABLE OF CONTENTS/OUTLINE
Brief literature review of extraspinal incidentals Presentation of cases by anatomic region Cervical spine: Problem areas: Posterior fossa, sella, nasopharynx, vasculature, thyroid, anterior and posterior soft tissues. Thoracic spine: Problem areas: Pulmonary parenchyma, mediastinum, central vasculature, paraspinous soft tissues. Lumbar spine: Problem areas: Abdominal and pelvic organs, retroperitoneum, paraspinous soft tissues, vasculature. Summary

MKE265
Facet Joint Syndrome: A Comprehensive Approach for the Radiologist

Education Exhibits
Location: MK Community, Learning Center

Participants
Hugues Gilles Brat MD (Presenter): Research Consultant, Medtronic, Inc
Tino Tancredi MD : Nothing to Disclose
Dominique Fournier MD : Nothing to Disclose
Tarik Bouziane MD : Nothing to Disclose
TEACHING POINTS

1. To understand complexity of facet joint syndrome
2. To differentiate facet joint related pain and disability from other causes
3. To use appropriate evaluation methods and diagnostic modalities
4. To use an age-related management algorithm for suspected facet joint related back pain
5. To understand current treatment options with their limitations and success rates

TABLE OF CONTENTS/OUTLINE

1. Definition of facet joint syndrome
2. Epidemiology
3. Clinics Clinical presentation and physiopathology Red and yellow flag signs Spine and 'other-than-spine' differential diagnosis of facet joint syndrome
4. Diagnosis Physical examination Pain and disability evaluation: VAS and Roland-Morris Disability Questionnaire (RMDQ) When to use imaging? Imaging strategy (focus on contrast-enhanced MRI and SPECT-CT) Semi-invasive diagnosis (CT-guided facet block)
5. Treatment Proposal of an age-related algorithm Physical treatment and medication strategy Levels of evidence Intra-articular or peri-articular facet joint infiltration Radiofrequency facet denervation/neurotomy Multidisciplinarity and follow-up
6. Conclusion Take home messages

MKE267

Intraspinal Calcifications or Ossifications: "Where Are They from?"

Education Exhibits
Location: MK Community, Learning Center

Participants
Seon-Jeong Kim MD (Presenter): Nothing to Disclose
Ok Hwa Kim : Nothing to Disclose
Sun Joo Lee MD : Nothing to Disclose
Hye Jung Choo MD : Nothing to Disclose
Jae Hyuck Yi MD : Nothing to Disclose
Kil Ho Cho : Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review various causes, pathophysiologies and clinical relevancies of intraspinal calcifications/ossifications 2. To present imaging findings of various disorders that can manifest as intraspinal calcifications/ossifications

TABLE OF CONTENTS/OUTLINE
Pathophysiology, clinical relevancies, and imaging findings of disorders that can manifest as intraspinal calcifications/ossifications categorized into 5 groups based on their etiopathogenesis: Degenerative/arthritides - Calcified intervertebral disc herniation - Ossification of posterior longitudinal ligament - Ossification of ligamentum flavum - Calcified facet joint synovial cyst - CPPD Infectious/Inflammatory disease - Tuberculosis - Brucellosis - Cysticercosis - Paragonimiasis - Sarcoidosis Neoplastic - Calcified meningioma - Osteoblastoma - Osteochondroma - Chondrosarcoma - Osteosarcoma Iatrogenic -Vertebroplasty/kyphoplasty -Steroid injection Miscellaneous -Arachnoiditis ossificans -Calcified dural plaque -Retropulsion of burst fracture -Calcification in epidural hematoma

MKE268

Magnetic Resonance Neurography (MRN) of the Lumbosacral Plexus

Education Exhibits
Location: MK Community, Learning Center

Participants
Vinicius Neves Marcos MD : Nothing to Disclose
Francisco Julio Muniz Neto MD (Presenter): Nothing to Disclose
Vitor Serrao Margotto MD : Nothing to Disclose
Tahan Rivas Tirapani MD : Nothing to Disclose
Victor Hada Sanders MD : Nothing to Disclose
Joao Carlos Rodrigues MD : Nothing to Disclose
Atul Kumar Taneja MD : Nothing to Disclose
Luiz Guilherme Hartmann MD : Nothing to Disclose
Laercio A. Rosemberg MD : Nothing to Disclose
Marcelo Buenquem Gusmao Funari MD : Nothing to Disclose

TEACHING POINTS
- MRN adds relevant imaging information in the clinical work-up of neuropathy involving the lumbosacral plexus, especially when electrodiagnostic tests are inconclusive
- The key imaging findings related neuropathies of the lumbosacral plexus detected by MRN include abnormal course, thickening, high signal intensity and contrast-enhancement of the nerve

TABLE OF CONTENTS/OUTLINE
A. Suggested MRN protocol and sequences parameters, as performed in our institution
B. Clinical indications to perform MRN of the lumbosacral plexus, using both scientific literature and authors experience
C. Normal anatomy of the lumbosacral plexus, main anatomic variants and illustrative pathologies related to the lumbosacral plexus will be presented in cases with clinical history and MR images
D. Additional and secondary findings related to denervation will also be discussed

MKE270

MRI of the Psoas Major Muscle: Anatomy, Anatomical Variants and a Catalogue of Pathologies Affecting the Muscle

Education Exhibits
Location: MK Community, Learning Center
TEACHING POINTS

1) Review of the anatomy and biomechanical role of the psoas muscle in the motion of the trunk and spine, 2) presentation of both frequent and rare anatomical variants of the psoas muscle 3) role of MRI in imaging the pathological psoas.

TABLE OF CONTENTS/OUTLINE

This exhibit will display: 1) MR images of the normal psoas in three plans with emphasis on the insertion points and origin of the muscle and its relationship with the intervertebral disc, 2) illustration of the vascular supply to the psoas, 3) illustration of the innervation of the psoas, 4) the diverse anatomical variants of the psoas such as: a) asymmetry of the insertion of the psoas, b) abnormal low insertion points below L1 level, c) asymmetry of the psoas size, d) unusual bilateral convex shape of the psoas, and e) unilateral absence of the psoas. The pathologies of the psoas will include: muscular hematoma and bleeding, muscle contusion, muscle tear, myositis ossificans, unilateral atrophy, bilateral atrophy, atrophy of the psoas associated with atrophy of the paraspinal muscles, atrophy and deformity of the psoas muscle associated with scoliosis, psoas edema, isolated psoas abscess and psoas abscess associated with spondylodiscitis.

MKE271
MultiModality Imaging Signs of Spondlylolysis and Isthimic Listhesis Revisited

Education Exhibits
Location: MK Community, Learning Center

Participants
Rammohan Vadapalli MD (Presenter): Nothing to Disclose
Raghavadutt Mulukutla MChir: Nothing to Disclose
Harshavardhan KR MD: Nothing to Disclose
Abhinav Sriram Sriram Vadapalli: Nothing to Disclose
Prasad Guntuluri: Nothing to Disclose

TEACHING POINTS

List and Illustrate the Imaging signs of Isthimic Spondlylolysis and Listhesis on CT,MRI,F18 PET CT.

TABLE OF CONTENTS/OUTLINE

Pars Defect sign on CT with broken neck of Scotty Terrier pattern Pars defect on MRI The Edema Sign on Coronal STIR MRI The Edema Sign on STIR Sag MRI The Edema sign on PET CT The Edema Sign with Neighourhood enhancement The Napolean hat Sign The Inverted napolean hat Sign The Wide canal Sign Abnormal posterior Wedge Sign or Spinous Process Step off Sign The Horizontal neural Foramen Sign. The Fat Isthumus Sign. The above signs are described illustrated with clinical examples

MKE272
Spondylodiscitis; What Radiologists Need to Know

Education Exhibits
Location: MK Community, Learning Center

Participants
Najmeh Rohani MD (Presenter): Nothing to Disclose
Oleg Teytelboym MD: Nothing to Disclose

TEACHING POINTS

Become familiar with typical clinical presentations of spinal infections. Understand imaging findings in spinal infection. Become aware of potential interpretative pitfalls. Understand various imaging options including CT, MRI, FDG PET-CT, and nuclear medicine. Identify challenges in follow up and evaluating response to treatment.

TABLE OF CONTENTS/OUTLINE

Epidemiology and typical clinical presentations of spinal infections.
Pathophysiology of infection spread and commonly involved pathogens.
Diagnostic work up of suspected spinal infection including approach to patients who cannot undergo MRI.
Review of diagnostic accuracy and pictorial illustration of spondylodiscitisappearance on various modalities: CT, MRI, FDG PET-CT, and nuclear medicine.
Illustration of common and unusual complications of spondylodiscitis.
Review and illustration of imaging pitfalls that may contribute to diagnostic delays; and practical tips for avoiding them.
Review of spondylodiscitisdifferential diagnosis.
Discussion and illustration of difficulties in treatment response assessment and follow up of spondylodiscitis.

MKE273
The Sternal-rib Complex Is the Fourth Column of the Thoracic Spine: 3D Modeling of Its Role in the Mechanism of Injury to the Chest Wall and Spine

Education Exhibits
Location: MK Community, Learning Center
Magna Cum Laude
The three-column model of the spine is widely recognized and used to classify the stability of spinal fractures. The sternal-rib complex has been shown to provide additional stability to the thoracic spine and as such has been designated the lesser known fourth column of the thoracic spine. Disruption of the sternal-rib complex can contribute to destabilization of the spine after injury and this should be recognized during assessment of stability. The biomechanical relationship between the sternal-rib complex and thoracic spine leads to specific osseous and soft tissue injury patterns in trauma and results in sternal insufficiency fractures after multiple thoracic spine osteoporotic fractures. The anatomy and biomechanics of the thoracic cage, mechanisms of traumatic and atraumatic sternal fractures, and associated injuries will be reviewed.

TABLE OF CONTENTS/OUTLINE

1. Review concept of three-column model of spine
2. Review anatomy of biomechanics of the thoracic cage
3. Illustrate stabilization of the thoracic cage by the sternal-rib complex, the so-called fourth column of the thoracic spine
4. Review mechanisms of both traumatic and osteoporotic insufficiency fractures of the sternum with three-dimensional computer animations
5. Describe life-threatening thoracic injuries associated with traumatic thoracic cage fractures

MKE274
Utility of MRI of the Spine in Axial Spondiloarthritis

Education Exhibits
Location: MK Community, Learning Center

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

TEACHING POINTS

- To understand the relevance of spine involvement in Axial Spondyloarthritis (SpA). - Description of characteristic spinal MRI lesions in Axial SpA: inflammatory and structural changes, with radiographic correlation. - To discuss the role of MRI as a biological marker of disease activity: definition of positive MRI of the spine, and utility for monitoring.

TABLE OF CONTENTS/OUTLINE


MKE275
Above and beyond Digital Tomosynthesis: Emphasis on Musculoskeletal Application

Education Exhibits
Location: MK Community, Learning Center

Participants
Seun Ah Lee MD (Presenter): Nothing to Disclose
Eun Sil Kim : Nothing to Disclose
Seon Jeong Oh : Nothing to Disclose
Jung Won Choi : Nothing to Disclose
Baek Hyun Kim MD : Nothing to Disclose
Kyung-Sik Ahn MD : Nothing to Disclose
Chang Ho Kang MD : Nothing to Disclose
Suk-Joo Hong MD : Nothing to Disclose

TEACHING POINTS

1. To review the history and basic principles of digital tomosynthesis. 2. To introduce current experimental and clinical applications of digital tomosynthesis. 3. To understand the benefits and limitations of digital tomosynthesis 4. To understand the role of digital tomosynthesis as a problem solver in the musculoskeletal part during daily clinical practice.

TABLE OF CONTENTS/OUTLINE

1. Background and basic principles of digital tomosynthesis with illustration. 2. Current experimental and clinical applications of digital tomosynthesis in other subspecialties. 3. Pros and cons of digital tomosynthesis. 4. The potential applications of digital tomosynthesis in the musculoskeletal part with sample cases. (1) Trauma: fracture detection, follow-up for fracture healing (callus formation, evaluation of union status at the fracture site with/without metallic implant) (2) Arthroplasty: periprosthetic loosening (3) Arthrography: wrist arthrography for triangular fibrocartilage complex tear (4) Arthritis: bone erosion, joint space narrowing for rheumatoid arthritis, osteoarthritis, sacroiliitis, and gout (5) Bone tumor: tumor evaluation, follow-up after tumor curettage (6) Others: avascular necrosis, osteochondrosis, crystal deposition disease
MKE276
An Automated 3D Kinematic Measurement for Total Joint Arthroplasty Using X-ray Fluoroscopic Images

Education Exhibits
Location: MK Community, Learning Center

Participants
Takaharu Yamazaki PhD (Presenter): Nothing to Disclose
Ryogo Kamei: Nothing to Disclose
Tatsuya Tomita MD: Nothing to Disclose
Hideki Yoshikawa MD: Nothing to Disclose
Kazuomi Sugamoto MD: Nothing to Disclose

TEACHING POINTS
1. To experience the benefits of an automated 3D kinematic measurement for total joint arthroplasty (TJA) using x-ray fluoroscopic images 2. To understand the 3D kinematics for the different types of joint motion after TJA including knee, hip, elbow and ankle in order to improve surgical techniques.

TABLE OF CONTENTS/OUTLINE

Outline: Quantitative assessment of 3D dynamic motion after TJA is very important for understanding the effects of joint diseases, dysfunction and for evaluating the outcome of surgical procedures. This exhibit demonstrates an automated 3D kinematic measurement system using x-ray fluoroscopic images, and also present various 3D kinematics for TJA. This system can be a strong motivation for orthopaedic surgeon to improve surgical techniques.

MKE277
Angle-sensitive Magnetic Resonance Imaging of Articular Cartilage (ASMRIC)

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

Participants
Nikita Garnov (Presenter): Nothing to Disclose
Wilfried Gruender PhD: Nothing to Disclose
Thomas Kurt Kahn MD: Nothing to Disclose
Harald F. Busse PhD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To make ASMRIC understandable for radiologists To demonstrate its capabilities for in-vivo analysis of articular cartilage To discuss initial results and promises of ASMRIC

TABLE OF CONTENTS/OUTLINE
Angle-Sensitive Magnetic Resonance Imaging of Cartilage (ASMRIC) Physics background Cartilage ultrastructure model MR intensity behavior Measurement requirements ASMRIC analysis Orientation-dependent MR images Weight-bearing measurements Native cartilage analysis in vivo Results and Discussion Experimental results Clinical applications Strengths, limitations/issues and promises of the technique

MKE278
Approaches to the Upper Cervical Spine for Percutaneous Vertebroplasty

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

Participants
Idan Genah MD (Presenter): Nothing to Disclose
Sebastien Touraine MD: Nothing to Disclose
Caroline Parlier MD: Nothing to Disclose
Bassam Hamze MD: Nothing to Disclose
Valerie Bousson: Nothing to Disclose
Elodie Sibleau MD: Nothing to Disclose
Jean-Denis Laredo MD: Research Consultant, Cardinal Health, Inc Research Consultant, Laurane Medical Research Consultant, F. Hoffman-La Roche Ltd Research Grant, SERVIER

TEACHING POINTS
To describe different approaches for performing percutaneous vertebroplasty of the upper cervical spine. To present an original transvertebral approach of C1 and C2 under fluoroscopic control. To discuss the advantages and disadvantages of surgical approaches used and described in the literature.
TABLE OF CONTENTS/OUTLINE
Destruction processes especially metastasis of C1 and C2 put the bulb and spinal cord at risk. Surgical approach to this skeletal site carries some risk of bleeding, vascular and nervous lesions, and anaesthetic risk. Interest for vertebroplasty of C1 and C2 is therefore obvious. Due to variety in the exact location of bone destruction area and vital anatomical structures, several approaches are needed. Percutaneous vertebroplasty remains for the upper cervical spine a challenging procedure because major vessels, nerves, the airway, often intervene in the projected needle path. In this presentation, we review the five different approaches used for vertebroplasty of upper cervical spine (anterolateral, transvertebral, posterolateral, lateral and transoral approach), focusing on the relevant anatomy, technical aspects, and advantages and limitations of each approach.

MKE279
Crying Out for Pain Relief with Cryoablation and Cementation for Pelvic Osseous Metastases

Participants
Brathaban Rajayogeswaran MBCh (Presenter): Nothing to Disclose
Neal C. Chhaya MBBS, FRCR: Nothing to Disclose
Paul Ian Mallinson MBChB: Nothing to Disclose
Peter L. Munk MD: Nothing to Disclose

TEACHING POINTS
To review the patient selection procedure for cryoablation and cementation of pelvic osseous metastasis, principles of cryoablation, planning of intervention, potential complications of cryoablation and cementation, post procedural imaging.

TABLE OF CONTENTS/OUTLINE
Osteolytic metastases are painful in 70% of patients and cause considerable loss of function and decreased quality of life. Radiotherapy alone is usually unable to control the pain, and increasing opiates usage causes significant morbidity. Cryoablation and cementation is offered as an adjunct in our institute as a minimally invasive palliative procedure providing instant reduction in pain and improving structural integrity.

Our pictorial review demonstrates the integration of multiple disciplinary care with techniques of cryoablation and cementation of variety of pelvic lesions.
1) Consideration of cryoablation in palliative care patients with pelvic metastases and pathological fractures.
2) Description of the principles of cryoablation and cementation.
3) Pictorial review of position and probe size selection to create a satisfactory ablation zone.
4) Discussion on techniques to minimise procedural complications.
5) Principles of reviewing post procedural imaging.

MKE280
CT-Guided Pain Interventions of the Spine

Participants
Michael Gregory Rodriguez MD (Presenter): Nothing to Disclose
Tatum Adams Mcarthur MD: Nothing to Disclose
Samuel J. Gaigano MD: Nothing to Disclose

TEACHING POINTS
1. To review the various CT-guided pain interventions that can be performed in the cervical, thoracic, and lumbar spine.
2. To review the indications and contraindications for performing CT-guided pain interventions in the spine.
3. To discuss the techniques in performing CT-guided pain interventions in the spine.
4. To review the complications associated with CT-guided pain interventions in the spine.
5. To review the advantages and disadvantages of performing pain interventions in the spine using CT versus fluoroscopy.

TABLE OF CONTENTS/OUTLINE

MKE282
Diffusion Weighted MRI: MSK Applications - Merits and Disadvantages

Participants
Avneesh Chhabra MD (Presenter): Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc
TEACHING POINTS
1. Learn the technical considerations of Diffusion (DWI) techniques including diffusion tensor imaging (DTI).
2. Learn the normal and abnormal appearances of musculoskeletal soft tissues and peripheral nerves on DWI.
3. Learn the role of ADC in benign versus malignant bone and soft tissue lesions, and role of DTI parameters (FA and ADC) and tractography in neuromuscular lesions.
4. Gain knowledge of the artifacts and imaging pitfalls on DWI.

TABLE OF CONTENTS/OUTLINE
1. Technical considerations of DWI and DTI.
2. Normal DWI and DTI qualitative imaging appearances as well as ADC and FA values of relevant musculoskeletal structures (fluid, fat, muscles, nerves, bones).
3. Discussion of role of DWI in malignancy detection, tumor grading and post-treatment response.
4. Discussion of role of DTI in neuromuscular imaging including tractography.
5. Application of DWI in whole body imaging.
6. Imaging pitfalls and artifacts.

MKE283
Elite Soccer Players and Platelet Rich-plasma Injection: Why Radiologist Is Important?

Education Exhibits
Location: MK Community, Learning Center

Participants
- Lourdes Guillen Vargas MD (Presenter): Nothing to Disclose
- Pilar Ferrer Ripolles: Nothing to Disclose
- Luisa Arinyo Montaner: Nothing to Disclose
- Moises Hernandez MD: Nothing to Disclose

TEACHING POINTS
To show the indications, technique and results of US-guided platelet rich plasma injection in MSK injuries in elite soccer players.

TABLE OF CONTENTS/OUTLINE
A. PLATELET RICH PLASMA PHYSIOLOGY’S Volume of the plasma fraction having a platelet concentration above baseline. Growth factors play a central role in the healing process and tissue regeneration. B. INDICATION In soccer players, tendons are vulnerable to injury and stubborn to heal. In this kind of patients, is very important to have a shorten recovery time and effective healing. C. HOW WE DO IT 38 ultrasound guided infiltrations were performed in 18 male patients, mean age 24.5 yo. HD15 ultrasound, linear probe L12-5 and L15-7io, centrifuge and 20-22G needles are used. 30 ml blood patient is extracted, then 15 minutes spin at 3,200 rpm. About 3-4 ml of PRP are separated. We proceed to inject PRP intra and perilesion under US-guidance. Injection is avoided if there are signs of local inflammation or infection. D. OUTCOME Most soccer players treated with PRP had faster recovery and they play before than in not treated with PRP. It is essential a radiologist who knows properly handle ultrasound and who has experience in this type of lesions of the musculoskeletal system, since in this way the lesion is located suitably to treat it accurately.

MKE288
Musculoskeletal Ultrasound (US)-guided Interventional Procedures of the Lower Limb: A Didactical Approach

Education Exhibits
Location: MK Community, Learning Center

Participants
- Giulio Ferrero (Presenter): Nothing to Disclose
- Emanuele Fabbro MD: Nothing to Disclose
- Davide Oriardi MD: Nothing to Disclose
- Silvia Perugin Bernardi MChir: Nothing to Disclose
- Luca Maria Sconfienza MD, PhD: Nothing to Disclose
- Enzo Silvestri MD: Nothing to Disclose
- Giovanni Serafini MD: Nothing to Disclose

TEACHING POINTS
The aim of this educational exhibit is to:
1. review the US-guided percutaneous procedures aimed to the treatment of lower limb musculoskeletal pathologies;
2. show technical aspects, precautions and tricks that may help to improve the outcome of such treatments;
3. provide anatomical schemes with didactic purpose and show correlations both with US static images and procedural US videos.

TABLE OF CONTENTS/OUTLINE
Ultrasound guidance is very helpful in the guidance of percutaneous musculoskeletal procedures on the lower limb due to the relatively deep location of some joint structures such as the hip, where free-hand techniques are affected by a low level of accuracy, and the superficial location of other structures that could be instead very small or close to neurovascular structures. Authors will show how to correctly perform several US-guided procedures aimed to treat lower limb pathologies such as: - hip osteoarthritis; - degenerative tendinitis of the hip; - ilioinguinal and trochanteric bursitis; - Morel-Lavallée and other soft tissues haematomas; - knee osteoarthritis; - Baker cyst; - patellar tendinopathy; - tibiotaral osteoarthritis; - tenosynovitis; - Achilles tendinopathy; - plantar fascitis; - Morton’s neuroma; - intermetatarsal bursitis.

MKE289
Myofascial Scars- Revolutionary Treatments Using Hyaluronic Acid Scar Stripping

Education Exhibits

Location: MK Community, Learning Center
TEACHING POINTS

Myofascial scars are a common response to traumatic injury and surgery in various locations in the musculoskeletal system. However, this overzealous healing response can be a cause of reduced function and pain in both athletes and non-athletes. These scars can be visualised on ultrasound and MRI. Conventional conservative management is of limited value but at present, there are no alternatives. 1. Outline of the pathophysiology leading to the development of myofascial scars 2. Clinical features of myofascial scars 3. Review of the imaging appearances on US and MRI 4. Theory behind “Scar Stripping” 5. Practical step by step guide to performing this novel ultrasound guided percutaneous technique using hyaluronic acid (ostenil plus), large volumes of Marcaine 0.5% and 25mgs of hydrocortisone.

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MKE290

Opportunities and Limitations with Interventional MRI Performed at 3 Tesla

Education Exhibits

Location: MK Community, Learning Center

Certificate of Merit

Participants

John Nicholas Morelli MD (Presenter): Nothing to Disclose
John A. Carrino MD, MPH: Consultant, BioClinica, Inc Consultant, Pfizer Inc Advisory Board, General Electric Company
Jonathan S. Lewin MD: Nothing to Disclose
Jan Fritz MD: Research Grant, Siemens AG Research Consultant, Siemens AG

TEACHING POINTS

1. Although interventional MR-guided procedures have conventionally been performed on low- and mid-field open MR systems, performance of interventional MRI at 3 T is technically feasible. 2. Similar to diagnostic imaging, utilization of 3 T MR for procedural guidance presents many potential advantages including the ability to leverage signal-to-noise gains in order to achieve greater temporospatial resolution. 3. Challenges for 3 T interventional MRI include needle artifact reduction, patient access, specific absorption rate, fat saturation and coil limitations.

TABLE OF CONTENTS/OUTLINE

Transition to 3T MR Intervention - Standard protocols for effective imaging guidance - Work flow considerations - Overview of advantages and disadvantages versus 1.5 T Pulse Sequence Optimization - Managing specific absorption rate limitations (Level 0 vs. First Level) - Needle artifact reduction techniques (WARP and SEMAC) - Fat saturation approaches (STIR vs. SPAIR vs. spectral techniques) System Attributes and Design - Coil design, optimization, and preparation - In-room console interface - Acoustic noise - Patient access and target localization - Future directions including augmented reality navigation

MKE291

Percutaneous Intervertebral Disc Coagulation Therapy (PDCT) by Plasma Light: A New Method for the Treatment of Lumbar and Cervical Disc Herniations; Description of Procedure, Technical Aspects and Preliminary Results

Education Exhibits

Location: MK Community, Learning Center

Participants

Matteo Bellini MD: Nothing to Disclose
Irene Grazzini MD (Presenter): Nothing to Disclose
Marco Ferrara: Nothing to Disclose
Ignazio Maria Vallone MD: Nothing to Disclose
Andrea Zandonella: Nothing to Disclose
Samuele Cioni: Nothing to Disclose
Umberto Arrigucci MD: Nothing to Disclose
Alessandro Cerace MD: Nothing to Disclose
Lucia Monti MD: Nothing to Disclose

TEACHING POINTS

1) to Illustrate a new method and materials to perform a percutaneous minimally invasive treatment of symptomatic cervical and lumbar disc herniations using Plasma Light fiber. 2) the work shows inclusion criteria, technical aspects of fluoroscopic guidance, and how to use the plasma fiber inside the intervertebral disc.

TABLE OF CONTENTS/OUTLINE

A. Review of Indication and Contraindication of the treatment. B. Diagnostic Imaging (CT - MRI) C Plasma light: physical aspects and differences from standard laser systems (Percutaneous Laser Disc Decompression - PLDD) D. Preliminary experience in 18 patients (patients selection, inclusion criteria, age range 18-77, contained symptomatic lumbar (n.19) and cervical (n.5) disc.
MKE292

Reduction of Artifacts with Large Metal Implants at MRI: Multiacquisition Variable-resonance Image Combination (MAVRIC) Method

Education Exhibits
Location: MK Community, Learning Center

Participants
Eric Georges Pessis MD (Presenter): Nothing to Disclose
Jean-Michael Sverzut MD: Nothing to Disclose
Raphael Campagna MD: Nothing to Disclose
Fabienne Bach MD: Nothing to Disclose
Antoine A. Feydy MD: Nothing to Disclose
Jean-Luc Drape MD, PhD: Nothing to Disclose

TEACHING POINTS
1) To be aware that MR imaging is a valuable tool in daily practice, for the assessment of patients with pain after placement of metal implants. 2) To review the several factors that reduce the severity of artifacts with large metal implants at MRI, in daily practice, including maximize the bandwidth used both during slice selection and during readout, use STIR imaging to avoid failure of fat suppression. 3) To learn about new techniques to reduce artifacts with large metal implants at MRI, including multiacquisition variable-resonance image combination (MAVRIC) method

TABLE OF CONTENTS/OUTLINE
1) Principles of metal induced susceptibility artifacts with MRI. 2) Description of common ways to reduce or modify metal artifacts using common and available imaging techniques. 3) Description of new methods to correct readout-direction artifacts and slice-direction artifacts with metal such as multiacquisition variable-resonance image combination (MAVRIC) method. 4) Clinical experience with the technique

MKE293

Review of Dynamic Contrast-Enhanced Magnetic Resonance Imaging of the Musculoskeletal System

Education Exhibits
Location: MK Community, Learning Center

Selected for RadioGraphics

Participants
Jan Skrok MD (Presenter): Nothing to Disclose
Laura Marie Fayad MD: Nothing to Disclose

TEACHING POINTS
1. Discuss technical aspects of dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI), including hardware requirements and dedicated sequences. 2. Highlight common applications of DCE-MRI in musculoskeletal imaging. 3. Discuss possible pitfalls and artifacts of DCE-MRI.

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MKE294

Stellate Ganglion Block and Neurolysis under CT Guidance: Simple Answers for the Interventional Radiologist

Education Exhibits
Location: MK Community, Learning Center

Participants
Adrian Imre Kastler MD, MSc: Nothing to Disclose
Bruno Alfred Kastler MD, PhD (Presenter): Nothing to Disclose

TEACHING POINTS
1- Complex regional pain syndrome (CRPS) is a chronic impairment characterised by severe pain associated with sensory, autonomic and motor symptoms. 2- Stellate ganglion has proven to be involved in the physiopathology of CRPS. 3- Patients suffering from CRPS suffer from long lasting refractory pain 4- The objective is to describe the prerequisites to perform Stellate ganglion block and neurolysis

TABLE OF CONTENTS/OUTLINE
MKE295
The Not-So-Obvious: CT-guided Biopsy of CT-occult Musculoskeletal Lesions

Education Exhibits
Location: MK Community, Learning Center

Participants
Robert J. Talbert MD (Presenter): Nothing to Disclose
Chris R. Smith MD: Nothing to Disclose
Michael V. Friedman MD: Nothing to Disclose
Travis J. Hillen MD: Consultant, Biomedical Systems Consultant, VidaCare Corporation
Jonathan Craig Baker MD: Research Consultant, Biomedical Systems

TEACHING POINTS
1. Computed tomography (CT)-guidance for percutaneous biopsy of musculoskeletal lesions remains the gold standard imaging modality for biopsy of musculoskeletal lesions, particularly osseous lesions. 2. Typically, most suspicious lesions have an identifiable CT correlate and biopsy can be easily targeted to the lesion of interest. However, with the increasing use of positron emission tomography-CT (PET/CT) and MRI for the surveillance and staging of cancer, suspicious lesions necessitating biopsy are sometimes identified which have no CT correlation. 3. Although PET/CT- and MR-guided biopsies are technically feasible, they are not without limitation or entirely necessary. Rather, these lesions, even if CT-occult, can often be biopsied with CT-guidance using anatomic landmarks for lesion targeting.

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MKE296
The Painful Foot: Imaging-guided Interventions for Pain Management

Education Exhibits
Location: MK Community, Learning Center

Participants
Joel S. Newman MD (Presenter): Consultant, Pfizer Inc
Isaac Peterson Reeve MD: Nothing to Disclose
Joseph Y. Tang MD: Nothing to Disclose

TEACHING POINTS
1. Review techniques for imaging-guided pain management at the foot including potential risks and complications. 2. Describe arthrographic techniques at selected joints of foot, focusing on positioning, tube angulation and specifics of injectate. 3. Discuss normal communications between specific joints at arthrography and how they influence technique and procedure success. 4. Describe technical approaches to ultrasound-guided tendon sheath injection including the advantages of in-plane technique. 5. Describe techniques for sonographic guided treatment of a variety of other painful soft tissue conditions in the foot.

TABLE OF CONTENTS/OUTLINE
I. Technical overview of image-guided pain management at the foot II. Arthrography A. Subtalar joint B. Small joints of midfoot and forefoot III. Ultrasound-Guided Injections A. Tendon sheaths B. Bursae, cysts and ganglia C. Plantar Fasciitis D. Other applications: Morton neuroma, perineural injection

MKE297
The Sural Nerve: A Review of Anatomy, Pathology, and Intervention

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

Participants
Michael Gregory Rodriguez MD (Presenter): Nothing to Disclose
Tatum Adams Mcarthur MD: Nothing to Disclose
Jessica L. Millsap MD: Nothing to Disclose

TEACHING POINTS
1. To review the normal anatomy of the sural nerve on various imaging modalities including MRI and ultrasound. 2. To review the clinical presentation of sural nerve neuropathy. 3. To review the pathologic conditions that affect the sural nerve and their imaging appearances. 4. To review the non-surgical and surgical management of pathologies affecting the sural nerve. 5. To discuss the techniques in performing image-guided intervention of the sural nerve.

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MKE298
The Union Gap: What Radiologists Need to Know about Bone Grafting and Osteogenesis
Participants

Xue Susan Bai MD (Presenter): Nothing to Disclose
Sana Parsian MD: Nothing to Disclose
Jonelle Marie Petscavage-Thomas MD, MPH: Consultant, Medical Metrics, Inc
Felix Sze-Kway Chew MD: Nothing to Disclose
Alice S. Ha MD: Nothing to Disclose

TEACHING POINTS

After this exhibit, learners will acquire understanding of:

1) Radiographic appearances of common current devices/techniques for filling bone defects/augmentation
and

2) Illustrate radiographic appearances of common complications from these techniques.

TABLE OF CONTENTS/OUTLINE

We will examine the imaging appearances of common bone defect filling/augmentation techniques and their complications, including:

1) Autografts: e.g. iliac crest, fibula shaft for glenoid reconstruction.
2) Allografts: e.g. cadaveric transplants, osteochondral allograft for osteochondral defects, intercalary graft for tumor resection, whole joint allograft for arthritis or tumor, morselized bone.
3) Manufactured implants and bone graft substitutes: e.g. titanium wedge, methyl methacrylate, calcium sulfate, hydroxyapatite.
4) Biologicals: e.g. bone morphogenetic protein and tissue growth factor-derived products
5) Distraction osteogenesis: e.g. finger distraction and reconstruction, leg lengthening with Ilizarov device.

MKE300

Ultrasound Guided Musculoskeletal Procedures: Indications, Methods, Complications and Efficacy

Participants

Adam Daniel Singer MD (Presenter): Nothing to Disclose
Jean Jose, MS, DO: Nothing to Disclose
Jonathan Tresley MD: Nothing to Disclose
Evan Ross Finkelstein MD: Nothing to Disclose
Nicholas Mark Gutierrez MD: Nothing to Disclose
Vinay Pai MS, MD: Nothing to Disclose

TEACHING POINTS

Various causes of musculoskeletal pain result in significant morbidity and loss of productivity. Ultrasound expertise facilitates the radiologist’s diagnosis and minimally invasive management of musculoskeletal pain.

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MKE301

Ultrasound of Bone Fracture and Healing: Make It Easy

Participants

Audrey Massein (Presenter): Nothing to Disclose
Guillaume Mercy: Nothing to Disclose
Aziza Abi-Yacici MD: Nothing to Disclose
Jerome Renoux MD: Nothing to Disclose
Delphine Zeitoun MD: Nothing to Disclose
Jean-Louis Brasseur: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To illustrate the spectrum of fractures on ultrasonography, with correlations with radiography, CT, and MRI. 2. To illustrate various types of normal and pathologic healing seen with ultrasound. 3. To discuss the role of ultrasound in the initial diagnostic and in the assessment of bone healing process, in particular for the early detection of delays of healing.

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MKE302
Ultrasound of Peripheral Nerves of the Upper Extremity: A Landmark Approach

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit
Selected for RadioGraphics

Participants
Jordan Brown MD (Presenter): Nothing to Disclose
Corrie Marlene Yablon MD: Nothing to Disclose
Matthew Ryan Hammer MD: Nothing to Disclose
Catherine J. Brandon MD: Stock options, VuCOMP, Inc
Yoav Morag MD: Nothing to Disclose
Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

TEACHING POINTS
After reviewing this exhibit, the viewer will be able to: 1. Describe the course of the peripheral nerves of the upper extremity, including their motor and sensory innervation. 2. List the important anatomical landmarks and transducer position used to locate the peripheral nerves of the upper extremity when performing sonographic evaluation. 3. Describe how US is useful for the evaluation of the upper extremity nerves. 4. Discuss the importance of dynamic imaging when evaluating for peripheral nerve entrapment.

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MKE305
Ultrasound-guided Musculoskeletal Interventions in the Upper and Lower Extremities: Tunnels, Sheaths and Other Uncommon Sites

Education Exhibits
Location: MK Community, Learning Center

Participants
Aaron J. Wyse MD (Presenter): Nothing to Disclose
Andrew Cordle MD, PhD: Nothing to Disclose

TEACHING POINTS
The exhibit purpose is: 1. To review indications for ultrasound-guided musculoskeletal injections in the upper and lower extremities for neurovascular and tendinous structures, with examples of relevant pathology. 2. To illustrate interventional methods for injection of structures including, but not limited to, the radial tunnel and tarsal tunnel as well as the flexor / extensor tendon sheaths of the extremities, with MR correlation. 3. To discuss role of ultrasound-guided intervention in the postoperative joint. 4. To summarize current radiologic literature regarding efficacy, including outcomes and complications.

TABLE OF CONTENTS/OUTLINE
I. Neurovascular ultrasound-guided intervention (including radial tunnel and tarsal tunnel injections) A. Pathology B. MR and ultrasound anatomy C. Intervention technique D. Efficacy, including outcomes and complications II. Tendon sheath ultrasound-guided intervention (including flexor hallucis longus, peroneal, digit flexor and long head biceps tendon injections) A. Pathology B. MR and ultrasound anatomy C. Intervention technique D. Efficacy, including outcomes and complications III. Postoperative joint ultrasound-guided intervention A. Diagnostic aspiration B. Synovial biopsy

MKE306
Ultrasound-guided Musculoskeletal Interventions: Where Are We Now?

Education Exhibits
Location: MK Community, Learning Center

Participants
Kara Gaetke Udager MD (Presenter): Nothing to Disclose
Corrie Marlene Yablon MD: Nothing to Disclose
Yoav Morag MD: Nothing to Disclose
Sung Moon Kim MD: Nothing to Disclose
Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

TEACHING POINTS
After reviewing this exhibit, the learner will be able to: 1. List common indications for ultrasound-guided musculoskeletal procedures. 2. Describe commonly performed ultrasound-guided musculoskeletal procedures. 3. Outline technical aspects, procedural considerations, and potential pitfalls.

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**MKE307**

**Utility of Multi-detector CT for the Evaluation of Hip and Knee Arthroplasty: Assessment of Component Alignment and Complications**

_Education Exhibits_

_Location: MK Community, Learning Center_

**Participants**

- Elina Zaretsky MD, MA (Presenter): Nothing to Disclose
- Kevin R. Math MD: Nothing to Disclose
- Douglas S. Katz MD: Nothing to Disclose
- Steven Harwin: Nothing to Disclose

**TEACHING POINTS**

CT is an effective method of assessment of the painful joint arthroplasty, and can be used to detect common conditions such as loosening, periprosthetic fracture, osteolysis related to particulate debris, and component malalignment or malpositioning. The exhibit will: 1) Review and demonstrate the current utility of multi-detector CT for the assessment of the painful knee and hip joint arthroplasty, including loosening, periprosthetic fracture, osteolysis related to particulate debris, and component malalignment or malpositioning. 2) Demonstrate how current CT technology and techniques minimize the previously substantial problem of beam hardening artifacts.

**TABLE OF CONTENTS/O U T L I N E**

1) Describe the optimal positioning of the acetabular and femoral components of a total hip arthroplasty (THA) and optimal rotational alignment of the femoral and tibial components of a total knee arthroplasty (TKA). 2) Describe and illustrate methods of CT assessment of important measurements of THA and TKA including acetabular version, acetabular cup abduction and femoral anteversion as well as the rotational alignment of the femoral and tibial components. 3) Review the important anatomical landmarks utilized for these measurements. 4) Present radiographic imaging as well as cadaveric specimens and intra-operative photographs to illustrate key principles.

**MKE308**

**“BENIGN” Fat Containing Soft Tissue Tumors Which Can Be “ENHANCED” on MR Imaging**

_Education Exhibits_

_Location: MK Community, Learning Center_

**Participants**

- Sung Moon Kim MD (Presenter): Nothing to Disclose
- Monica Kalume Brigido MD: Nothing to Disclose
- Jon A. Jacobson MD: Consultant, BioClinica, Inc. Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc
- David Paul Fessell MD: Nothing to Disclose
- Corrie Marlene Yablon MD: Nothing to Disclose

**TEACHING POINTS**

After reviewing this exhibit, the learner will be able to: 1. Realize that enhancing fat containing soft tissue tumors are not always liposarcomas. 2. List differential diagnoses of benign enhancing fat containing soft tissue tumors on MR imaging. 3. Describe their clinical and MR imaging findings.

**TABLE OF CONTENTS/O U T L I N E**

I. Background 1. Liposarcomas are malignant soft tissue tumors which often contain fat component and can have some portions of enhancement. 2. Benign lipomas usually do not have enhanced component. However, some benign fat containing soft tissue tumors can be enhanced on MR imaging, which can have the similar appearances with liposarcoma. II. Benign fat containing soft tissue tumors with contrast enhancement. 1. spindle cell lipoma 2. angiolipoma 3. lipoblastoma 4. hibernoma 5. hemangioma 6. heterotopic ossification

**MKE309**

**Aneurysmal Bone Cysts: Imaging Review, Pitfalls in Diagnosis, and Treatment Overview**

_Education Exhibits_

_Location: MK Community, Learning Center_

**Participants**

- Kavi Krishna Devulapalli MD, MPH (Presenter): Nothing to Disclose
- Jennifer Jen-Wei Wan MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to: 1.) Review the imaging of aneurysmal bone cysts 2.) Discuss pitfalls in diagnosis including common mimic lesions 3.) Demonstrate unusual presentations including aneurysmal bone cysts presenting outside of long bones, malignant transformation of primary aneurysmal bone cysts and metastasis 4.) Review treatment options

**TABLE OF CONTENTS/O U T L I N E**

1.) Overview of aneurysmal bone cysts including epidemiology, pathogenesis, and discussion of primary and secondary lesions. 2.) Review of multi-modality imaging findings including plain radiograph, computerized tomography, magnetic resonance imaging and nuclear bone scintigraphy. 3.) Discussion of pitfalls in diagnosis including differentiation from other tumors exhibiting fluid-fluid levels such as telangiectatic osteosarcoma and giant cell tumor of the bone. 4.) Case-based presentation of unusual manifestations of aneurysmal bone cyst including those lesions outside of long bones, malignant transformation and metastasis. 5.) Review of treatment options including surgical management and radiation therapy.
MKE311
Cartilage Tumors on MR Imaging: Characterization of Hyaline vs Non-hyaline Cartilage Histology

Education Exhibits
Location: MK Community, Learning Center

Participants
- Gaurav Kumar Thawait MD (Presenter): Nothing to Disclose
- Edward F. McCarthy MD: Nothing to Disclose
- Laura Marie Fayad MD: Nothing to Disclose

TEACHING POINTS
1. Cartilaginous tumors encountered in musculoskeletal practice can be classified by their hyaline and non-hyaline cartilage histology. 2. MR imaging features are related to the histology of each tumor. 3. Correlation of the histologic features of cartilage lesions with their MR imaging appearance is valuable to the practicing radiologist.

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MKE312
Cartilaginous Bone Tumors: What to Look for?

Education Exhibits
Location: MK Community, Learning Center

Participants
- Yessica Ruth Foutes Costa MS (Presenter): Nothing to Disclose
- Angela Daniela dos Santos Figueiredo MD: Nothing to Disclose
- Cristina Marques MD: Nothing to Disclose
- Luis Curvo-Semedo MD, PhD: Nothing to Disclose
- Joao Fale Pisco: Nothing to Disclose
- Filipe Caseiro-Alves: Nothing to Disclose

TEACHING POINTS
- To describe and illustrate the multimodality imaging findings of cartilaginous bone tumors and tumor-like lesions. - To review imaging features of these lesions that may suggest their benign or malignant etiology.

TABLE OF CONTENTS/OUTLINE
Cartilaginous bone tumors are a relatively common lesions encountered in daily clinical practice. In this essay the authors include a wide range of benign and malignant entities focusing on distinctive imaging features (Osteochondroma, Enchondroma, Chondroblastoma, Chondromyxoid fibroma, Synovial chondromatosis and Chondrosarcoma). Plain film characteristic associated with demographic and clinical information may sometimes be enough to identify a given cartilaginous bone tumor. Computed tomography and magnetic resonance complement the characterization of these lesions, mostly in the attempt to clarify the possibility of malignant transformation.

MKE314
Diversity of Atypical Lipomatous Tumor/Well-Differentiated Liposarcoma (ALT/WDLS)

Education Exhibits
Location: MK Community, Learning Center

Participants
- Akio Tsukabe MD (Presenter): Nothing to Disclose
- Hisashi Tanaka MD: Nothing to Disclose
- Yoshiyuki Watanabe MD, PhD: Nothing to Disclose
- Hiroto Takahashi: Nothing to Disclose
- Yuki Kunitomi MD: Nothing to Disclose
- Atsuko Ansawa: Nothing to Disclose
- Chisato Matsuo: Nothing to Disclose
- Yumiko Horii: Nothing to Disclose
- Norifumi Naka: Nothing to Disclose
- Noriyuki Tomiyama MD, PhD: Nothing to Disclose

TEACHING POINTS
1. To recognize the diversity of imaging features of an atypical lipomatous tumor / well-differentiated liposarcoma (ALT/WDLS) reflecting its morphological variation. 2. To know the differential diagnosis and recognize the difficulty in diagnosing ALT/WDLS. 3. ALT/WDLS is subdivided into three main subtypes: adipocytic (lipoma-like), sclerosing, and inflammatory. The presence of more than one pattern in the same lesion is common. Moreover, some have the component like enchondroma or osteosarcoma without dedifferentiation. In the literatures, the lipoma-like subtype is so emphasized that little mentioned to another types. We should know the diversity in radiological features of ALT/WDLS to diagnose and treat it precisely.

TABLE OF CONTENTS/OUTLINE
1. Definition and pathological features of ALT/WDLS
2. Typical and atypical imaging features of ALT/WDLS corresponding to pathological features
MKE315

Elastofibroma Dorsi; Imaging Characteristics with CT, MRI, Thallium-201 Scintigraphy and FDG-PET/CT

Education Exhibits
Location: MK Community, Learning Center

Participants
Maho Tsukamoto MD (Presenter): Nothing to Disclose
Masahiro Okada MD : Nothing to Disclose
Tsuneo Yamashiro MD : Nothing to Disclose
Hiroki Maehara MD : Nothing to Disclose
Sadayuki Murayama MD, PhD : Nothing to Disclose

TEACHING POINTS
The epidemiology and clinical presentation of elastofibroma dorsi. Characteristic imaging appearance on MRI and CT in comparison with underlying pathological appearance; composed of fibrous tissue with streaks of fat components. To define the enhancement level and pattern on MRI, accumulation pattern of thallium-201 (201Tl) and FDG uptake. Pitfalls in the diagnosis of elastofibroma dorsi.

TABLE OF CONTENTS/OUTLINE
1. Epidemiology 2. Clinical presentation from the literature and data from our institution. 3. Pathological features 4. Radiological features of each modality: CT, MRI, 201Tl scintigraphy and FDG-PET/CT. CT: lenticular mass in the subscapular region; typical findings. MRI: fibrous signal mass with fat streaks; patterns of Gd-DTPA contrast enhancement and diffusion weighted image (DWI). 201Tl scintigraphy: no uptake in the mass; figures from our institution. FDG-PET/CT: moderate FDG uptake in the lesion; range of the SUV max. 5. Other chest wall tumors for differential diagnosis of elastofibroma dorsi. Fibrous or fibrohistiocytic tumors Muscular tumors Vascular tumors Peripheral nerve tumors Adipocytic tumors Other tumors 6. Characteristic imaging pattern of elastofibroma dorsi for diagnosis. 7. Pitfalls in the diagnosis of elastofibroma dorsi.

MKE316

Ewing's Sarcoma in the Older Age Group

Education Exhibits
Location: MK Community, Learning Center

Participants
George Hermann MD (Presenter): Nothing to Disclose
William Louie Simpson MD : Research Consultant, BioClinica, Inc
Roberto Garcia MD : Nothing to Disclose
Vivek Joshi BEng, MD : Nothing to Disclose
Darren Fitzpatrick MD : Nothing to Disclose
Alex Baer Maderazo MD : Nothing to Disclose

TEACHING POINTS
1. Ewing's sarcoma is a rare tumor. 2. It occurs most commonly in the first and second decades but can be seen later in life as well. 3. Slightly more common in males (1.6:1 male to female). 4. Can occur in bone or soft tissues. 5. Occurs most commonly in the pelvis and long tubular bones. 6. The tumor arises in the bone marrow. 7. Most common presenting symptom is pain. 8. Ewing's sarcoma should be included in the differential diagnosis of bone and soft tissue masses in older patients.

TABLE OF CONTENTS/OUTLINE
- Description of the typical presentation of Ewing's sarcoma. - Description and examples of the typical radiologic appearance - Genetics of the tumor - Majority of the exhibit will be based on review of all pathologically proven Ewing's sarcoma in our institution between 2001 and 2014 with emphasis on tumors in atypical locations or outside the normal age group with pathologic correlation.

MKE317

Hand Bumps: Tricks and Tips for a Useful Report

Education Exhibits
Location: MK Community, Learning Center

Participants
Queralt Ordi I Camprubi ARRT (Presenter): Nothing to Disclose
Kathleen Ramirez Ticas MD : Nothing to Disclose
Sarai Roche : Nothing to Disclose
CLEOFE ROMAGOSA : Nothing to Disclose
Xavier Merino-Casabiel MD : Nothing to Disclose
Rosa Dominguez-Onono MD : Nothing to Disclose

TEACHING POINTS
The objectives of the exhibit are: 1 - To show what MRI technique should be used for a correct diagnosis of the masses in the hand and the current role of contrast administration and dynamic vascular imaging. 2 - To explain how to make an accurate approach to hand masses that leads us to the perfect report for the clinician. 3 - To evaluate different cases showing key imaging features that can help us identify different masses showing its anatomopathologic correlation.
The presentation will be divided into four parts: 1. Important anatomical features to consider when evaluating a hand. 2. MRI 3T imaging technique. 3. Tips to write an orderly report that leads us to the final diagnosis. 4. Cases which will be presented in a quiz format. Key differential diagnostic points will be highlighted in the discussion of each case as well as the anatomopathologic correlation. The list of cases includes: - Cystic pseudotumors; epidermoid cyst, mucoid cyst, synovial cyst - Lipoma, fibrolipomatous hamartoma - Vascular; glomus, capilar hemangioma - Fibromatosis; Gardner fibroma, Giant cell tumor of the tendon sheath - Neural; postsurgical neuroma

MKE318

How to Perform and Evaluate Whole Body, Dynamic Contrast-enhanced and Diffusion MR Imaging in Multiple Myeloma

Education Exhibits
Location: MK Community, Learning Center

Participants
Julie Celine Dutoit MD (Presenter): Nothing to Disclose
Matthias Vanderkerken : Nothing to Disclose
Anne-Sophie Beerens MD, MA : Nothing to Disclose
Koenraad L. Verstraete MD, PhD : Nothing to Disclose

TEACHING POINTS
1. How to perform whole body, dynamic contrast-enhanced and diffusion weighted MRI in patients with multiple myeloma or its prestages.
3. How to recognize common pitfalls and mimics.

TABLE OF CONTENTS/OUTLINE
MR imaging is the most sensitive technique for the detection of bone marrow pathologies such as multiple myeloma (MM) or its prestages monoclonal gammopathy of undetermined significance (MGUS) and smoldering myeloma (SMM). Part 1: Technical aspects. Imaging consists of coronal T1-weighted and STIR T2-weighted images of the whole body, sagittal T1-weighted and fat-suppressed T2-weighted images of the spine, multislice dynamic contrast enhanced MRI with time-intensity curves and diffusion weighted b-images (0-1000) with ADC calculation of the thoracolumbar spine. Part 2: Evaluation. How can a combined 'skeletal score' be obtained based on the pattern and extent of bone marrow invasion, the type of TIC and enhancement rate, and data from diffusion weighted imaging. This approach allows differentiation between MGUS, SMM, MM and assessment of response to treatment. Part 3: Displays several mimics and pitfalls (e.g. vertebral fractures, intracorporal disc herniation, red bone marrow hyperplasia, ...)

MKE324

MR Imaging of Lower Extremity Peripheral Nerve Sheath Tumors (PNST) and Neuromas: A Pictorial Review

Education Exhibits
Location: MK Community, Learning Center

Participants
Van D. Trinh MD (Presenter): Nothing to Disclose
Michael H. Ngo MD : Nothing to Disclose

TEACHING POINTS
- Identify the imaging characteristics of peripheral nerve sheath tumors (PNST) and neuromas
- Review the anatomic distribution of the major lower extremity nerves with description of important distal branch nerves
- Describe the muscle denervation pattern in specific muscle compartments based on the location of the PNS

TABLE OF CONTENTS/OUTLINE
Anatomic review of the major lower extremity nerve distributions and their muscular innervation MRI Pictoral Review of biopsy proven peripheral nerve sheath tumors* and neuromas of each of the major lower extremity nerves. femoral nerve (3 cases) -- * 1 case involving the femoral nerve was the exception that was thought initially to represent a PNST but was histologically proven to be a sarcoma obturator nerve tibial nerve (2 cases proximal and distal) Sciatic nerve (stump neuroma status post above knee amputation) I case of inferior gluteal nerve common peroneal nerve deep peroneal nerve superficial peroneal nerve intermetatarsal plantar nerve.

MKE325

Multimodality Imaging Features ,Orthodox and Unorthodox Avatars of Fibrous Lesions of Bone a Pictorial Essay

Education Exhibits
Location: MK Community, Learning Center

Participants
Rammohan Vadapalli MD (Presenter): Nothing to Disclose
Harshavardhan KR MD : Nothing to Disclose
Krishna Mohan Pottal MD : Nothing to Disclose
Anuj Jain MD : Nothing to Disclose
Abhinav Sriram Sriram Vadapalli : Nothing to Disclose
TEACHING POINTS
Multimodality Imaging features of Fibrous lesions of Bone are illustrated and the cardinal features of these lesions on Radiography, CT, MRI and Nuclear Imaging (PET CT) are described. Atypical Imaging features of the Fibrous lesions of Bone are illustrated.

TABLE OF CONTENTS/OUTLINE
A: Common and Uncommon Fibrous lesions of Bone are classified and listed with their Cardinal Radiographic, CT, MR and Nuclear Imaging Features are described. Fibrous lesions of bone include entities with a wide range of radiographic appearance and clinical behavior. Benign Fibrous lesions: Fibrous cortical defect medial supra condylar defects Non ossifying Fibromas Desmoplastic fibromas Fibrous histiocytoma of bone Fibrous Dysplasia: Monoostotic and Poly ostotic forms Malignant fibrous lesions, malignant fibrous histiocytomas and fibrosarcoma B: Unorthodox Imaging Features and Avatars of Fibrous lesions are presented with Differential diagnosis and Radio pathological Correlation

MKE326
Multimodality Imaging of Tendon sheath Masses (Tumours and Tumour Like Lesions) A Pictorial Essay

Education Exhibits
Location: MK Community, Learning Center

Participants
Rammohan Vadapalli MD (Presenter): Nothing to Disclose
Harshavardhan KR MD: Nothing to Disclose
Prasad Guntuluri: Nothing to Disclose

TEACHING POINTS
Approach to Diagnosis of tendon sheath masses is outlined with common Clinical and Imaging Differential Diagnosis. Radiographic features, Ultrasound and MR Imaging findings of Common and Uncommon Tendon sheath masses is illustrated with examples

TABLE OF CONTENTS/OUTLINE
Common Tendon Sheath Masses: Localized PVNS Giant Cell Tumour of Tendon sheath The clinical differential diagnosis includes desmoids ganglion cysts, foreign body granuloma, epidermoid cyst, lipoma, knuckle pad, Cavernous haemangioma, Thrombosis Gout, Necrobicotic granuloma, tendinous xanthoma, fibroma of the tendon sheath, infection, rheumatoid nodule, pseudogout and amyloidoma Imaging based Differential Diagnosis Includes any soft-tissue mass with low signal intensity on both T1-weighted and T2-weighted images, such as a desmoid tumor (particularly if deep) or pigmented villonodular synovitis, which more commonly involves the larger joints. Aside from possessing similar signal characteristics, giant cell tumor of the tendon sheath also histologically resembles pigmented villonodular synovitis as both of them contain haemosiderin Tendon sheath neoplastic entities tend to be localized processes. Involvement of multiple tendon sheaths and involvement of long segments of the tendon sheath would be more typical of infection e.g. Tuberculosis+

MKE328
Navigating the Web of Musculoskeletal Vascular Anomalies: Nomenclature, Anatomic and MR Angiographic Imaging Features, and Treatment Strategies

Education Exhibits
Location: MK Community, Learning Center

Participants
Swati Deshmukh MD (Presenter): Nothing to Disclose
Laura Marie Fayad MD: Nothing to Disclose

TEACHING POINTS
1. Accurate vascular anomaly terminology remains a notable area of confusion in clinical practice and the medical literature. 2. The ISSVA classification scheme provides a practical approach for evaluating vascular neoplasms and malformations. 3. Correct identification of a vasculoproliferative lesion on imaging studies is crucial to facilitate communication and guide treatment strategies.

TABLE OF CONTENTS/OUTLINE
Case examples with description of demographics, imaging findings, and treatment for:
1. Vascular tumors
   - Infantile hemangioma
   - Congenital hemangioma
   - Kaposiform hemangioendothelioma and tufted angioma (Kasabach-Merritt syndrome)
   - Spindle cell hemangioendothelioma (Maffucci syndrome)
   - Epitheloid hemangioendothelioma
   - Angiosarcoma (Multiple infantile hemangiomas)
   - Pyogenic granuloma
2. Fast-slow vascular malformation
   - Arteriovenous malformation (Osler-weber-rendu)
   - Arteriovenous fistula
3. Slow-flow vascular malformations
   - Venous malformations
   - Lymphatic malformations
   - Capillary malformations (Klippel-Trenaunay syndrome)

MKE329
Patterns in Quantitative Diffusion-weighted Imaging of Soft Tissue Masses That Are

Education Exhibits
Location: MK Community, Learning Center

Participants
Swati Deshmukh MD (Presenter): Nothing to Disclose
Laura Marie Fayad MD: Nothing to Disclose

TEACHING POINTS
1. Vascular tumors
   - Infantile hemangioma
   - Congenital hemangioma
   - Kaposiform hemangioendothelioma and tufted angioma (Kasabach-Merritt syndrome)
   - Spindle cell hemangioendothelioma (Maffucci syndrome)
   - Epitheloid hemangioendothelioma
   - Angiosarcoma (Multiple infantile hemangiomas)
   - Pyogenic granuloma
2. Fast-slow vascular malformation
   - Arteriovenous malformation (Osler-weber-rendu)
   - Arteriovenous fistula
3. Slow-flow vascular malformations
   - Venous malformations
   - Lymphatic malformations
   - Capillary malformations (Klippel-Trenaunay syndrome)
### Associated with Different Histologies

**Education Exhibits**

**Location:** MK Community, Learning Center

#### Participants

- **Shivani Ahlawat MD (Presenter):** Nothing to Disclose
- **Shadpour Demehri MD:** Nothing to Disclose
- **Laura Marie Fayad MD:** Nothing to Disclose

#### TEACHING POINTS

1. Diffusion weighted imaging (DWI) is a functional non-contrast MRI technique that adds little time to a routine soft tissue mass MR imaging protocol. 2. Soft tissue masses can be categorized by their different imaging patterns on quantitative DWI with apparent diffusion coefficient (ADC) mapping. 3. ADC values obtained by quantitative DWI often correspond with the histologic composition of tumors, and non-neoplastic soft tissue masses have a variable appearance that can mimic tumors.

#### TABLE OF CONTENTS/OFFLINE


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### Radiologic Approach to Benign Chondroid Lesions of Bone with Emphasis on Radiographic and MRI Appearance

**Education Exhibits**

**Location:** MK Community, Learning Center

#### Participants

- **Nicholas Bhojwani MD (Presenter):** Nothing to Disclose
- **Nathan Patrick Fergus MD:** Nothing to Disclose
- **Jeffrey Goletz MD:** Nothing to Disclose
- **Christos Kosmas MD:** Nothing to Disclose
- **Mark Richard Robbin MD:** Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is: 1. Understand the role of the multiple imaging modalities for evaluation. 2. Describe imaging features of benign chondroid lesions of bone. 3. Learn how to formulate a differential diagnosis based upon imaging characteristics, anatomic location, sex, and age. 4. Learn how to develop a plan for biopsy based upon tumor location and size. 5. Understand management and treatment of benign chondroid bone lesions, specifically surgical treatment.

#### TABLE OF CONTENTS/OFFLINE


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### Review of Radiologic Features of Benign Fibrous Histiocytoma of the Bone with Multiple Imaging Modalities: Emphasis on MR Imaging including Diffusion-weighted Imaging

**Education Exhibits**

**Location:** MK Community, Learning Center

#### Participants

- **Chang Woo Chun MD (Presenter):** Nothing to Disclose
- **Won-Hee Jee MD:** Nothing to Disclose
- **Sang Hoon Lee:** Nothing to Disclose
- **Young Cheol Yoon MD:** Nothing to Disclose
- **Suk-Joo Hong MD:** Nothing to Disclose
- **Yoon-Soo Jung MD:** Nothing to Disclose
- **Yang-Guk Chung MD:** Nothing to Disclose

#### TEACHING POINTS

1. Review the clinical, pathologic and radiologic findings of benign fibrous histiocytoma of bone including plain radiographs, CT, MRI.
2. Review specific possible helpful findings on MRI that may help narrow the diagnosis
3. Review a case report of features of PET-CT and diffuse weighted imaging

#### TABLE OF CONTENTS/OFFLINE

- Introduction including definition, clinical and pathologic findings of benign fibrous histiocytoma
- Review of imaging findings
  - Radiographic and CT findings
  - Bone scintigraphy and 18F FDG PET-CT
Role of Imaging in Non-surgical Management of Desmoid Fibromatoses

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit
Selected for RadioGraphics

Participants
Marta Braschi Amirfarzan MD (Presenter): Nothing to Disclose
Sreeharsha Tirumani MBBS, MD : Nothing to Disclose
Atul Bhanudas Shinagare MD : Nothing to Disclose
Michael Hayden Rosenthal MD, PhD : Nothing to Disclose
Nikhil H. Ramaiya MD : Nothing to Disclose
Jyothi Priya Jagannathan MD : Nothing to Disclose

TEACHING POINTS
- Desmoid fibromatoses are rare locally aggressive tumors with no known potential for metastasis, that can develop at virtually any body site. - Surgical resection may be offered in selected cases, however recurrences following surgery are high, and tend to be more aggressive than the primary tumor. - Non-surgical options includes observation, medical management and radiotherapy. - Imaging plays a critical role in the initial assessment, treatment planning, monitoring of response to treatment and detection of complications.

TABLE OF CONTENTS/OUTLINE
- Illustration of common and uncommon imaging appearances of desmoid tumors at various locations (abdominal, extraabdominal, extremity, head and neck), and in various settings (FAP associated, pregnancy associated, post traumatic, and sporadic) - Review the role of imaging in treatment planning, surgical decision making, and assessment of resectability - Discuss the gamut of non-surgical treatment options, including observation, chemotherapy (Doxil), hormonal therapy (tamoxifen), molecular targeted therapy (Imantinib, sorafenib) and radiation therapy - Describe the patterns of tumor response on different imaging modalities (CT, MRI and PET), with particular emphasis on MRI. - Illustrate the common complications of desmoid tumors, both on and off therapy.

Skin Deep: Radiologic Pathologic Correlation of Epidermal Inclusion Cysts in the Extremities

Education Exhibits
Location: MK Community, Learning Center

Certificate of Merit

Participants
Brittany Ritchie MD (Presenter): Nothing to Disclose
Liem Thanh Mansfield MD : Nothing to Disclose
Steven Peckham : Nothing to Disclose

TEACHING POINTS
1. Epidermal inclusion cyst is commonly seen in the extremities.
2. Despite its name, epidermal inclusion cysts may present as a solid mass on clinical exam and imaging studies mimicking soft tissue sarcomas.
3. On radiography, they present as non-calcified masses that may erode the adjacent bone.
4. On sonography, epidermal inclusion cysts arise from the dermis without or with visible sinus tract to the skin. They have variable echogenicity, distal acoustic enhancement, and without internal vascularity.
5. On CT, they are found in the subcutaneous fat compartment, contact the dermis, and have Hounsfield measurement of fluid. Post contrast, there is peripheral enhancement of the cyst wall.
6. On MR, epidermal inclusion cysts are subcutaneous masses that contact the dermis. On T2WI, they may have heterogeneous appearance mimicking a solid mass. However, on T1WI with fat suppression, there is peripheral enhancement consistent with a simple cyst.

TABLE OF CONTENTS/OUTLINE
1. Review the clinical presentation of epidermal inclusion cysts
2. Review the histopathological appearance of epidermal inclusion cysts
3. Imaging appearance of epidermal inclusion cysts
   a. Radiography
   b. Sonography
   c. CT
   d. MR imaging
4. Imaging appearance of unruptured and ruptured epidermal inclusion cysts
Soft Tissue Mass of the Hand and Foot: Diagnostic Approach

Education Exhibits
Location: MK Community, Learning Center

Participants
Maria Dolores Lopez Parra MD (Presenter): Nothing to Disclose
Jose Acosta Batlle: Nothing to Disclose
Catalina Maria Garcia Barrio: Nothing to Disclose
Carmen Soteras MD: Nothing to Disclose
Blanca Palomino: Nothing to Disclose
Alejandro Urbina Balanz: Nothing to Disclose

TEACHING POINTS
- to review the most common soft tissue masses of the foot and hand, focusing on those lesions, that based, on their behavior and location, the radiologist can suggest a specific type of tumor.
- to describe the role of imaging techniques in the diagnostic approach.

TABLE OF CONTENTS/OUTLINE
The differential diagnosis of soft tissue lesions of the foot and hand can be narrowed significantly with the aid of imaging (X-ray, sonography, CT and MRI). Radiographs are critical in determining the presence/absence of mineralization and setting whether soft tissue mineralization are chondral or ossific in nature and to evaluate cortical involvement versus isolated soft tissue lesion. The ultrasound seems well suited for screening soft tissue masses, allowing us to differentiate cystic from solid nature. In non-cystic lesion the location and signal characteristics can suggest the diagnosis of some specific pathologies such as Morton’s neuroma, giant cell tumor of tendon sheath, and plantar fibromatosis. Equally, and based on the presence or absence of mineralization, lesion density/signal intensity, and enhancement pattern Synovial based lesions of the foot and hand can be suggested. Finally, knowledge of the incidence of specific neoplasms of the foot and hand based on patient age aids radiologists in providing a limited differential diagnosis.

MKE336

Spectrum of Fat-Containing Soft Tissue Masses on MRI: The Common, the Characteristic, and the (Sometimes) Confusing

Education Exhibits
Location: MK Community, Learning Center
Certificate of Merit
Selected for RadioGraphics

Participants
Tom Potti MD (Presenter): Nothing to Disclose
David Andrew Pacholke MD: Nothing to Disclose

TEACHING POINTS
Proper characterization of a fat-containing mass on MRI requires careful evaluation of lesion complexity on T1 weighted imaging. Lipomas are the most commonly encountered mesenchymal tumors. Lipomas typically consist of encapsulated homogeneous fat, similar to adjacent subcutaneous fat. Some lipomas demonstrate few, thin septations and other nonlipomatous elements. Lipoma variants and fat necrosis can resemble well-differentiated liposarcomas on MRI. Well-differentiated liposarcomas often demonstrate thickened (greater than 2 millimeters), irregular, enhancing septations and nonlipomatous globular and/or nodular areas. A focal, nonlipomatous mass seen within or adjacent to a well-differentiated liposarcoma suggests a dedifferentiated liposarcoma.

TABLE OF CONTENTS/OUTLINE
- Disclosure
- Introduction
- Benign Lipomatous Tumors
  - Lipoma
  - Lipoma Variants
  - Lipomatous Tumors
  - Infiltrating Lipoma
  - Hibernoma
- Malignant Lipomatous Tumors
  - Well-Differentiated Liposarcoma
  - Dedifferentiated Liposarcoma
  - Myxoid Liposarcoma
  - Pleomorphic Liposarcoma
- Conclusion
- References

MKE337

Systematic Approach to Soft Tissue Vascular Anomalies. Not Everything Is a Hemangioma!

Education Exhibits
Location: MK Community, Learning Center

Participants
Ruairi Meagher MD (Presenter): Nothing to Disclose
Christopher B. Lightfoot MD: Nothing to Disclose

TEACHING POINTS
To review the International Society for the Study of Vascular Anomalies (ISSVA) classification system of vascular tumors and malformations and stress the importance of using proper nomenclature.

1. To review the natural growth patterns of common vascular anomalies.
2. To present a systematic reliable approach to classifying soft tissue vascular anomalies based on clinical presentation, ultrasound imaging and magnetic resonance imaging.

TABLE OF CONTENTS/OUTLINE

- Review the ISSVA classification system
- Stress the need for a classification system
- Review out of vogue terms
- Briefly review embryology and pathogenesis of common vascular anomalies
- General approach to vascular anomalies

MKE338

The Abdominal Wall Mass: An Imaging-based Algorithm for Diagnosis

Education Exhibits

Location: MK Community, Learning Center

Participants

Usman Bashir MBBS (Presenter): Nothing to Disclose
Venus Hedayati MRCP, FRCP: Nothing to Disclose
Christina Messiou MD, BMBS: Nothing to Disclose

TEACHING POINTS

1. Guidelines for imaging masses in the anterior abdominal wall including sonography, computed tomography, MRI, FDG PET/CT and image guided biopsy.
2. Imaging features of the most common lesions presenting as a mass to the anterior abdominal wall as well as highly specific features of less common pathologies.
3. The use of imaging and clinical features to guide accurate diagnosis.

TABLE OF CONTENTS/OUTLINE

- Overview
- Imaging Technique
- Benign Entities
  - Abdominal wall fibromatosis
  - Hemorrhagic lesions
  - Haematomata
  - Endometriosis
  - Fat containing lesions
  - Lipoma
  - Well-differentiated liposarcoma (discussed here for simplicity)
  - Vascular malformation
  - Fat necrosis
- Nerve sheath tumors
- Malignant Entities
  - Primary malignant tumors
  - Sarcoma
  - Dermatofibrosarcoma protuberans
  - Solitary fibrous tumors
  - Metastasis
- Proposed Diagnostic Algorithm based on imaging and clinical features.

MKE339

Welcome to the Family: A Multimodality Review of Ewing Sarcoma Family of Tumors (ESFT) Focusing on Extraosseous Ewing Sarcoma (EES) and Peripheral Primitive Neuroectodermal Tumors (pPNET)

Education Exhibits

Location: MK Community, Learning Center

Participants

Steven Eric Kong MD (Presenter): Nothing to Disclose
George Robert Matcuk MD: Nothing to Disclose
Eric Allan White MD: Nothing to Disclose
Dakshesh Bhulabhai Patel MD: Nothing to Disclose
Deborah M. Forrester MD: Nothing to Disclose
Dakshesh Bhulabhai Patel MD: Nothing to Disclose
Deborah M. Forrester MD: Nothing to Disclose
Christopher Joseph Gottsegen MD: Nothing to Disclose
Aaron Schein MD: Nothing to Disclose
Lawrence R. Menendez MD: Nothing to Disclose
Alexander Fedenko MD: Nothing to Disclose
James Hu MD: Nothing to Disclose

TEACHING POINTS

1. To define and review characteristics of the Ewing sarcoma family of tumors (ESFT) and provide a multimodality imaging review including examples of extremity, breast, thoracopulmonary, subcutaneous, visceral, retroperitoneal, and spinal involvement.
2. To familiarize the radiologist with the clinical presentation, pathophysiology, imaging findings, differential diagnosis, and relevant clinical management of ESFT emphasizing extraosseous Ewing sarcoma (EES) and peripheral primitive neuroectodermal tumors (pPNET).

TABLE OF CONTENTS/OUTLINE

- Background: Ewing Sarcoma Family of Tumors
  - Genetics
  - Histology
  - Immunohistochemistry
- Osseous vs Extraosseous Ewing Sarcoma vs pPNET vs Askin Tumors
- Demographics
- Clinical presentation
- Imaging Characteristics
- Differential Diagnoses
- Diagnostic Criteria
- Treatment Standard of Care
- Illustrative Cases

MKE340

Whole Body MRI (WB-MRI) for Detecting Bone Metastases: Usefulness of Fused Coronal Images of Diffusion-weighted Images (DWI) and T1-weighted Images (T1-WI)

Education Exhibits

Location: MK Community, Learning Center

Certificate of Merit

Participants

Katsuyuki Nakanishi MD, PhD (Presenter): Nothing to Disclose
Yoshikazu Tanaka MD: Nothing to Disclose
TEACHING POINTS

Teaching point: Whole body MRI has been widely used. However, the standard protocol is not established. In this exhibit, we introduce an example of the imaging protocol of WB-MRI, especially, to show the usefulness of fused image of coronal DWI and T1WI of body. The purposes of this exhibit are: 1. to introduce the imaging protocol which is used in our department. 2. list the various metastatic bone tumor and multiple myeloma. 3. to show the importance of coronal images. The major teaching points of this exhibit are: 1. how to improve the image quality of DWI of 3T MR machines. A technique to shorten the echo time, reduce bulk susceptibility artifacts and spatial distortions without significantly affecting SNR or scan time is explained. 2. to introduce the usefulness of the fused image combining the DWI coronal maximal intensity projection images and coronal T1-WI. 3. to teach a method for analyzing the images or comparison of other imaging modalities such as CT and FDG-PET/CT.

TABLE OF CONTENTS/OUTLINE


MSE005-b

Recognition of These Imaging and Clinicopathological Features May be Helpful in Suggesting the Possibility of Peripheral Primitive Neuroectodermal Tumor (pPNET)/Ewing Sarcoma (EWS)

Education Exhibits

Location: MS Community, Learning Center

Participants

Jingfeng Zhang PhD, MD (Presenter): Nothing to Disclose
Yanyuan Li : Nothing to Disclose
Qidong Wang : Nothing to Disclose
Lingxiang Ruan PhD, MD : Nothing to Disclose
Shunliang Xu : Nothing to Disclose

TEACHING POINTS

We will be using case material from our Imaging Center to illustrate the imaging findings and pathological manifestations. We have collected imaging and pathological data on sixteen patients with pPNET/EWS. The purpose of this exhibit is:

- To review the radiological and clinicopathological findings of the peripheral primitive neuroectodermal tumor (pPNET)/Ewing sarcoma (EWS).
- To discuss the radiological and pathological correlation of pPNET / EWS.
- To explain the utility of CT/MRI particularly contrast enhanced CT/MRI in the diagnosis of pPNET / EWS.

TABLE OF CONTENTS/OUTLINE

- Clinicopathology of pPNET / EWS
- Review of imaging findings of pPNET / EWS
  - Conventional CT and MRI
  - Contrast enhanced CT and MRI
- Sample cases and mimics
- Summary

pPNETs showed various radiological appearances. Tumors arising from different sites had different signs correspondingly. MRI could reveal more precisely the size and shape of tumor and its local invasion than CT and X-ray. The correct diagnosis depended on the inspection of pathology and immunohistochemistry.

MSE009-b

Sarcopenia: A Primer for Radiologists

Education Exhibits

Location: MS Community, Learning Center

Participants

Maria Daniela Martin MD (Presenter): Nothing to Disclose
Palmi Nitin Shah MD : Nothing to Disclose
Stephanie Marie Shors MD : Nothing to Disclose

TEACHING POINTS

- Sarcopenia, generally known as severe muscle wasting, has been redefined as a more complex syndrome related to muscle mass and strength. It can be present in patients of all body types (underweight, overweight, obese).
- Sarcopenia can be established from calculation of skeletal muscle cross-sectional area. This can be done using image analysis software and single cross-sectional images from routine CT and MR examinations. This measurement has been shown to correlate with whole-body skeletal muscle mass and is now the gold standard for diagnosing sarcopenia.
- Literature review has shown that sarcopenia can be a predictor of clinical outcome, including increased length of hospital stay, nosocomial infections, overall decreased survival and higher incidence of dose limiting toxicity during chemotherapy.
- As part of a multidisciplinary team, radiologists could help to identify patients with sarcopenia who may benefit from earlier and more aggressive intervention in order to improve their clinical outcomes.

TABLE OF CONTENTS/OUTLINE

- Sarcopenia - Definition - What are established standards: European consensus - Clinical relevance and emerging concepts in sarcopenia - Methods of measurement - Gold standard: CT vs MRI - Case examples: normal versus sarcopenic patient - Conclusion

MSE108
Bone Marrow Assessments with Diffusion Weighted Imaging (DWI)

Education Exhibits
Location: MS Community, Learning Center

Participants
Amish Lakhani MBBS, MA (Presenter): Nothing to Disclose
Arwan Roshanali Padhani MD : Advisory Board, Acuitas Medical Ltd Advisory Board, Siemens AG Speakers Bureau, Siemens AG Researcher, Siemens AG Speakers Bureau, Johnson & Johnson
Andrew Gogbashian MD, FRCR : Nothing to Disclose
Tina Mistry MBBS, FRCR : Nothing to Disclose
Ashik Amlani : Nothing to Disclose
Subhadip Ghosh-Ray MBBS : Nothing to Disclose

TEACHING POINTS
1. DW-MRI is excellent at showing the distribution of bone marrow in health and disease; reflecting the cellular status of the bone marrow that correlates with histologic cellularity measurements. (2) There are non-linear relationships between bone marrow cellularity and DWI parameters (high b-value SI and ADC) with cellularity and fat have dominant competing effects. (3) Bone marrow assessments on DW-MRI should be done in conjunction with morphologic and quantitative fat sequences particularly for the assessment of changes in response to therapy.

TABLE OF CONTENTS/OUTLINE
1. Brief overview whole body DWI (WB-DWI) as a method suited for whole body applications including technique, post-processing and display methods. (2) Review of normal bone marrow structure, its variability with age and appearance on WB-DWI. (3) To demonstrate the non-linear relationships between diffusion imaging parameters (high b-value SI and ADC) and bone marrow fat fraction. (4) Review with case illustrations, the causes of bone marrow hypocellularity and hypercellularity, including the effects of chemotherapy, hormonal treatments and bone marrow stimulating factors. (5) Summary, teaching points and future directions.

Skeletal and Extraskeletal Ewing Sarcoma/Primitive Neuroectodermal Tumor

Education Exhibits
Location: MS Community, Learning Center

Participants
Ahmed-Emad Mahfouz MD (Presenter): Nothing to Disclose
Hanan Sherif MD : Nothing to Disclose
Hassan Abdulla Alansari MBCh : Nothing to Disclose
Batoul Mashhadi MD : Nothing to Disclose

TEACHING POINTS
Ewing sarcoma/primitive neuroectodermal tumor (PNET) may originate in different parts of the body within or outside the skeleton. Purely extraskeletal Ewing/PNET may represent a diagnostic challenge entering into the differential diagnosis of lesions in the anatomical location. Examples presented here are Ewing/PNET of the carotid sheath and the anterior abdominal wall. Predominantly extraskeletal soft tissue Ewing/PNET located adjacent to bone may have a subtle bony projection into the soft tissue mass, which gives a clue to the diagnosis. Predominantly skeletal Ewing/PNET classically involves the diaphysis in children, showing the classical onion-peel periosteal reaction and may extend outside bone forming a soft tissue mass. Ewing/PNET tends to cross anatomical boundaries without complete destruction, leaving a ghost of the anatomical structure (particularly bone) while spreading on both sides of it.

TABLE OF CONTENTS/OUTLINE
Ewing/PNET with full radiologic-pathologic correlation Purely skeletal Predominantly skeletal with soft tissue extension after cortical disruption Predominantly extraskeletal with subtle nidus related to the adjacent bone Predominently extraskeletal with spread through the bone forming the typical bone ‘ghost’ with soft tissue masses on both sides Purely extraskeletal

Avoiding Tunnel Vision: Extra-Spinal Findings on Lumbar Spine Imaging

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

Participants
Neha Gowali MD (Presenter): Nothing to Disclose
Gunja Paresh Parikh MD : Nothing to Disclose
Elana Beth Smith MD : Nothing to Disclose
Mark Oliver Cosentino MD : Nothing to Disclose
Neil B. Horner MD : Nothing to Disclose

TEACHING POINTS
1. Structures carefully evaluated as part of a standard search pattern on abdominal and pelvic imaging have the potential to be overlooked on spine imaging.
2. Due to a limited field of view, exam indication and satisfaction of search, extra-spinal findings may be missed on spine imaging.
3. The audience will learn to recognize potential blind spots in lumbar spine imaging. The importance of these blind spots will be illustrated.
4. A diagnostic approach to extra-spinal findings on lumbar spine imaging will be reviewed.
TABLE OF CONTENTS/OUTLINE

Extra-spinal abnormalities will first be shown on dedicated spine imaging, highlighting typical blind spots on lumbar spine studies. The same findings will then be shown to better advantage on dedicated abdominal/pelvic studies. Cases will be presented in quiz format and will include the following: I. Abdomen A. Adrenal gland - adenoma, adrenocortical carcinoma B. Liver - FNH, adenoma, HCC C. Pancreas - pancreatitis, neoplasm, laceration D. Spleen - splenomegaly, laceration E. Kidneys - hydronephrosis, Lithium nephropathy, RCC F. Pelvis A. Adnexa - mucinous cystadenoma B. Uterus - leiomyoma III. Vascular A. Aorta - aneurysm, dissection, thrombosis B. Other - pelvic varices

MSE147

No Strain, No Pain: A Guide to Reducing Musculoskeletal Strain and Eye Fatigue Among Radiologists

Education Exhibits
Location: MS Community, Learning Center

Participants
Rebecca Lynn Seidel MD (Presenter): Nothing to Disclose
Desiree Nathanson MS : Nothing to Disclose
Michael R. Aho MD : Nothing to Disclose

TEACHING POINTS

Prior studies show that many radiologists suffer from work related injuries and pain, and that most radiologists are not aware of best ergonomic practice. In this exhibit, we will review literature on work related musculoskeletal disorders and eye strain in radiologists, demonstrate workstation ergonomics, introduce proper body alignment, review techniques to reduce eye strain, and present stretches and exercises to improve musculoskeletal health and prevent injury.

TABLE OF CONTENTS/OUTLINE

1. Overview of work-related musculoskeletal strain disorders in radiologists
2. Reading room ergonomics a. Appropriate sitting position and posture b. Workstation ergonomics c. Avoiding repetitive strain injury of the hands and wrists d. Room temperature e. Checklist for optimization of work area
4. Take a Break a. Recommended frequency and duration of breaks b. In-office stretches and exercises c. How to increase physical activity during the work day d. Break reminder software and other helpful resources
5. Review

SPSP01

Nuevos Horizontes en Diagnostico por Imagen Desde el CIR: Sesión del Colegio Interamericano de Radiología (CIR) en Español/New Horizons in Diagnostic Imaging from CIR: Session of the Interamerican College of Radiology (CIR) in Spanish

Special Courses

AMA PRA Category 1 Credits ™: 3.75
ARRT Category A+ Credits: 4.00
Sat, Nov 29 1:00 PM - 5:00 PM Location: E451A

LEARNING OBJECTIVES

1) To review advances or new horizons in imaging in major subspecialties from experts from different CIR (Interamerican College of Radiology) countries. 2) To use a practical approach including case-based learning. 3) To seek audience participation with presentation of unknown clinical examples related to the organ system presentations.

Sub-Events

SPSP01A  Introducción/Opening Remarks
Gloria Soto Giordani MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01B  Primera Parte/Part 1
Moderator Pablo Riera Ros MD, PhD : Medical Advisory Board, Koninklijke Philips NV Medical Advisory Board, KLAS Enterprises LLC Medical Advisory Committee, Oakstone Publishing Departmental Research Grant, Siemens AG Departmental Research Grant, Koninklijke Philips NV Departmental Research Grant, Sectra AB Departmental Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01C  Sistema Nervioso Central: Correlación Entre Marcadores Genéticos e Imágenes en Astrocitomas/Central Nervous System: Imaging-Gene Genetic Markers Correlation in Astrocytomas
LEARNING OBJECTIVES

1) To become familiar with the traditional biochemical/genetic markers of astrocytomas and how their presence or absence correlate with imaging findings. 2) To understand the biological changes, as reflected by MR advanced imaging techniques, that astrocytomas go through when malignant transformation occurs.

ABSTRACT

In this lecture we will use advanced MR imaging techniques, perfusion (both contrast enhanced and arterial spin labelled), permeability, diffusion, and spectroscopy to understand the biological behavior of astrocytomas. Low grade astrocytomas may not show high choline on MRS but show high myoinositol which correlates with low perfusion values. Anaplastic astrocytomas produce metalloproteases and thus VEGF and PDGF can stimulate angiogenesis resulting in high perfusion with gadolium and ASL. Lastly, hypoxia induces formation of permeability factors leading to edema and contrast enhancement in glioblastomas. Necrosis, seen as lipids on MRS is a marker of glioblastoma. Presence of MGMT promoter and alterations in the IDH1 gene (present in most secondary glioblastomas) confer a better survival pattern to glioblastoma patients and these findings are seen predominantly in temporal and deep tumors and in those with little contrast enhancement and high signal on T2 and DWI images. Thus, the initial transformation in all low grade astrocytomas is ischemia that can be seen as the presence of lactate on MRS, while markers of higher grades such as angiogenesis, permeability, and necrosis can be identified with perfusion, K-trans maps, and MR spectroscopy. Lack of myoinositol on MRS indicates its consumption for production of metalloproteases and thus it is also an early marker of angiogenesis. Many of these changes occur before anatomical images may suggest them.

URL

https://sites.google.com/site/castilloneuroradiology/

Active Handout

http://media.rsna.org/media/abstract/2014/14002958/SPSP01C sec.pdf

SPSP01D Cardiovascular: Cambios Desde el TAC y RM Hacia la Imagen Funcional y Molecular/ Cardiovascular: CT and MRI Changes towards Functional and Molecular Imaging

Antonio Luna MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Revisar las indicaciones actuales del TC y RM en el diagnóstico cardiovascular. 2) Ensalzar las nuevas aproximaciones técnicas en TC y RM del sistema cardiovascular. 3) Esbozar el papel potencial de la imagen funcional y molecular en enfermedades cardiovasculares. 1) Review the current clinical indications of CT and MRI in cardiovascular diagnosis. 2) Highlight the new technical approaches in CT and MRI of the cardiovascular system. 3) Outline the potential role of functional and molecular imaging in the management of cardiovascular diseases.

SPSP01E Mama: Integración de Medicina Nuclear en las Imágenes Diagnósticas de Mama/Breast: Nuclear Medicine Integration in Breast Imaging

Maria Victoria Velasquez MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Present the current indications for Molecular Breast Imaging and Positron Emission Mammography. 2) Describe imaging protocols, radiation exposure and benefits for both techniques. 3) Outline the most common findings of benign and malignant breast lesion on MBI and PEM with correlation with other breast imaging studies. 4) Navigate through the different steps of PEM guided biopsy. 5) Describe alternative management and follow up with these techniques.

ABSTRACT

Integration of Nuclear Medicine in Breast Imaging In the last decade the introduction of Nuclear medicine as Molecular imaging of the breast had a significant development in the diagnosis of breast abnormalities. Positron Emission Mammography (PEM) and Molecular Breast Imaging (MBI) have been successful in the detection of benign, atypical and malignant breast conditions. PEM have been proven to represent a very helpful staging tool in patients with contraindications to breast MRI. MBI is a valuable technique for screening of high risk patients and as for problem solving for patients with inconclusive clinical or imaging findings. This presentation will review the main indications of these Nuclear Medicine studies and will detail the findings and the correlation with conventional breast imaging. The breast imager will have a better understanding of the anatomic, functional and molecular breast imaging techniques.

SPSP01F Tórax: Hallazgos de la Resonancia Magnética en Enfermedades del Parénquima/Chest: Magnetic Resonance Findings in Lung Parenchymal Disease

Arthur Soares Souza MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To show the value of thoracic MRI for assessment of parenchymal lung disease. 2) To demonstrate the value of diffusion weighted MRI (DWI) for differentiating benign from malignant lung neoplasms.

**ABSTRACT**

In this lecture we will show the clinical ability of thoracic MRI to depict the most common patterns of parenchymal lung diseases, and do the correlation with CT findings. MRI seems to be a valuable tool, without radiation exposure, for management of parenchymal lung disease. We will, also, address the importance of diffusion weighted MRI (DWI) for differentiating benign from malignant lung lesions.

**URL**

http://www.ultrax.com.br/chest

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**SPSP01G**

Conferencia del Colegio Interamericano de Radiología/Interamerican College of Radiology Lecture

Dante R. Casale Menier MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPSP01H**

Segunda Parte/Part II

Moderator Miguel E. Stoopen MD: Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPSP01I**

Musculoesqueletico: Imágenes Avanzadas del Cartílago Articular y "Chemichal Shift" de Médula Ósea/Musculoskeletal: Advanced Imaging of the Articular Cartilage and Bone Marrow Chemical Shift Imaging

Gonzalo Javier Delgado MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPSP01J**

Abdomen e Hígado: Contrastes Hepatoespecíficos y Elastografia por Resonancia Magnética/Abdomen and Liver: Liver Specific Contrast Agents and Hepatic MR Elastography

Luis Antonio Sosa MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPSP01K**

Próstata: Resonancia Magnética de 3T y PET/CT con Colina/Prostate: 3T MRI and Choline PET/CT

Daniela Stoisa MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**Handout:** Daniela Stoisa

http://media.rsna.org/media/abstract/2014/14002966/cap chicago 2014.ppt
LEARNING OBJECTIVES

View learning objectives under main course title.

SSA13

ISP: Musculoskeletal (Soft Tissue Tumors)

Scientific Papers

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Sun, Nov 30 10:45 AM - 12:15 PM Location: E451B

Sub-Events

SSA13-01 Musculoskeletal Keynote Speaker: Soft Tissue Tumors—Diagnosis and MR Tools for Characterization
Mark Douglas Murphey MD (Presenter): Nothing to Disclose

SSA13-03 Carcinomatosis of Muscle: A Potential Mimic of Myositis
Fatima Soliman MD, PhD (Presenter): Nothing to Disclose, Sinchun Hwang MD: Nothing to Disclose, Jonathan Landa DO: Nothing to Disclose, Robert Andrew Lefkowitz MD: Nothing to Disclose, David M. Panicek MD: Nothing to Disclose

PURPOSE

To determine the prevalence of an unusual, infiltrative pattern of primary carcinoma metastatic to muscles of an extremity, which sometimes mimics myositis at MRI.

METHOD AND MATERIALS

This retrospective study was IRB and HIPPA compliant. The reports of extremity MRI exams of 907 patients with a proven diagnosis of carcinoma from a recent two-year period were reviewed to identify those that mentioned muscle metastasis or myositis in an extremity. Pathology reports, follow-up imaging, and clinical records were used to confirm the diagnosis of metastasis. MR images from each patient with muscle metastasis then were reviewed by two radiologists in consensus to record whether the metastases manifested as discrete masses or as an infiltrative process (i.e., carcinomatosis).

RESULTS

36 (4%) of 907 MRI reports described muscle metastases (n=18) or myositis (n=18), in 25 males and 11 females (mean age, 64 yrs; range, 33-83 yrs). After review of the medical records, three cases reported as myositis were found to actually represent muscle metastases. Metastases manifested as discrete masses at MRI in 16 (76%) of 21 patients; in each of the remaining 5 (24%), the metastases showed extensive infiltration of multiple muscles. All five (100%) cases of carcinomatosis of muscle were caused by primary esophageal (n=3) or gastric (n=2) cancers. One such case was proven by biopsy; in the other four patients, the lesions were determined to represent metastases based on follow-up imaging and clinical course. Only two of the five cases were correctly diagnosed as carcinomatosis of muscle in the original MRI report; the other three cases of carcinomatosis had been misdiagnosed as myositis. The most common types of primary carcinoma resulting in discrete muscle metastases were lung (4/21=19%) and kidney (4/21=19%).

CONCLUSION

Muscle metastases usually manifest as discrete masses at MRI, with primary lung or renal cancers being the most common sources. An infiltrative pattern, representing carcinomatosis of muscle, is uncommon; typically results from primary esophageal or gastric cancers; and may mimic myositis at MRI.

CLINICAL RELEVANCE/APPLICATION
Esophageal and gastric cancers uncommonly metastasize to multiple muscles of an extremity as infiltrative carcinomatosis, which may be misdiagnosed as myositis at MRI.

**SSA13-04** Radiologic Imaging Features and Clinicopathologic Correlation of Hemosiderotic Fibrolipomatous Tumor: Experience in a Single Tertiary Cancer Center

**PURPOSE**
To determine imaging features of hemosiderotic fibrolipomatous tumor (HFLT), which is increasingly recognized as an entity with propensity for local recurrence and the potential to transform into myxoinflammatory fibroblastic sarcoma (MIFS), and to correlate with its clinicopathologic behaviour.

**METHOD AND MATERIALS**
This retrospective study was conducted by searching the electronic medical records from 1990 to 2014. Eight patients (3 males, 5 females; mean age 58, ranging 48-71 years) with histologic diagnosis of HFLT and imaging available on PACS were identified. The review of imaging studies included radiographs (n=2/8), ultrasonograms (n=3/8), and MRI scans (n=16/8). Clinical course of each patient and diagnosis of MIFS were recorded. Imaging features at diagnosis or local recurrence were evaluated including body site, location, calcification, echogenicity at US, and size, border, MR signal characteristics, and contrast enhancement of tumor at MRI.

**RESULTS**
HFLT was most commonly located in the ankle and foot present in 4/8 (50%) and subcutaneous in 8/8; the mean size was 6.0 cm (range 2-18 cm). Histology at initial diagnosis was HFLT alone in 4 patients and HFLT coexisting with MIFS in 4 patients, and 3/7 after surgical resection recurred as MIFS or HFLT with MIFS. None were calcified on radiograph (2/2), and on US most (2/3) were heterogeneously iso- or hypo echoic to subcutaneous fat with greater than 10 foci of vascular flow on color Doppler. Two of 8 patients had MRI only at local recurrence. The tumor border at initial diagnosis was infiltrative in 4/6 and multinodular in 2/6 patients; it was infiltrative in 2 patients with MRI at recurrence only. Fat interspersed and multiple internal septations in HFLT were present in 7/8 at both initial diagnosis and recurrence. Contrast enhancement was heterogeneous in 7/7; blooming in 2/3 cases with GRE sequence suggested intratumoural haemorrhage. None developed distant metastases.

**CONCLUSION**
HFLT is a subcutaneous tumor with an infiltrative border, interspersed fat, and seaptations at MRI. In this series we found high prevalence of concurrent MIFS at initial diagnosis or transformation into MIFS at local recurrence.

**CLINICAL RELEVANCE/APPLICATION**
HFLT often presents as a subcutaneous mass with an infiltrative border and interspersed fat at MRI; it has a high local recurrence rate and can coexist with MIFS or recur as MIFS.

**SSA13-05** Angiomatoid Fibrous Histiocytoma: Novel MR Observations, Pathologic & Clinical Features

**PURPOSE**
To describe MR imaging, pathologic, and clinical characteristics of soft tissue angiomatoid fibrous histiocytoma (AFH).

**METHOD AND MATERIALS**
The MR imaging studies of six cases of pathology-proven AFH were compiled from a single institution, the largest single institution series to date. Features evaluated included lesion location, morphology, margin, predominant T1 and T2 signal, and enhancement pattern. Specific features including presence of alternating layers of high and low signal around the periphery of the lesion (‘double rim’ sign), infiltrating cords of tumor cells (‘Medusa head’ sign), cystic-solid pattern, and fluid-fluid levels were assessed. Pathologic findings and clinical presentation and outcome were reviewed.

**RESULTS**
Mean patient age was 23 years (range 3-46 yrs; 3 male, 3 female). Lesions occurred in the upper extremity (n=3) and lower extremity (n=3). All tumors were primarily cystic. Five tumors were located in the subcutaneous tissues, and one was intramuscular. Primary tumors were surrounded by a low T1 and low T2 signal fibrous capsule with hemosiderin staining. A high signal lymphocyttoplasmic infiltrate was visible in T2 and post contrast images as a high signal rim around the low signal capsule (‘double rim’ sign). Infiltrating cords of tumor cells extended through capsular defects (‘Medusa head’ sign). Fluid-fluid levels were variably present. Post-contrast imaging demonstrated the cystic component, enhancement of tumor cell nodularity, and the lymphocytoplasmic infiltrate. Recurrent tumors appeared as multiple 1-1.5 cm masses in the subcutis with peripheral enhancement, variable fluid-fluid levels, and were often misinterpreted as post-surgical change. Clinically, patients were often thought to have benign lesions such as hematomas at initial presentation and underwent marginal resection rather than the preferred treatment of wide excision. Five patients experienced local tumor recurrence, and one patient developed distant metastatic disease (mean follow-up 3.6 years).
local tumor recurrence, and one patient developed distant metastatic disease (mean follow-up 3.6 years).

CONCLUSION

A predominantly well-circumscribed, primarily cystic mass with a low signal capsule and infiltrating cords of tumor cells suggests the possibility of AFH, in particular in a child or young adult with a subcutaneous mass in a limb.

CLINICAL RELEVANCE/APPLICATION

Inclusion of AFH in the differential diagnosis is important so that the patient can undergo the preferred treatment of wide excision as tumors may recur following marginal resection.

PURPOSE

MRI with gadolinium-based contrast (Gd) is used to screen for recurrence after soft tissue sarcoma (STS) treatment. Previously, we failed to demonstrate that Gd improved the detection of recurrent STS in our population, although Gd-enhancing recurrences were more conspicuous. We hypothesized that Gd could improve diagnostic performance, especially for readers without high levels of expertise.

METHOD AND MATERIALS

This prospective reader study was IRB-approved and HIPAA compliant. From patients undergoing MRI for possible STS recurrence, we selected 26 (13 with recurrence, 13 without) who had MRI without and with Gd (52 total scans). 4 readers of differing expertise (radiology resident, fellow, and attending; and tumor surgeon), blinded to the diagnosis, rated each MRI for recurrence on a 7-point scale to create receiver operating characteristic (ROC) curves. Net reclassification index (NRI) was used to evaluate changes in confidence.

RESULTS

All readers discriminated recurrence from non-recurrence; areas under the ROC curves ranged from 0.976 to 1.0 without Gd and from 0.997 to 1.0 with Gd (p>0.1 for improvement for each reader). However, NRI showed that with Gd, diagnostic confidence improved for resident (p<0.001), fellow (p=0.001), and surgeon (p=0.001), but not attending (p=0.17). The resident showed more confidence for both assigning and excluding recurrence; the fellow showed more confidence assigning recurrence only; and the surgeon showed more confidence in excluding recurrence only.

CONCLUSION

Gd does not improve the detection of recurrent soft tissue sarcoma by MRI, but may improve the confidence level depending on the reader’s expertise.

CLINICAL RELEVANCE/APPLICATION

Gd is not necessary in the detection of local STS recurrence, but may be helpful in improving confidence depending on the reader’s expertise. Costs and potential morbidity associated with Gd could be eliminated, with the same diagnostic results.

A Comparative Study for Soft Tissue Sarcoma between Diffusion Weighted Imaging and Histopathology

PURPOSE

To investigate the statistical correlation between Apparent Diffusion Coefficients (ADCs) of MR-DWI and histopathologic grade of soft tissue sarcomas (STSs).

METHOD AND MATERIALS

1. Case data: 33 cases of STSs were chosen for surgical treatment. 2. Equipment and technology: DWI(b=600s/mm2) scanned before the DCE-MRI, the lesion site was fixed. 3. DWI post-processing and data collection: Functool functional software was used to post-process the original image, each of them were worked with the ROI-1 and ROI-2, recording ADCs on the ADC reconstruction maps respectively. 4. Observational indexes: (1) ADCs of STSs: including minimum ADCs (average 3 minimum ADCs from ROI-1) and average ADCs (average all of the average ADCs from ROI-2). (2) The histopathological grade of STSs: according to the histopathological grading system of French Federation Cancer Centre, we classified STSs into grade I, II, III. (3) According to mucinous in STSs pathological diagnosis, we divide STSs into myxoid and non-myxoid groups.

RESULTS
As STSs histopathological grade increased, Minimum ADCs and Average ADCs decreased gradually. But there was no significant difference with ADCs among 9 cases of grade I, 13 cases of grade II and 11 cases of grade III (p>0.05). Average ADCs of 13 myxoid STSs was significantly higher than the other 20 with non-myxoid STSs when Average ADCs is 1.357×10⁻³ mm²/s; they were identified with the sensitivity of 76.9% and specificity of 80.0%. Minimum ADCs of the myxoid STSs was higher than the non-myxoid STSs, but the difference was not significant (p> 0.05). 3. Minimum ADCs and histopathological level of 20 non-myxoid STSs cases were negatively correlated (r = -0.824, p = 0.000); there were significant difference between the non-myxoid STSs of each grade (p <0.05); there were no significant difference in average ADCs between non-myxoid STSs of each grade (p> 0.05); and also no significant difference in minimum ADCs, average ADCs between myxoid STSs of each grade (p> 0.05).

CONCLUSION
1. As STSs pathological level increased, Minimum ADCs and Average ADCs decreased gradually, but we can not identify STSs histopathological level based on Minimum ADCs and Average ADCs.
2. Average ADCs of myxoid STSs was higher than that of non-myxoid STSs.
3. Minimum ADCs can show the histopathological grading of non-myxoid STSs.

CLINICAL RELEVANCE/APPLICATION
ADCs of MR-DWI can reflect histopathologic grade of STSs.

SSA13-08
The Efficacy of Intravoxel Incoherent Motion Diffusion-weighted MR Imaging in the Evaluation of Benign and Malignant Bone and Soft Tissue Tumors
You Seon Song (Presenter): Nothing to Disclose, In Sook Lee: Nothing to Disclose, Jeung Il Kim MD, PhD: Nothing to Disclose, In Seong Kim PhD: Nothing to Disclose

PURPOSE
To evaluate the efficacy of intravoxel incoherent motion (IVIM) diffusion-weighted (DW) MR imaging for differentiating benign and malignant bone and soft tissue tumors

METHOD AND MATERIALS
From June to December 2013, 304 patients underwent musculoskeletal MR imaging including IVIM DW sequence with ten b values (0-1000 sec/mm²). Among them, 73 consecutive patients (38 women, 35 men; age range, 1-84 years; mean age, 47 years) with bone or soft tissue mass lesions were included. All ROIs about the mass were manually positioned on parametric maps obtained with software (MatLab), and then apparent diffusion coefficient (ADC) and IVIM-derived parameters (Dslow, Dfast, perfusion fraction) were calculated. The ADC value, Dslow, Dfast and perfusion fracture (PF) parameters were compared between the benign and malignant group by using independent samples t-test and ROC analysis.

RESULTS
41 patients had malignant tumors and 32 had benign tumors. The ADC value and Dslow parameter were statistically significant factors (p<0.05) in differentiating between benign and malignant bone or soft tissue tumors. By ROC analysis, Dslow (AUC, 0.801; SE, 0.0579; 95% confidence interval, 0.691-0.885; p<0.0001; cut-off value, 1.15x10⁻³ mm²/sec; sensitivity, 80.5%; specificity, 75%) demonstrated higher significance and specificity than the ADC value (AUC, 0.739; SE, 0.0646; 95% confidence interval, 0.623-0.834; p=0.0002; cut-off value<1.5x10⁻³ mm²/sec; sensitivity, 82.9%; specificity, 62.5%).

CONCLUSION
IVIM-derived Dslow values demonstrated superior performance compared with the ADC value in differentiating benign from malignant bone and soft tissue tumors.

CLINICAL RELEVANCE/APPLICATION
IVIM diffusion-weighted MR imaging is useful in diagnosing musculoskeletal tumors since it reflects pure diffusion effect of the tumor.

SSA13-09
Metabolic versus Morphologic Therapy Monitoring in Soft Tissue Sarcoma under ILP Utilizing Simultaneous [18F]-FDG PET/MRI

PURPOSE
The use of tumor necrosis factor in isolated limb perfusion (ILP) has shown to be a successful treatment of locally advanced limb soft-tissue sarcomas (STS). Hence, the assessment of therapy response is an important issue of neoadjuvant cancer treatment. The aim of this study was to compare the diagnostic ability of metabolic (tracer uptake in PET/MRI) and morphologic (maximum diameter; RECIST) for assessment of cancer response in correlation to pathologic response.
**METHOD AND MATERIALS**

10 patients with histologically proven STS were enrolled in this trial and underwent an [18F]-FDG PET/MRI examination (a) prior and (b) 6 weeks after ILP (Biograph mMR, Siemens). The MR-scan protocol comprised: 1) STIR cor, 2) T2 TSE ax, 3) fatsaturated T1w TSE post contrast ax. and cor. after the application of 0.5 mmol/kg BW Dotarem (Guerbet). All tumor lesions were assessed in the baseline and follow-up, in regard of the metabolic (SUVmax) and morphologic response (maximum diameter according to RECIST). Results were correlated to pathological response according to Salzer-Kuntschik regression scale. Wilcoxon rank test was applied to test for statistical significance.

**RESULTS**

According to histopathology and Salzer-Kuntschik, 3 patients were classified as pathologic responders (R1=2; R3=1) and 7 patients were classified as non-responders (R4=3, R5=3, R6=1). Accordingly, the pathologic responders showed a mean decrease of SUVmax of 63.2%, while pathologic non-responders showed a mean decrease of SUVmax of 16.7%. According to RECIST criteria, neither pathologic responders (mean decrease of max diameter 4%), nor non-responders (mean decrease of max diameter 19%) showed morphologic response, and were hence classified as clinical non-responders.

**CONCLUSION**

PET/MRI enables superior assessment of therapy monitoring based on functional metabolic response, while exclusive morphologic assessment, in terms of RECIST evaluation does not provide sufficient evaluation of therapy response in STS after ILP.

**CLINICAL RELEVANCE/APPLICATION**

Aside from morphologic assessment, PET/MRI provides beneficial additional metabolic assessment of STS under ILP, enabling superior assessment of therapy response.
RESULTS

In 59/92 symptomatic tendons (64%), pathologic changes at B-mode US were detected (thickening, hypo- or hyperechoic areas and calcifications and/or neovascularization). In 77/92 (84%), SWE exhibited pathologically "soft" values (mean 37 kPa, ± 10.2). B-mode and Doppler appeared normal In 33/92 tendons (36%); these were 11/35 Achilles tendons (31%), 10/30 patellar tendons (33%) and 12/27 patients with epicondylitis humeri (44%). SWE exhibited pathologically soft tissue values in 28 of these 33 B-mode-normal-appearing tendons (91%). This included 10 of the 11 symptomatic, but B-mode negative Achilles tendons (91%), 10 of the 10 symptomatic, but B-mode-negative patellar tendons, and 8 of the 12 symptomatic, but B-mode negative elbow tendons (67%). Overall sensitivity for displaying a correlate for clinically symptomatic Achilles, patellar, and elbow tendinopathy was 69%, 67% and 56% for B-mode and Doppler US. Adding SWE increased the sensitivity significantly to 97%, 100%, and 85%, respectively.

CONCLUSION

SWE provides diagnostic information that is complementary to that of B-mode and power Doppler ultrasound, and helps significantly improve US sensitivity for diagnosing tendinopathy.

CLINICAL RELEVANCE/APPLICATION

SWE reveals a pathologic correlate for clinical tendinopathy in over two-thirds of patients with normal B-mode and power Doppler US.

Sodium MRI Detects Glycosaminoglycan Alteration in the Achilles Tendon after Ciprofloxacin Intake in Healthy Subjects

SSA14-04

Vladimir Juras BMedSc, PhD (Presenter): Nothing to Disclose, Yvonne Winhofer: Nothing to Disclose, Pavol Szomolanyi PhD: Nothing to Disclose, Benedikt Hager: Nothing to Disclose, Anton Luger MD: Nothing to Disclose, Siegfried Trauttnig MD: Nothing to Disclose

PURPOSE

To investigate novel quantitative MRI techniques (sodium MRI, gagCEST, and T2*-mapping) as potential markers for biochemical changes in the Achilles tendon induced by ciprofloxacin intake.

METHOD AND MATERIALS

Fourteen ankles from seven male subjects (32±12 years) were included in the study (all subjects gave written, informed consent). All subjects underwent MRI examinations of the Achilles tendon at baseline (tB), as well as 10 days (t10D) and five months (t5M) after ciprofloxacin intake. For sodium imaging, the variable echo time sequence adapted to x-nuclei capabilities was used in the 2D mode. gagCEST effects were measured by a train of Gaussian RF pulses followed by signal readout with a 3D-RF-spoiled-GRE sequence. The variable-echo-time sequence (vTE) was used to generate the bi-exponential T2*-maps. In order to compare average MRI parameters at different time points, a hierarchical-linear-model was used in order to consider multiple measures per patient.

RESULTS

The mean sodium signal was significantly decreased by 25% in the whole tendon (from 130±8 (tB) [a.u.] to 98±5 (t10D) [a.u.], P = 0.020) and in the insertion part (from 134±8 (tB) [a.u.] to 105±5 (t10D) [a.u.], P = 0.026). The mean gagCEST value was significantly decreased from 4.74±0.75 (tB) [%] to 4.50±0.23 [%] (t10D) [P<0.037]. Morphologically, there were no significant changes found between tB, t10D, and t5M.

CONCLUSION

In conclusion, this study demonstrates a ciprofloxacin induced reversible reduction of the normalized sodium MRI signal and the gagCEST effect in the Achilles tendon of healthy volunteers. The observed changes in glycosaminoglycan content contribute to the characterization of the pathomechanism of FQ associated tendinopathy.

CLINICAL RELEVANCE/APPLICATION

Sodium imaging of the Achilles tendon may improve the detection of biochemical alterations after ciprofloxacin intake.

Multi-parametric Characterization of Idiopathic Inflammatory Myopathy at 3.0 Tesla

SSA14-05

Ke Li: Nothing to Disclose, Richard Dortch PhD: Nothing to Disclose, Brian Welch: Nothing to Disclose, Susan Kroop MD: Nothing to Disclose, Joseph Huston: Nothing to Disclose, Bruce M. Damón PhD (Presenter): Nothing to Disclose, Jane Harting Park PhD: Nothing to Disclose

PURPOSE

To characterize the pathophysiological abnormalities of Idiopathic Inflammatory Myopathy (IIM) patients using multi-parametric quantitative magnetic resonance imaging (MRI) methods, including fat/water, T1, T2, magnetization transfer (MT), and diffusion tensor imaging (DTI).

METHOD AND MATERIALS
Eleven IIM patients (six polymyositis (PM) and five dermatomyositis (DM)) and eleven age-matched healthy controls were examined. Images were acquired from their right thighs. T1-weighted and T2-weighted images were acquired as anatomical references. Fat/water contents were estimated with a multiple gradient echo sequence. T1 and T2 values were estimated using inversion recovery and multiple spin-echo methods, respectively. QMT parameters were estimated using pulsed saturation method. DTI parameters were estimated with 15 diffusion-weighted directions (and one b = 0 image). All data were processed in pixel-wise approach. Imaging data were analyzed using a two-way ANOVA, with main effects for disease and muscle. CPK and LDH levels were measured with blood test.

RESULTS

The patients had higher mean fat fractions (0.142) than the controls (0.063) (p < 0.05), indicating significant fat infiltration/replacement. In patients vs. controls, there were higher mean T2 (37.1 vs. 32.1 ms), higher T1 (1.54 vs. 1.47 s), lower macromolecular fractions (qMT) (0.077 vs. 0.089), and higher ADC values (0.0018 vs. 0.0017) (p < 0.05), indicating inflammation. Fiber tracking indicated that the fiber tracts in patients are shorter, less dense, and less ordered. ANOVA test indicated differences between PM and DM patients with more significant muscle damage in quadriceps muscles compared to other muscle groups. Consistent with MRI findings, all patients have higher CPK (1498) and LDH (470) levels than the controls (107 and 169, respectively) (p < 0.05).

CONCLUSION

These multi-parametric methods may provide an improved understanding of the pathological processes associated with inflammatory diseases at a microscopic level, objectively, quantitatively, and independently of the acquisition details. In the future, they may be applied to longitudinal studies to track treatment response in individuals and other muscle diseases.

CLINICAL RELEVANCE/APPLICATION

The proposed multi-parametric approach may allow clinicians to correlate the quantitative parameters to variations in lab findings, and to track treatment response on an individual basis.
**PURPOSE**
To evaluate the feasibility of quantitative assessment of gradual and selective skeletal muscle activation using intravoxel incoherent motion (IVIM) MRI.

**METHOD AND MATERIALS**
We included 6 right-handed healthy volunteers (mean age 31, 3 males). The muscle exercise consisted of selective contraction of right biceps and triceps brachii, with 2kg of weight against gravity. Two series of 12 and 24 contractions were performed for each muscle, alternating muscle between series. Images were obtained before, and 1 min 15 sec after the end of each series. The MRI acquisition consisted of 10 slices of a standard Stejskal-Tanner diffusion sequence with single shot echo planar imaging read-out, at 3 T and using an 8 multichannel receiver knee coil. 16 b-values ranging from 0 to 900s/mm² were acquired. Other acquisition parameters were: in-plane resolution=1.6×1.6 mm², slice thickness=5 mm, TR/TE=4000/83ms, GRAPPA acceleration factor=2, bandwidth=1302 Hz/px. IVIM perfusion fraction f and pseudo-diffusion coefficient D* were obtained by fitting the IVIM double exponential model, from which the blood-flow related parameter fD* was calculated. Transverse FSE PD morphologic sequences were used to place ROIs.

**RESULTS**
Both muscles showed gradual increase in blood-flow related perfusion parameters (fD*) after exercise (biceps after biceps flexion: fD*_rest=0.00133 +/- 0.00007mm²/s, fD*_2kg_12repeats=0.00139 +/- 0.00003, p=0.02; fD*_2kg_24repeats=0.00144 +/- 0.00005, p=0.01). (triceps after triceps flexion: fD*_rest=0.00140 +/- 0.0180, fD*_2kg_12repeats=0.00148 +/- 0.02331, p=0.03; fD*_2kg_24repeats=0.00153 +/- 0.0349, p=0.02). The increase was significantly correlated to the number of contractions for the triceps, and but not statistically significant for the biceps muscles (p_triceps=0.04, p_biceps=0.12). The increase of fD* was selective for the triceps 24 repeats compared to the antagonist (p=0.01), but below significance for triceps 12 repeats (p=0.11), biceps 12 repeats (p=0.29) and biceps 24 repeats (p=0.18).

**CONCLUSION**
IVIM perfusion imaging is a promising, non-invasive method for assessing skeletal muscle activation after exercise.

**CLINICAL RELEVANCE/APPLICATION**
IVIM perfusion imaging could contribute to the physiological exploration of complex muscle activities (such as in sports) and in pathological conditions where a follow-up of muscle function is requested (such as after revascularization or reinnervation surgery).

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**SSA14-08**

**Longitudinal Study of Myofiber Diameter Recovery after Injury Using Time-dependent Diffusion MRI**

**PURPOSE**
A random permeable barrier model (RPBM) has been suggested [Nature Physics 2011, 7:508; PNAS 2014, doi:10.1073/pnas.1316944111] to quantify cell size and membrane permeability using time-dependent diffusion MRI. We apply this framework to monitor the recovery of an atrophied calf muscle.

**METHOD AND MATERIALS**
Calf muscles of a 30 y/o male, recovering from a posterior tibial (PT) tendon rupture on one foot, were scanned using a Trio 3T Tim system (Siemens AG, Erlangen) with a Tx/Rx CP extremity coil. The injured leg was in a non-weight bearing cast for 6 weeks, where it atrophied from inactivity, after which both calf muscles were scanned. The volunteer was then enrolled in physical therapy after his cast was removed and switched to a walking boot. Subsequent scans of the affected leg occurred after 4 and 8 weeks. Regions were manually outlined on T2-weighted anatomical images, Fig.(a, b), to study the time-dependent diffusion Fig.(c) in the Anterior Tibialis (AT), Extensor Digitorum Longus (EDL), Gastrocnemius Medialis (GM), Gastrocnemius Lateralis (GL), Peroneous Longus (PL), PT and Soleus (SOL). RPBM was used to extract fiber diameter and permeability from each region.

**RESULTS**
Fig.(d)-(j) show signs of recovery across all muscle groups with no changes in membrane permeability. After 8 weeks, fiber diameters of AT, SOL, and EDL of the injured leg surpassed those of the healthy leg by 1.5%, 19.5%, and 5.3% respectively. After 8 weeks fiber diameters of the immobilized PT and GM were still 22.8% and 24.8% smaller than those of the control leg.

**CONCLUSION**
Large differences in fiber diameter were observed between immobilized and control muscle regions. RPBM was sensitive to recovery processes during physical therapy. E.g., inversion and plantarflexion were avoided in the early stages of physical therapy. Congruently, our analysis shows that muscle groups associated with such movements initially showed minimal signs of recovery (PT) and continued atrophy (EDL, GM), while recovery was observed in the AT, GL and SOL early on due to walking and dorsiflexion.

**CLINICAL RELEVANCE/APPLICATION**

Time-dependent diffusion MRI with RPBM allows for quantifying subtle changes in myofiber diameter, and enables non-invasive monitoring of the process of muscle building and healing. Such quantitative information could be utilized in the field of physical therapy and sports medicine for developing efficient casts and exercises.

**7-Tesla Chlorine and Sodium MR Imaging Detects Mutation Dependent Alterations in Muscular Sodium and Chloride Concentrations in Muscular Periodic Paralyses**

Marc-Andre Weber MD (Presenter): Research Grant, Bayer AG Research Grant, Guerbet SA Research Grant, Bracco Group Research Grant, Siemens AG Speakers Bureau, Merck & Co, Inc, Armin Nagel DiplPhys: Nothing to Disclose, Anja Marschar: Nothing to Disclose, Karin Jurkat-Rott PhD: Nothing to Disclose, Maya B. Mueller-Wolf MD: Nothing to Disclose, Hans-Ulrich Kauczor MD: Research Grant, Boehringer Ingelheim GmbH Research Grant, Siemens AG Research Grant, Bayer AG Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Siemens AG Speakers Bureau, Novartis AG, Frank Lehmann-Horn PhD: Nothing to Disclose

**PURPOSE**

Patients with periodic paralysis experience episodic weakness spells with intervals of normal muscle function caused by altered muscle membrane potential due to changes in ion conductivities, such as nonselective cation leaks in hypokalemic periodic paralysis and Kir2.1 mutations of the myocellular potassium (K\(^+\)) channel in Andersen-Tawil syndrome. The objective was to assess whether altered sodium (Na\(^+\)) and chloride (Cl\(^-\)) homeostasis can be visualized in these periodic paralyses using ultrahigh field MRI.

**METHOD AND MATERIALS**

Institutional review board approval and informed consent of all participants were obtained. Twelve \(^{23}\)Na-MR (TR/TE=160/0.35) und ten \(^{35}\)Cl-MR examinations (TR/TE=40/0.6) of both lower legs were performed on a 7-Tesla system in genetically confirmed hypokalemic periodic paralysis (Cav1.1-R1239H mutation, n=5; Cav1.1-R528H mutation, n=5) and Andersen-Tawil syndrome (n=2); median age, 47 years. Data from previous examinations of four healthy volunteers (median age, 45 years) were taken as reference. Additionally, each patient received 3-Tesla proton MR imaging on the same day using T1-weighted, STIR and DIXON sequences. Muscle edema was assessed on STIR images, fatty degeneration on T1-weighted images and the muscular fat fraction was quantified using DIXON. Na\(^+\) and Cl\(^-\) were quantified in the soleus muscle using three phantoms containing 10, 20, and 30 mM NaCl solution as reference.

**RESULTS**

Median muscular \(^{23}\)Na concentration in mmol/l was higher in Cav1.1-R1239H (34.7, p=0.008), Cav1.1-R528H (29.8, p=0.001), and Kir2.1 mutation (24.2, p<0.001) than in healthy volunteers (17). Median muscular \(^{35}\)Cl concentration in mmol/l was higher in Cav1.1-R1239H (27.7, p=0.002) and Cav1.1-R528H (25.1, p=0.003) but not in Kir2.1 mutation (14.6, p=0.073) than in volunteers (11). Compared with volunteers, Cav1.1-R1239H and Cav1.1-R528H showed muscular edema (p=0.027, p=0.018) but only Cav1.1-R1239H had fatty muscle degeneration (p=0.036) with a fat fraction of 0.26 vs. 0.08 both in Cav1.1-R528H and Kir2.1 mutations.

**CONCLUSION**

Using 7-Tesla MRI changes of Na\(^+\) and Cl\(^-\) homeostasis can be visualized in periodic paralyses, most pronounced in the severe phenotype Cav1.1-R1239H with up to daily paralytic episodes.

**CLINICAL RELEVANCE/APPLICATION**

7-Tesla \(^{23}\)Na and \(^{35}\)Cl MRI can monitor myocellular ion homeostasis non-invasively and may help in testing of pathogenesis, estimating prognosis, and monitoring of treatment in periodic paralyses.

**MKS-SUA**

**Musculoskeletal Sunday Poster Discussions**

**Scientific Posters**

**M**

AMa PRA Category 1 Credits ™: .50

Sun, Nov 30 12:30 PM - 1:00 PM Location: MK Community, Learning Center

**Participants**

Moderator

Luke R. Scalcione MD : Nothing to Disclose

SSA14-09
**MKS341**

**The Plantar Plate Complex of the First Metatarsophalangeal Joint: High Resolution MR Imaging at 11.7T and 3.0T with Anatomic and Histologic Correlation (Station #1)**

Diego Avila Lessa Garcia MD (Presenter): Nothing to Disclose,
Higor Grando MD: Nothing to Disclose,
Eric Y. Chang MD: Nothing to Disclose,
Sheronda Statum: Nothing to Disclose,
Graeme M. Bydder MBChB: Nothing to Disclose,
Christine B. Chung MD: Nothing to Disclose

**PURPOSE**

There is discrepancy regarding the nomenclature and inconsistent anatomical descriptions in the literature with regard to the plantar plate of the first metatarsophalangeal joint (MTPJ). The purpose of the study is 1) to provide high and ultra-high resolution morphologic evaluation of the plantar region of the first MTPJ focusing on anatomic relationships and structural integrity and 2) to introduce the concept of the plantar plate complex.

**METHOD AND MATERIALS**

The first MTPJ of six fresh-frozen cadavers were used for this study. Imaging of the first MTPJ was performed on a 3.0T clinical MR system (General Electric Healthcare Medical Systems, Milwaukee, WI, United States) with a 2D intermediate-weighted sequence (TR 2000ms TE 35ms) and a 3D-FSPGR sequence (TR 50ms TE 5.2ms) as well as on an 11.7T MR system with a spin echo sequence (TR 5000ms TE 10ms). The plantar regions of each MTPJ were qualitatively analyzed on the MR images. Correlation with gross anatomic dissections and histology was performed.

**RESULTS**

Five ligaments, two sesamoids, a fibrous tissue pad, a capsule and six tendons compose the plantar plate region of the first MTPJ. The external and internal architecture of each of these structures is well demonstrated at both field strengths. Through anatomic and histologic correlation, it is evident that the first plantar plate is not a single structure, but rather a capsuloligamentous complex assisted by a dynamic musculotendinous apparatus.

**CONCLUSION**

MR imaging with gross and histologic correlation allows clarification of the previously confusing plantar plate complex of the first MTPJ.

**CLINICAL RELEVANCE/APPLICATION**

Dedicated coils and high resolution MRI allows for evaluation of the first MTPJ at a level never before seen. Knowledge of the normal detailed anatomy of each component is important for radiological interpretation.

**MKS342**

**Adult Acquired Flat Foot Deformity: Dynamic Ultrasound in the Evaluation of the Stabilizers of the Medial Longitudinal Arch (Station #2)**

Elena Gallardo MD, PhD (Presenter): Nothing to Disclose,
Rosa Maria A. Landeras MD: Nothing to Disclose,
Eduardo Torres Diez: Nothing to Disclose,
Rosario Garcia Barredo: Nothing to Disclose,
Rosa de la Puente: Nothing to Disclose,
Gerardo Lopez Rasines MD: Nothing to Disclose

**PURPOSE**

To assess the role of the calcaneonavicular ligament in the peritalar destabilization in patients with acquired flat foot deformity.

**METHOD AND MATERIALS**

We performed a systematic exploration of the ankle with a high linear array transducer (8-13 MHz), focused on the evaluation of the medial stabilizers, posterior tibial tendon (PTT) and calcaneonavicular ligament or spring ligament complex (SLC), in patients with the diagnosis of acquired flat foot deformity. We evaluated the presence of peritalar destabilization in all patients, measuring the medial talus bone motion from the sitting position to the standing position.

**RESULTS**

We reviewed 60 cases in 49 patients. Tendinosis of PTT was visualized only in 59.5% of the ankles, whereas a significant degeneration of the SLC was demonstrated in 87% of the cases. The most affected area of the SLC was the distal part of the superomedial component in all cases and we visualized a fibrillar disruption in almost one out of three of the cases. We assessed destabilisation more frequently in cases with both SLC degeneration and PTT tendinosis; additionally, in those patients with clear adduction of the talar head while standing, was more frequent the rupture of the SLC.

**CONCLUSION**

Ultrasound is an accurate technique in the evaluation of the spring ligament, and its signs of degeneration are more frequently visualized than PTT tendinosis in patients with acquired flat foot in their initial phases. Dynamic US is a reliable method for measurement the peritalar desestabilization.

**CLINICAL RELEVANCE/APPLICATION**

The radiological literature of the acquired adult flat foot is based on the study of the posterior tibial tendon and PTT insufficiency is considered the main cause of this disorder, however imaging techniques may show no abnormalities in this structure. This study shows that degeneration signs are more frequently visualized in SLC than in PTT, demonstrating the capital importance of this ligament complex on its own, in maintaining the
normal alignment and height of the medial longitudinal arch.

**MKS343**

**Ligament Complex in the Carpometacarpal Joint of the Thumb: Assessment Using 3D Isotropic T1-weighted Fast-spin Echo Indirect MR Arthrography (Station #3)**

Hye Jung Choo MD (Presenter): Nothing to Disclose, Sun Joo Lee MD: Nothing to Disclose, Young Mi Park MD, PhD: Nothing to Disclose, Dong Ho Ha MD, PhD: Nothing to Disclose, Seon-Jeong Kim MD: Nothing to Disclose, Ok Hwa Kim: Nothing to Disclose

**PURPOSE**

The exact evaluation about the ligaments supporting the carpometacarpal joint (CMCJ) of the thumb is not easy on MRI, because the ligaments in the 1st CMCJ are complicated and the 1st CMCJ rests in a pronated and flexed position relative to the plane of the CMCJ of the other fingers. In this study, the ligament complex in the 1st CMCJ was evaluated by using 3D isotropic T1-weighted fast spin-echo (3D T1 FSE) indirect MR arthrography.

**METHOD AND MATERIALS**

Three-dimensional T1 FSE indirect MR arthrography of the wrists was obtained from 26 patients (11 women, 15 men, and mean age, 39.9 years) without abnormality in the 1st CMCJ. On the reformatted axial, coronal and sagittal MR images according to the plane of the 1st CMCJ, the visibility, signal intensity, and thickness of the dorsoradial ligament (DRL), posterior oblique ligament (POL), superficial anterior oblique ligament (sAOL), deep anterior oblique ligament (dAOL) and ulnar collateral ligament (UCL) of the 1st CMCJ were evaluated by two musculoskeletal radiologists in consensus.

**RESULTS**

The DRL, POL, and dAOL were visualized in all the patients (100%), whereas sAOL was visualized in 12 (46%) and UCL in 24 (92%). The DRL showed low signal intensity in 77% of the patients, POL intermediate signal intensity in 77%, dAOL intermediate signal intensity in 100%, and UCL striated appearance in 83%. The POL was the thickest ligament (mean thickness, 2.3 mm; range, 1.7-3.4 mm) and the sAOL was the thinnest ligament (mean thickness, 0.5 mm; range, 0.4-0.8 mm).

**CONCLUSION**

The multiplanar reformatted 3D T1 FSE indirect MR arthrographic images according to the plane of the 1st CMCJ provided the high visibility and the detailed information about the ligament complex of the 1st CMCJ.

**CLINICAL RELEVANCE/APPLICATION**

The multiplanar reformatted 3D T1 FSE indirect MR arthrographic images provided the high visibility and the detailed information about the ligament complex of the 1st CMCJ.

**MKS344**

**Evaluation of Soft-tissue Sarcoma Response to Pre-operative Neoadjuvant Therapy: Added Value of Functional MR Imaging Techniques at 3.0T (Station #4)**

Theodoros Soldatos MD, PHD: Nothing to Disclose, Majid Chalian MD (Presenter): Nothing to Disclose, Michael Anthony Jacobs PhD: Nothing to Disclose, Laura Marie Fayad MD: Nothing to Disclose

**PURPOSE**

To determine the added value of functional magnetic resonance (MR) sequences (dynamic contrast-enhanced [DCE] and quantitative diffusion-weighted imaging [DWI] with apparent diffusion coefficient [ADC] mapping) to conventional MR for assessing the response of soft tissue sarcomas (STS) to pre-operative neoadjuvant therapy.

**METHOD AND MATERIALS**

At 3T, 23 patients (13 males, 10 females, mean age 48±26 years, range 2-89 years) with high grade STS who underwent MR imaging with conventional (T1-weighted, fluid-sensitive, fat-suppressed static post-contrast T1-weighted) and functional (DWI/ADC mapping, DCE-MR) sequences following neoadjuvant therapy, were included. Two readers evaluated all imaging independently (with resolved differences by consensus) for the presence of response by conventional imaging (response defined as ≤5% post-contrast enhancement within the tumor), DCE-MR (response defined as ≤5% of tumor enhancement on arterial phase images), and DWI (response defined as ≤5% of tumor with ADC <1.0 mm²/sec). The presence of response by imaging was compared to the post-operative histologic response, (response defined as >95% non-viable tissue in the tumor), using Fisher’s exact test. ROC analysis was performed to determine ADC threshold values that show adequate histologic response.

**RESULTS**

Of 23 tumors, 4 (17.4%) had adequate histologic response (≤5% viable tumor) in the form of necrosis and scar tissue (necrosis range 0%-95%, scar range 0%-100%), whereas the remaining 19 (82.6%) had a range of 10%-100% viable tumor. The sensitivity and specificity of imaging for determining adequate treatment response was 0% and 94.7% for conventional MR, 100% and 77.7% for DWI/ADC mapping, and 100% and 85.7% for DCE-MR, respectively. A threshold ADC for adequate treatment response was obtained with a minimum ADC>2.0 mm²/s (100% sensitivity, 61.1% specificity) or an average ADC>2.2 mm²/s (50% sensitivity, 77.8% specificity).

**CONCLUSION**
The addition of functional MR sequences to the conventional MR protocol increases the sensitivity of MR imaging for determining the presence of adequate treatment response in STS, particularly when the tumor undergoes histologic response by forming scar tissue rather than necrosis.

**CLINICAL RELEVANCE/APPLICATION**

Since STS may respond to neoadjuvant therapy with scar formation rather than necrosis, functional imaging may be used to improve the prediction of response by MR.

**MKS345**

Characterization of Healthy and Symptomatic Patellar and Achilles Tendons by Shear Wave Elastography (SWE) (Station #5)

**Timm Dirrichs (Presenter): Nothing to Disclose, Christiane Katharina Kuhl MD: Nothing to Disclose, Simone Schrading MD: Nothing to Disclose**

**PURPOSE**

Non-invasive evaluation of tendon elasticity may enhance diagnosis of tendon injury, and if so, could be used to monitor treatment effects. Shear wave elastography (SWE) has shown to be a powerful tool to estimate tissue stiffness. Aim of this study was to evaluate the feasibility and imaging findings of SWE in healthy and symptomatic patellar and achilles tendons.

**METHOD AND MATERIALS**

55 achilles tendons (35 symptomatic and 20 asymptomatic tendons) and 50 patellar tendons (30 symptomatic and 20 asymptomatic tendons) were systematically examined with SWE in the longitudinal and axial plane using a high-resolution linear 15 MHz probe (Aixplorer, Supersonic Imagine, Aix-en-Provence, France). In all tendons at least 3 SWE color maps were acquired in the distal, middle and proximal part of the tendon. A semi-quantitative analysis was done by analyzing the SWE color maps (homogenously blue = soft, turquoise=intermediate stiffness, yellow-red= high rigidity) (max. 180kPA). In addition, a quantitative, ROI-based analysis of tendon elasticity was done. SWE values of symptomatic and healthy tendons were compared by using the student's t-test.

**RESULTS**

At semiquantitative analysis of the SWI color map, symptomatic tendons were rated as "soft" in 87.6% (57/65), as "intermediate" in 9.2% (6/65), and as "rigid" in 0.3% (2/65). In contrast, healthy tendons were rated as "soft" in 10% (4/40), as "intermediate" in 37.5% (15/40), and as "rigid" in 52.5% (21/40). At quantitative analysis, the symptomatic tendons exhibited significantly lower mean SWE values (43 kPa, range 19-65 kPa) than healthy tendons (185 kPa, range 56-265 kPa) (p=0.0004). No differences were observed between SWE values of symptomatic achilles (40.2 kPa) vs. symptomatic patellar tendons (45.4 kPa).

**CONCLUSION**

SWE appears to be a simple and reproducible way to identify tendon pathology. Symptomatic tendons can be identified due to their reduced SWE rigidity. SWE may therefore prove to be a sensitive tool to monitor treatment effects.

**CLINICAL RELEVANCE/APPLICATION**

Shear wave elastography (SWE) is a simple and reproducible tool to identify tendon pathology in patellar and achilles tendons due to reduced tendon rigidity.

**MKE191**

You've Got Nerve!: A Review of Entrapment Neuropathies of the Ankle and Foot (Station #6)

**Jessica Langer MD (Presenter): Nothing to Disclose, Daria Motamedi MD: Nothing to Disclose, Kira Chow MD: Nothing to Disclose, Shahla Modarresi MD: Nothing to Disclose**

**TEACHING POINTS**

The goal of this exhibit is to: (1) Review anatomy of nerves in the lower extremity, (2) Provide an overview of the common causes and imaging manifestations of entrapment neuropathies of the ankle and foot, and (3) Discuss the imaging and clinical presentation of some of the most commonly encountered entrapment neuropathies in order to improve awareness and detection of these conditions.

**TABLE OF CONTENTS/OUTLINE**

Our exhibit will review the anatomy of nerves in the lower extremity, discuss the causes and clinical manifestations of common lower extremity entrapment neuropathies, and provide magnetic resonance imaging (MRI) examples of each, including: (1) Superficial Peroneal Nerve Compression, (2) Deep Peroneal Nerve Compression, (3) Sural Nerve Compression, (4) Tarsal Tunnel Syndrome, (5) Morton Neuroma, and (6) Baxter's Neuropathy.

**MKE234**

Greater Trochanteric Pain Syndrome: Anatomy, Pathology and Ultrasound Guided Interventions (Station #7)

**Eugene Maida MBChB (Presenter): Nothing to Disclose, Mary Margaret Chiavaras MD, PhD: Nothing to Disclose, Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc, Lisa Billone: Nothing to Disclose, Jay Smith MD: Patent agreement, Tenex Health Inc Institutional license agreement, Tenex Health Inc Royalties, Tenex Health Inc Stockholder, Tenex Health Inc**
TEACHING POINTS

1. To review the anatomy of the greater trochanter and surrounding structures, and to emphasize the use of bone landmarks for accurate identification of specific tendons and bursae. 2. To outline ultrasound techniques, including dynamic ultrasound examples of greater trochanteric pathology, such as tendinosis, tendon tears, bursitis and various snapping conditions with MRI correlation, as well as discussion of diagnostic pearls and pitfalls. 3. To provide a treatment algorithm which incorporates ultrasound as a diagnostic tool as well as ultrasound-guided treatment for both tendon and bursal abnormalities.

TABLE OF CONTENTS/OUTLINE


MKE201

Artifacts in Musculoskeletal Ultrasonography (Station #8)

Lana Hirai  Gimber  MD (Presenter):  Nothing to Disclose, David Melville  MD:  Nothing to Disclose, Luke R. Scalciome  MD:  Nothing to Disclose, Russell S. Witte  PhD :  Nothing to Disclose, Hina Arif Tiwari  MD :  Nothing to Disclose, Milhra S. Taljanovic  MD :  Nothing to Disclose

TEACHING POINTS

1. Recognize the high-resolution ultrasonography (US) appearance of normal and injured musculoskeletal (MSK) structures including bone surface, muscle, tendon and ligament. 2. Recognize the US findings of common artifacts in MSK US with B-mode gray-scale and Doppler imaging that can be mistaken for pathology and several artifacts that frequently accompany pathologic conditions. 3. Learn techniques that can help avoid or minimize artifacts in MSK US.

TABLE OF CONTENTS/OUTLINE

1. MSK US Equipment and Technology 2. US findings of normal bone, muscle, tendon and ligament 3. US findings of injured bone, muscle, tendon and ligament 4. US artifacts with B-mode gray-scale imaging: side-lobe, beam-width, anisotropy, artifacts related to velocity errors (speed displacement and refraction), posterior acoustic shadowing, posterior acoustic enhancement/increased through transmission, posterior reverberation, and mirror image 5. US artifacts with Doppler imaging: transducer pressure, tissue strain, improper focus, motion, blooming, mirror image, background noise, aliasing, and twinkling 6. Techniques that can help avoid or minimize artifacts in MSK US.

MKE211

Impingement Syndromes of the Lower Extremity: The Great Masqueraders (Station #9)

Gitanjali Bajaj  MBBS (Presenter):  Nothing to Disclose, Roopa Ram  MD:  Nothing to Disclose, Carey Lee Guidry  MD :  Nothing to Disclose, Maharshi Harischandra Patel  DO :  Nothing to Disclose, Kedar Jambhekar  MD :  Nothing to Disclose, Tarun Pandey  MD, FR CR :  Nothing to Disclose

TEACHING POINTS

1. Discuss the clinical presentation of lower extremity impingement syndromes. 2. Describe the imaging findings of lower extremity impingement syndromes. 3. Emphasize the diagnostic value of MR (Magnetic Resonance) Imaging in the early diagnosis of these commonly misdiagnosed conditions.

TABLE OF CONTENTS/OUTLINE

1. Graphic illustrations showing impingement syndromes about the hip, knee, ankle and foot. 2. MR imaging correlation using case based scenarios. 3. Pearls and pitfalls to prevent diagnostic delay and inappropriate management of lower extremity impingement syndromes.

MKE310

Bone Tumors, Their Reconstructive Options, and the Role of the MSK Radiologist in Their Assessment (Station #10)

Joshua Zeidenberg  BA, MD (Presenter):  Nothing to Disclose, Juan Abelardo Augusto Pretell  MD :  Nothing to Disclose, Ty Kanyon Subhawong  MD :  Nothing to Disclose, Jean Jose  MS, DO :  Nothing to Disclose, Thomas Temple  MD :  Nothing to Disclose, Sheila Conway  MD :  Nothing to Disclose

TEACHING POINTS

1. Limb sparing reconstruction plays a major role in the treatment of orthopedic oncology patients. 2. Strategic choice of endoprosthesis, autograft, allograft, or allograft-prosthetic composites balance procedural complexity/morbidity with maximizing functional outcome. 3. Familiarity with these procedures facilitates early recognition of complications.

TABLE OF CONTENTS/OUTLINE


MKE327

Myxoid Containing Tumors of Soft Tissues: MR Appearance with Radiologic-Pathologic Correlation
TEACHING POINTS
Myxoid soft tissue tumors are a heterogeneous group of mesenchymal neoplasms with characteristic imaging features. Thus, MR results give the basis of decision-making by a multidisciplinary committee. The aim of this education exhibit was to identify specific MRI features and to correlate with pathology in a large series of histologically proven myxoid soft tissue tumours (STT) based upon our experience in a large tertiary referral centre.

TABLE OF CONTENTS/OUTLINE
I) MYXOMA II) MYXOID LIPOSARCOMA III) LOW-GRADE FIBROMYXOID SARCOMA IV) MYXOFIBROSARCOMA V) EXTRASKELLETAL MYXOID CHONDROSARCOMA

MKE233
Evaluation and Management of Ischiofemoral Impingement: A Radiologic and Therapeutic Approach to a Complex Diagnosis (Station #12)

TEACHING POINTS
To describe in detail the anatomy of the ischiofemoral space. To assess the pathophysiological mechanisms and develop an understandable classification, particularly focusing on its etiology, predisposing factors and musculoskeletal associated abnormalities. To assess the role of radiologist in the diagnosis, treatment and postoperative evaluation in the ischiofemoral impingement, both primary and secondary.

TABLE OF CONTENTS/OUTLINE

MKE010-b
Is a Soft Tissue Mass Involving the Tendon Sheath Always a Tenosynovial Giant Cell Tumor? (hardcopy backboard)

TEACHING POINTS
1. To introduce tenosynovial giant cell tumor according to the 2013 WHO classification. 2. To review the radiologic and pathologic features of tenosynovial giant cell tumor in the extremities: localized and diffuse type. 3. To understand various other diseases that can occur in the extremities involving the adjacent tendon sheath.

TABLE OF CONTENTS/OUTLINE
Our exhibit will be divided into 4 sections and presented with relevant cases: 1. Revised nomenclature of tenosynovial giant cell tumor according to the 2013 WHO classification. 2. Tenosynovial giant cell tumor in the extremities: radiologic and pathologic appearance. (1) Localized type: primary, recurced cases (2) Diffuse type 3. Other disease entities involving the adjacent tendon sheath of the extremities which mimic tenosynovial giant cell tumor: radiologic features with a brief disease review (1) Fibroma of tendon sheath (2) Fibromatosis of plantar fascia (3) Peripheral nerve sheath tumor such as schwannoma (4) Vascular leiomyoma (5) Synovial sarcoma (6) Alveolar rhabdomyosarcoma (7) Others 4. Differential diagnostic considerations between tenosynovial giant cell tumor and other disease entities.
Follow Up of Flexor Tendon Repair in the Hand: MR and US Imaging Assessment (Station #1)

PURPOSE
To compare contrast enhanced MR and ultrasound (US) performance in differentiating complications after repair of digital flexor tendon as tendon rupture (frank rupture or elongated callus) or adhesions, from normal post operative aspect.

METHOD AND MATERIALS
Sixteen consecutive patients with tendon rupture were included to be explored by MR ans US 3 months after surgery. 19 fingers, 25 tendons (16 Flexor Digitorum Profondis, 8 Flexor Digitorum Superficialis in zone 1 or 2 IFSSH and 1 Flexor Pollicis Longus) were explored by MR and US studies. Axial and sagittal spin echo sequences (T1, proton density and T1 with fat saturation and gadolinium injection) were performed. US included dynamic study. US and MR studies were blinded. The MR criteria for rupture was the complete lack of continuity of the tendon hypersignal on axial sequences. Standard of reference was either surgical results in case of reoperation or clinical status assessed by a senior surgeon 6-9 months after surgery.

RESULTS
The average time between surgery and imaging was 130 days (+/-109). Four tendons were reoperated with confirmation of frank rupture,10 had intensive reeducation for peritendinous adhesions and 11 had a normal outcome. MR and US depicted frank tendon ruptures in all 4 cases. False positive MR results for rupture was observed in two tendons and US was false positive for rupture in one of these 2 tendons. In these 2 cases, tendons were controlled very early after surgery (24/40 days). Gadolinium enhancement did not improve MR performance in assessing tendon continuity. In case of continuous tendon, the peritendinous scar tissue was depicted in all MR studies except 4 /11 normal outcome tendons controlled 350 days after surgery. US was more specific for peritendinous adhesions, showing the synchronous mobilisation of tendon and peritendinous tissue only in the 10 cases of peritendinous adhesions. In 2 normal outcome tendons xith suture in zone 1, dynamic US study was technically difficult.

CONCLUSION
MR and US study are complementary in the assessment of post operative flexor tendon. Special care should be taken in case of early post operative study, since immature connective healing tissue appears as a gap in the tendon continuity, especially in MR study.

CLINICAL RELEVANCE/APPLICATION
MR and US study are complementary in the assessment of post operative finger flexor tendon. Early control car lead to false positive results for tendon rupture.

Diffusion-weighted MR Imaging for Assessing Synovitis of Wrist and Hand in Patients with Rheumatoid Arthritis: A Feasibility Study (Station #2)

PURPOSE
The purpose of this study was to investigate the feasibility of diffusion-weighted imaging (DWI) in detecting synovitis of wrist and hand in patients with rheumatoid arthritis (RA) and evaluate its sensitivity, specificity and accuracy as compared to T2-weighted imaging (T2WI) with short tau inversion recovery (STIR) with the reference standard contrast-enhanced magnetic resonance imaging (CE-MRI).

METHOD AND MATERIALS
Twenty-five patients with RA underwent MR examinations including DWI, T2WI with STIR and CE-MRI. MR images were reviewed for the presence and location of synovitis of wrist and hand. The sensitivity, specificity and accuracy of DWI and T2WI with STIR were calculated respectively and then compared.

RESULTS
All patients included in this study completed MR examinations and yielded diagnostic image quality of DWI. For individual joint, there was good to excellent inter-observer agreement (k=0.62-0.83) using DWI images, T2WI with STIR images and CE-MR images, respectively. The k-values for the detection of synovitis indicated excellent overall inter-observer agreements using DWI images (k=0.86), T2WI with STIR images (k=0.85) and CE-MR images (k=0.91), respectively. Overall, DWI demonstrated a sensitivity, specificity and accuracy of 75.6%, 89.3% and 84.6%, respectively, for detection of synovitis, while 43.0%, 95.7% and 77.6% for T2WI with STIR, respectively. DWI showed positive lesions much better and more than T2WI with STIR.

CONCLUSION
Our results indicate that DWI presents a novel non-invasive approach to contrast-free imaging of synovitis. It may play a role as an addition to standard protocols.

CLINICAL RELEVANCE/APPLICATION
It may play a role as an addition to standard protocols for assessing synovitis of wrist and hand in patients with rheumatoid arthritis.

**MKS348**

Clinical Utility of Musculoskeletal Ultrasound in Foot and Ankle Pathology: How Ultrasound Imaging Changes Diagnosis and Management (Station #3)

Benjamin Alan  Tritle  MD (Presenter):  Nothing to Disclose,  Michael C. Forney  MD :  Nothing to Disclose,  Patricia Botti Delzell  MD :  Nothing to Disclose

**PURPOSE**

The foot and ankle are well suited for musculoskeletal ultrasound since many structures are superficial and able to be well seen. Clinicians have often narrowed the possibilities for a patient’s symptoms to a limited differential or a specific anatomic location. In such situations, MRI may be an overly extensive and expensive test. Because of its usefulness and economic advantage, we sought to investigate the frequency with which musculoskeletal ultrasound supports or changes clinical management.

**METHOD AND MATERIALS**

After obtaining IRB approval, a retrospective review of 110 consecutive patients who underwent MSK ultrasound of the foot or ankle was conducted (January 4, 2012-November 26, 2013). 98 of these patients had both a pre- and post-ultrasound clinical impression/plan documented in the medical record. The categories of the pre-ultrasound impressions included: Inflammatory conditions (36); Morton’s Neuroma (16); Traumatic/Mechanical conditions (15); Suspected mass (other than neuroma) (10); Foreign body (8); Degenerative (7); Infectious (2). Note was made if the clinical diagnosis was changed or confirmed by ultrasound, and if treatment decisions were altered.

**RESULTS**

Ultrasound of the foot or ankle impacted diagnosis and or management for a large number of patients. Diagnosis or management was influenced in 62 of 98 (63%; 95% CI: 53-72%) patients. In the majority of these cases, 68% (95% CI: 55-78%), both the diagnosis and the treatment were altered. In 36 patients whose diagnosis and treatment were not altered, ultrasound confirmed the initial clinical impression 97% of the time (35/36; 95% CI: 85-100%).

**CONCLUSION**

Musculoskeletal ultrasound of the foot and ankle can play an important role in clinical decision making for a large group of patients. When musculoskeletal ultrasound did not change the diagnosis or management in this group of patients, it confirmed the initial clinical impression which may also be important to the clinician and the patient. In addition to being significantly lower in cost compared with MRI, ultrasound offers a more readily available test and may be better tolerated by some patients.

**CLINICAL RELEVANCE/APPLICATION**

Musculoskeletal ultrasound is a cost effective imaging modality which has become more readily available. Our data demonstrate ultrasound of the foot and ankle frequently impact clinical management.

**MKS349**

Post-operative Follow-up MRI of Malignant or Locally Aggressive Tumors: Tissue 4D Perfusion and Diffusion Weighted Images (Station #4)

In Sook   Lee (Presenter):  Nothing to Disclose,  You Seon   Song :  Nothing to Disclose,  Hie Bum   Suh  MD :  Nothing to Disclose,  Se Kyoung   Park :  Nothing to Disclose,  Jeung Il   Kim  MD, PhD :  Nothing to Disclose,  Jong Woon   Song :  Nothing to Disclose

**PURPOSE**

To evaluate the presence or absence of recurrent or remnant lesion during post-operative follow-up of malignant or locally aggressive tumors by using dynamic constrast enhanced (DCE, perfusion image) and diffusion weighted images (DWI).

**METHOD AND MATERIALS**

From January 2013 to February 2014, 24 patients (16 women, 8 men; age range, 18-84 years; mean age, 50 years) with 33 follow-up MR images performed DCE and DW images adding to conventional MR images after surgical removal of malignant or locally aggressive tumors. The day interval between first operation and follow-up date was ranged 7-439 days (mean 151 days). On conventional MR images, we evaluated the presence or absence of definite mass or nodule formation and focally fluid or hematoma formation at operation site, and edema and fascial thickening adjacent operation site. We measured apparent diffusion coefficient (ADC) values on ADC maps calculated from DWI. On DCE images, we obtained the values of Ktrans, Kep, Ve, iAUC. And also, time-concentration curve (TCC) was automatically obtained with 7 types.

**RESULTS**

20 patients had malignant soft tissue tumors, two malignant bone tumors and two Langerhans cell histiocytosis. Seven patients performed follow-up MR images of two-times and one performed three-times. Among 33 follow-up MR images, 12 cases had occurred or remnant lesions confirmed with re-operation. Only 4 cases were determined with clinical and imaging follow-up more than 6 months. The factors evaluated on conventional MR images were all statistically insignificant (p < 0.05). On DCE images, the values of Ktrans and iAUC and TCC
patterns were significant (p < 0.05). On DWI, the values of ADC were significant (p < 0.05).

CONCLUSION

For evaluating the presence or absence of recurrence or remnant lesion at operation site after surgical removal of malignant or locally aggressive tumors, DCE and DWI were more effective than conventional MR images.

CLINICAL RELEVANCE/APPLICATION

In the cases that the determination of recurred or remnant lesion at previous operation site is difficult on follow-up MR images, these functional MR images might be helpful for avoiding unnecessary re-operation or procedures.

MKS350

Non Invasive and Quantitative Evaluation of Muscle Damage has Important Clinical Application and a Crucial Role on Preclinical Research. Aim Was to Set Up and Validate an MR Based Non-invasive Protocol for the Quantitative Assessment of Muscle Damage (Station #2)

Anna Palmisano MD (Presenter): Nothing to Disclose , Antonio Esposito MD : Nothing to Disclose , Tamara Canu RT : Nothing to Disclose , Francesco Maria Lo Russo : Nothing to Disclose , Francesco Aldo De Cobelli MD : Nothing to Disclose , Alessandro Del Maschio MD : Nothing to Disclose

PURPOSE

Non invasive and quantitative evaluation of muscle damage has important clinical application and a crucial role on preclinical research. Aim was to set up and validate an MR based non-invasive protocol for the quantitative assessment of muscle damage/healing process in murine models of acute ischemic and non-ischemic damage.

METHOD AND MATERIALS

MR imaging was performed on a 7T magnet (Bruker): T2w-MSME sequences were acquired for the assessment of T2 relaxation time (T2-rt) and diffusion tensor images (EPI-DTI sequences) for the quantification of the fractional anisotropy (FA), in 24 C57BL/6N mice before intramuscle injection of cardiotoxin (CTX) and after 1, 3, 5, 7, 10, 15, 30 days. The same protocol was acquired 1, 3, 5, 7, 14, 21 days after femoral artery ligation in 10 mice. Moreover, in these last group of mice DCE-MRI was performed and Ktrans and Ve evaluated. MRI parameters were compared to histological findings at each time point.

RESULTS

After i.m. injection of CTX: T2-rt peaked at day 3 followed by a progressive return to normal values; FA drops at day 1 with a progressive increase over normal values between day 7 and 15. A strong correlation was found between T2-rt and leukocyte infiltrates (r = 0.92 p<0.003), and between FA and the extent of tissue regeneration (% of regenerating fibres) (r = 0.88 p<0.001). In mouse model of acute ischemic damage we observed a trend similar to the previous but with a slower kinetics: T2-rt peaked between day 3 and 7 with a progressive return to basal value; FA drops between day 3 and 5 and reaches values higher than normal after day 14. DCE-MRI study showed a drop of k trans after damage, due to absent perfusion, with a progressive increase over normal value between day 7 and 14, paralleling to vascular regeneration. Ve increased at 24 hr after ischemic damage with a plateau till day 14-21, then return to normal values.

CONCLUSION

Multiparametric MRI offers an effective and complete evaluation of muscle damage/healing process. In particular, T2-mapping e Diffusion Tensor Imaging allow an accurate quantitative monitoring of inflammatory infiltration and muscle regeneration occurring after acute muscle damage.

CLINICAL RELEVANCE/APPLICATION

Multiparametric quantitative MRI is a potentially powerful tool for the non invasive assessment of muscle damage/repair process also in clinical fiel.

MKE146

Routine Knee MRI: T2 Black Lesions- Differential Considerations (Station #6)

Vibhor Wadhwa MBBS (Presenter): Nothing to Disclose , Gina Cho Sims MD : Nothing to Disclose , Avneesh Chhabra MD : Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc

TEACHING POINTS

1. Most lesions in the knee joint are T2 bright. 2. T2 dark lesions exhibit limited differential possibilities and their location in the knee joint and appearances are characteristic. 3. A diagnostic algorithm should be followed for arriving at a definitive diagnosis of a T2 dark lesion.

TABLE OF CONTENTS/OUTLINE

1. Table of differential diagnosis of T2 dark lesions, such as vacuum phenomenon, blood clot or hemophilia, intraarticular body, discoid meniscus, displaced flap/bucket handle tears of meniscus, meniscal variants (oblique meniscocapsular ligament, unilaterial meniscocapsular ligament, anterior and posterior transverse meniscocapsular ligaments), thickened plica, displaced interference screw, particle disease from ACL graft, calcium hydroxyapatite deposition of posterior oblique ligament, gout, PVNS, lipoma arborescence and primary and secondary synovial osteochondromatosis.
2. Quiz format for the diagnosis of these lesions or lesion categories.
3. Diagnostic algorithm with summary of the salient features.

**MKE181**

**Posterior Ankle Impingement in Athletes: Pathogenesis, Imaging Features and Differential Diagnoses (Station #7)**

Daichi Hayashi MBBS, PhD (Presenter): Nothing to Disclose, Frank W. Roemer MD: Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC, Pieter D’hooghe MD: Nothing to Disclose, Ali Guermazi MD, PhD: President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgaA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc

**TEACHING POINTS**

To review relevant anatomy of posterior ankle To describe different types of posterior ankle impingement syndromes due to traumatic and non-traumatic osseous and soft tissue pathology To describe the approach to imaging of these pathologies and illustrate their imaging features, including relevant differential diagnoses

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
2. Anatomy of posterior ankle
3. Imaging protocol for posterior ankle evaluation
4. Pathogenesis, clinical features, imaging findings and differential diagnoses
   - Bony lesions: fracture of posterolateral talar process; presence of os trigonum; osteophytes at the posterior margin of the tibial plafond and posteroinferior osteophytes of posterolateral talar process; loose bodies in the posterior recesses or posterior subtalar joint
   - Posteromedial soft tissue lesions: posterior tibiotalar ligament injury; posteromedial gutter synovitis and scar; avulsion fractures of posteromedial process of the talus at the insertion of posterior tibiotalar ligament
   - Posterolateral soft tissue lesions: posterior intermalleolar ligament injury; displaced distal tear of the calcaneofibular ligament
   - Anomalous and accessory muscles
5. Conclusion: Multimodality imaging readily identifies predisposing factors and distinct manifestations of posterior impingement syndromes

**MKE109**

**Update and Review of Dual-Energy CT Clinical Applications of the Gout (Station #8)**

Xiaohu Li (Presenter): Nothing to Disclose, Bing Liu MD: Nothing to Disclose, Yu Yongqiang MD, PhD: Nothing to Disclose

**TEACHING POINTS**

1. Review DECT technique and discuss clinically specific joints protocols
2. Apply various DECT imaging displays and advance post-processing techniques to detection of uric acid depositing in topaceous gout

**TABLE OF CONTENTS/OUTLINE**

1. Dual energy implies at two different kv(80KV,140KV) levels simultaneously. The result is two spiral data sets acquired in a single scan providing information, which allows characterizing the imaged tissue or material. 2.Gout is characterized by the inflammatory response that results from the deposition of monosodium urate crystals in soft tissues and joints. 3.Dual source Dual-energy CT has been used to differentiate uric acid from calcium in musculoskeletal tissue, allowing gouty urate crystals to be distinguished from bone or dystrophic calcifications. 4.Dual-energy spectral CT can detect gout tophi within the peripheral joints of the patients. The quantitative measurement of the tophi concentration provides a new imaging method for quantitatively monitoring clinical outcomes of tophi.

**MKE159**

**Calcaneal Avulsion Fractures: Anatomy, Nuances, Mechanisms, and Pitfalls (Station #9)**

Sarah M. Yu: Nothing to Disclose, Joseph Sekiguchi Yu MD (Presenter): Nothing to Disclose

**TEACHING POINTS**

1. To identify the vulnerable areas in the calcaneus that is susceptible to avulsion fractures. 2. To differentiate avulsion fractures from other fractures that affect the calcaneus. 3. To discuss imaging strategies and algorithms that facilitates diagnosis.

**TABLE OF CONTENTS/OUTLINE**

The calcaneus is the primary weightbearing bone in the heel. The morphology of this bone is complex and many of its surfaces serve as attachments to tendons, muscles, and ligaments. Radiographic imaging is difficult. The four articulating surfaces are oriented in different directions and the stabilizing ligaments that hold the calcaneus in place occupy very specific locations. Avulsion fractures vary in size as well as in their mechanisms of injury. A proper search strategy allows recognition of these fractures and differentiation from normal variants in the foot. Contents: 1. NORMAL OSSEOUS ANATOMY 2. NORMAL SOFT TISSUE ANATOMY 3. TYPES OF CALCANEAL AVULSION FRACTURES 4. SITES OF VULNERABILITY a. Achilles tendon-calcaneal tuberosity b. Plantar fascia-middle calcaneal process c. Bifurcate ligament-anterior calcaneal process d. Extensor digitorum brevis-lateral cortex e. Calcaneocuboid ligament-cuboid articulating surface 5. PITFALLS a. Achilles tendon ossification b. Accessory ossicles c. Direct fractures
Thorough understanding of the thoracoabdominal musculoskeletal structures in sports, with training regimens now incorporating ‘core strengthening’ as an important pillar. The recognition, throwing, kicking, and related activities. There is growing understanding of the role of the thoracoabdominal musculoskeletal structures in sports injuries. Susceptible to direct blunt force trauma in contact and collision sports and to indirect stretching injuries during running, cutting, and pelvis, while stabilizing the body during locomotion and limb movements. Each of these bone and soft tissue structures are responsible for the large movements of the upper extremities and for stabilizing the upper body during twisting motions.

**TABLE OF CONTENTS/OUTLINE**


**TEACHING POINTS**

1. To review the most common injuries in runners. 2. To illustrate a wide spectrum of pathological situations in a case-based scenario.

**TABLE OF CONTENTS/OUTLINE**


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**TEACHING POINTS**

1. To review the most common injuries in runners. 2. To illustrate a wide spectrum of pathological situations in a case-based scenario.

staging, therapy, and rehabilitation of these injuries are likewise becoming more sophisticated. This refresher course will review the role imaging plays for these injuries, emphasizing the added value of advanced imaging modalities for diagnosis, treatment planning, and prognostication.

**PS12**

**Sunday Afternoon Plenary Session**

**Plenary Sessions**

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AMA PRA Category 1 Credits™: 1.75
ARRT Category A+ Credits: 1.50

Sun, Nov 30 4:00 PM - 5:45 PM Location: Arie Crown Theater

**Participants**

Presiding
N. Reed Dunnick MD Nothing to Disclose President, Radiological Society of North America

**Sub-Events**

**PS12A**

**Report of the RSNA Research and Education Foundation**

James P. Borgstede MD (Presenter): Nothing to Disclose Chairman, Board of Trustees, RSNA Research and Education Foundation

**Abstract**

The RandE Foundation - A Transformative Force in Radiology The theme of the 2014 RSNA Scientific Assembly and Annual Meeting is "A Century of Transforming Medicine." For 30 years of that century, the RandE Foundation has played a significant role in advancing the RSNA mission to promote excellence in patient care and health care delivery through education, research and technologic innovation. In celebration of 100 years, the Foundation is launching Inspire-Innovate-Invest, The Campaign for Funding Radiology's Future. This bold campaign seeks to raise $17.5 million to fund grants in radiologic research and education, bridging the gaps in funding for promising investigators and educators. The need is great and the time is now, if the Foundation reaches its campaign goal of $17.5 million, it will keep pace with the growing demand and help ensure that critical discoveries by radiologic investigators come to fruition. This year, the Foundation will fund 95 grants totaling $3.7 million. This means the RandE is funding 25% of our ever increasing number of excellent grant applications. While pleased with these achievements, imagine what the RandE Foundation could fund with additional support from all of us as radiology colleagues? And please recall that we are all the beneficiaries of this research. Of these individuals, who will start their academic research career with an RandE grant, and what will grow from this initial funding? What advances will emanate from their research? And, how can radiologists support these investigators and educators as they pursue their chosen career paths in an effort to make the specialty even stronger? During the meeting week, please take time to visit the RandE Foundation Booth, located on Level 3 of Lakeside Center to learn more about how you can be a part of the campaign and support the RandE Foundation and the future of our specialty.

**PS12B**

**Image Interpretation Session**


**LEARNING OBJECTIVES**

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

**SPSC20**

**Controversy Session: Shoulder Imaging: US vs MR**

**Special Courses**

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AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 1.00

Mon, Dec 1 7:15 AM - 8:15 AM Location: E351

**Participants**

Moderator
LEARNING OBJECTIVES

1) Describe the indications for shoulder US. 2) Describe the advantages and disadvantages of US for evaluating the shoulder. 3) Describe the indications for shoulder MRI. 4) Describe the advantages and disadvantages of MRI for evaluating the shoulder.

MSCM21

Case-based Review of Magnetic Resonance (An Interactive Session)

Multisession Courses

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LEARNING OBJECTIVES

1) Understand the role of MRI for the evaluation of disorders of the upper and lower extremities, brain and neck, and abdomen and pelvis. 2) Apply helpful tips and tricks in MRI interpretation to avoid pitfalls and make accurate diagnoses. 3) Recognize frequently missed or misinterpreted findings on MRI of the head, neck, and body. 4) Understand the latest, clinically relevant MRI techniques and how they can be used in practice. 5) Develop a succinct MRI-based differential diagnosis for select disorders of the head, neck, body, and extremities.

ABSTRACT

MRI is a workhorse of imaging in most radiology practices, with applications in the brain, head and neck, abdomen and pelvis, and extremities. As the clinical utility of MRI has grown, so has its complexity. This series of talks aims to guide participants through the various anatomic regions of the body while highlighting the appropriate use of MRI through a series of interactive case presentations. Speakers will emphasize frequently missed diagnoses while providing tips for avoiding interpretive pitfalls and providing accurate diagnoses.

Sub-Events

MSCM21A  Lower Extremity
Donald Joel Flemming MD (Presenter): Royalties, Reed Elsevier

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM21B  Upper Extremity
Timothy Gene Sanders MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM21C  Upper Abdomen
Jorge A. Soto MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Use illustrative cases to highlight common sources of error in the interpretation of MR imaging examinations of the upper abdomen (liver, pancreas, biliary tract, kidneys, adrenal glands). Issues related to poor imaging technique/protocol planning, errors in contrast administration, anatomic variants and pseudo-lesions will be demonstrated. 2) Review methods that can be used to decrease the likelihood or misinterpreting upper abdominal MR images related to these potential pitfalls.

RC231

Master Class in Musculoskeletal Ultrasound (How-to Workshop)

Refresher/Informatics

AMAPRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Mon, Dec 1 8:30 AM - 10:00 AM   Location: S100AB
LEARNING OBJECTIVES

1) Recognize and identify pitfalls of scanning that lead to false positive or false negative musculoskeletal ultrasound results. 2) Perform skills for scanning difficult patients. 3) Follow rigorous protocols for the examination of different anatomic regions. 4) Position patients for more complicated musculoskeletal ultrasound examinations. 5) Recognize and integrate the importance of tissue movement in judging the functionality of the extremities.

ABSTRACT

In this Musculoskeletal Ultrasound Master class, an opportunity will be given to participants to start a written dialogue in advance to RSNA 2012. The electronically submitted questions will be sorted by instructors and organized per topic. A select number of recurrent themes in these questions will be prepared for dialogue on stage. When the questions focus on a particular scanning skill, the authors of the questions will be invited on the examination platform to show problems they encounter in their practice. By using a step-by-step approach in solving the scanning issues, all who are present should benefit from the technical interactions on stage. Cameras will project scanning details on large screens. The seating in the master class will guarantee close proximity for an enriching interaction between audience and stage. At the end of the master class, the audience will be broken up in smaller groups for a more personal interaction with the instructors with the intent of improving scanning skills on an individual level.
musculoskeletal radiologist who was blinded to the original MRI interpretations, the subjects’ injury status, and innings pitched. The total innings that the player pitched prior to the MRI was recorded in addition to elbow injuries requiring a stay on the disabled list following the MRI. Statistical analysis was performed to examine association between total career innings pitched and the presence of a particular MRI finding as well as between MRI findings and a subsequent disabled list stay.

RESULTS

When grouped as a whole and analyzed for MRI findings in relation to innings pitched several trends were observed that reached statistical significance. There was a greater number of innings pitched in players with degenerative findings of the UCL, cartilage lesions, olecranon osteophytes, flexor pronator mass tendinosis, and increased signal in the extensor wad.

CONCLUSION

The major league baseball pitcher’s elbow is subject to repetitive valgus torque over the course of their career, leading to adaptive and degenerative changes with the medial elbow and intra-articular structures. Though detected on MRI, these findings do not necessarily correlate with elbow pain or dysfunction. Analysis of a small but significant number of asymptomatic pitchers, who later sustained elbow injuries requiring a stay on the disabled list, revealed that all had degeneration of the UCL with olecranon osteophytes, and most had flexor pronator mass tendinosis.

CLINICAL RELEVANCE/APPLICATION

Degenerative findings along the medial elbow are commonly observed on MRI in professional pitchers. However, these findings are often clinically insignificant and do not correlate with time on the disabled list.

VSMK21-03

Quantitative MRI Analysis of the Relationship between the Anconeus Epitrochlearis Muscle and Ulnar Compression Neuropathy

Hing Yee Eng MD (Presenter): Nothing to Disclose, Carlos Luis Benitez MD: Nothing to Disclose

PURPOSE

The anconeus epitrochlearis muscle (AEM) is an anomalous accessory muscle in the elbow, coursing from the medial olecranon to the medial epicodyle. Several cases in the literature have suggested the association of this muscle with ulnar compression neuropathy. The purpose of this study is to review the MRI findings of the AEM, assess the relationship between muscle size and ulnar nerve morphology, and investigate the muscle’s correlation with ulnar compression neuropathy.

METHOD AND MATERIALS

Thirty two cases of elbow MRI studies of patients with an AEM from July 2007 to March 2014 were reviewed retrospectively. All of these patients presented with elbow pain and/or numbness with mean age of 40 years (range 18 to 60 years). The following parameters were evaluated: ulnar nerve diameter proximal, within, and distal to the cubital tunnel (CT); AEM cross sectional area (MA) and volume (MV); and encroachment ratio of the muscle at the superior and inferior aspects of the CT. Changes in ulnar nerve caliber and signal were also assessed.

RESULTS

The mean ulnar nerve diameters proximal, within, and distal to the CT were 3.63, 3.97, and 3.39 mm respectively. The mean MA was 68.47 mm² and mean MV was 6300 mm³. The mean encroachment ratio of the AEM in the CT was 0.58 superiorly and 0.56 inferiorly. There was no statistically significant correlation between the ulnar nerve diameter within the CT and MA (r = 0.05) or MV (r = 0.06). There were positive correlations between the MA and both the superior (r = 0.66) and inferior (r = 0.64) encroachment ratios as well as between the MV and the superior (r = 0.65) and inferior (r = 0.57) encroachment ratios. The most common abnormalities involved the common extensor (n = 17) and biceps (n = 6) tendons. Four of the thirty two cases demonstrated focal T2 hyperintensity and/or thickening of the ulnar nerve consistent with ulnar neuritis, three within the CT and one just proximal to the CT.

CONCLUSION

Most findings of anconeus epitrochlearis muscle are incidental and asymptomatic without ulnar compression neuropathy. There is no significant correlation between anconeus epitrochlearis muscle size and ulnar nerve caliber in the cubital tunnel.

CLINICAL RELEVANCE/APPLICATION

Anconeus epitrochlearis muscle is usually incidentally found and not associated with symptoms or ulnar compression neuropathy. This knowledge can help the clinician in the management of elbow pain.

VSMK21-04

Entrapment Neuropathies of the Upper Extremity

Ali M. Naraghi MD, FRCR (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the normal peripheral nerve anatomy and muscle innervation in the upper extremity with an
emphasis on sites of compression. 2) Identify the common sites of nerve entrapment in the upper extremity. 3) Recognize the imaging features of peripheral nerve entrapment in the upper extremity. 4) Recognize the limitations in imaging of upper limb entrapment neuropathies.

**VSMK21-05**  
**The Triangular Fibrocartilage Complex: High-Resolution Morphologic and Quantitative MR Evaluation**

Monica Tafur MD (Presenter): Nothing to Disclose, Mohammed Jamal Aakef: Nothing to Disclose, Tania Kumar: Nothing to Disclose, Jiang Du PhD: Nothing to Disclose, Sheronda Statum: Nothing to Disclose, Christine B. Chung MD: Nothing to Disclose

**PURPOSE**

The objectives of this study are to implement high-resolution magnetic resonance imaging (MRI) using ultrashort time-to-echo (UTE) techniques to evaluate the triangular fibrocartilage complex (TFCC) and to quantify the MR properties of the TFCC.

**METHOD AND MATERIALS**

Institutional review board approval with exemption of informed consent was obtained. Wrists of subjects and human cadavers were imaged in a 3T Signa TwinSpeed scanner (GE Healthcare) with optimized coils (microscopy and dedicated wrist coils). Morphologic evaluation sequences included high-resolution proton density (PD), 3D spoiled gradient echo (SPGR) and 2D/3D UTE. Quantitative evaluation included conventional (T2 SE), T1rho sequences tailored for long T2 values (2D/3D T1rho) and UTE (UTE T2* and UTE T1rho) sequences and an in-house MatLab analysis algorithm fitting regions of interest (ROIs) to determine average values.

**RESULTS**

High-resolution MR images demonstrated the different structures of the TFCC as well as pathological findings including perforations, degeneration and calcifications of the fibrocartilage among others. UTE sequences allowed the visualization of structures with short T2 components and subtraction techniques facilitated the identification of these components, such as TFC calcifications, which were better demonstrated in UTE sequences as compared with conventional PD sequences. Quantitative MR analysis of the TFC showed a bi-component decay behavior in normal subjects (short T2* = 0.31 ms, long T2* = 9.68 ms). T2, UTE T2* and T1rho values were increased with degeneration of the TFC. In the presence of calcifications, UTE T2* values were decreased probably due to magnetic susceptibility effects. In some cases, certain areas of the TFC showed increased UTE T2* values despite a normal appearance on standard PD sequences, which may indicate early stages of degeneration.

**CONCLUSION**

UTE MRI allows the visualization of short T2 components of the TFCC and improved the demonstration of certain pathologies as compared with the standard clinical sequences. Quantitative MR analysis reflected changes in TFC composition in some pathological cases.

**CLINICAL RELEVANCE/APPLICATION**

Morphological and quantitative UTE sequences allow visualization of the short T2 components of the TFCC and demonstration of some pathological cases not provided by the standard clinical sequences.

**VSMK21-06**  
**Comparison of Wrist MR Arthrography Alone and Wrist MR Arthrography Plus Dynamic Cine-arthrography: The Usefulness in the Diagnosis of Triangular Fibrocartilage Complex and Intrinsic Ligament Tear**

Seun Ah Lee MD (Presenter): Nothing to Disclose, Baek Hyun Kim MD: Nothing to Disclose, Seon Jeong Oh: Nothing to Disclose, Jong Woong Park: Nothing to Disclose, Kyung-Sik Ahn MD: Nothing to Disclose, Ji Yung Choo MD: Nothing to Disclose, Suk-Joo Hong MD: Nothing to Disclose, Chang Ho Kang MD: Nothing to Disclose

**PURPOSE**

The purposes of this study were to introduce dynamic cine-arthrography (DCA) and compare the diagnostic performance between MR arthrography (MRA) alone and MRA with DCA for evaluating triangular fibrocartilage complex (TFCC) and intrinsic ligament tears.

**METHOD AND MATERIALS**

93 wrists of 88 patients underwent both DCA and MRA from May 2010 to February 2014. Among them, 44 wrists of 42 patients who had undergone arthroscopy were included in this study. DCA was performed during contrast injection for MRA. After puncture of the radio-carpal joint, DCA was taken while slowly injecting contrast under fluoroscopic guidance during passive wrist exercise. We obtained 3.0T MRA with fat-suppressed coronal, sagittal, and axial images. Two radiologist evaluated TFCC, scapho-lunate (S-L) ligament, and luno-triquetral (L-T) ligament tears on MRA and MRA with DCA, respectively. Based on the arthroscopic findings, we compared the diagnostic values between MRA and MRA with DCA by the McNemar test.

**RESULTS**

The overall sensitivity and specificity of the diagnosis of TFCC tear were the same between MRA and MRA with
DCA (reader 1, sensitivity 96.4%/96.4% (MRA/MRA with DCA), specificity 68.8%/68.8%, accuracy 86.4%/86.4%, reader 2, sensitivity 96.4%/96.4%, specificity 93.8%/93.8%, accuracy 95.5%/95.5%). For intrinsic ligaments, all diagnostic values were increased on MRA with DCA as compared with MRA for both readers (S-L ligament: reader 1, sensitivity 77.8%/77.8% (MRA/MRA with DCA), specificity 92.3%/96.2%, accuracy 86.4%/88.6%, reader 2, sensitivity 61.1%/61.1%, specificity 76.9%/88.5%, accuracy 70.5%/77.3%, L-T ligament: reader 1, sensitivity 66.7%/100%, specificity 89.7%/89.7%, accuracy 81.8%/93.2%, reader 2, sensitivity 60.0%/86.7%, specificity 82.8%/86.2%, accuracy 75%/86.4%), without statistical significance (p>0.05). The inter-observer agreement was more increased on MRA with DCA than MRA alone.

CONCLUSION

Wrist MR arthrography with dynamic cine-arthrography resulted in a higher diagnostic value of intrinsic ligament tear and increased the inter-observer agreement of TFCC and intrinsic ligament tear as compared with wrist MR arthrography alone.

CLINICAL RELEVANCE/APPLICATION

The use of wrist MR arthrography plus dynamic cine-arthrography which was performed during contrast injection for MRA, may help increase diagnostic performance for TFCC and intrinsic ligament tear.

VSMK21-07  Wrist MRI vs MR Arthrography

Mark Douglas Murphey MD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSMK21-08  Sports Related Injuries of the Wrist

Wilfred C. G. Peh MD (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Review relevant anatomical structures in the wrist that may be injured during sports. 2) Discuss the biomechanics of various types of wrist injuries. 3) Illustrate the imaging features of common sports injuries demonstrated on different imaging modalities.

ABSTRACT

Many anatomical structures in the wrist may be injured in a variety of ways during participation in sports. Many of these sporting activities, whether competitive or recreational, are associated with specific injury patterns related to actions and stresses associated with a particular sport. Imaging has an important role in the evaluation of the range of bone and soft tissue injuries sustained. Knowledge of the biomechanics behind a particular sporting activity is useful for understanding the pathophysiology of wrist injury and helps explain the findings seen at imaging. Recognizing the imaging features aids in the early diagnosis, identification and prevention of potential complications, management and follow-up of these injuries. It is particularly important to be aware of wrist injuries affecting the immature skeleton of pre-adolescent and adolescent athletes, as continued sporting activity may result in growth arrest and other long-term problems.

Active Handout


VSMK21-09  Cost-effectiveness Analysis of Utilizing 3T MRI to Select Which Patients with Chronic Wrist Pain Should Undergo Arthroscopy


PURPOSE

To evaluate the cost effectiveness of performing 3T MRI in patients with chronic wrist pain

METHOD AND MATERIALS

A decision analysis model was designed to compare the following diagnostic algorithms in the patients with chronic wrist pain (> 3 months): (1) 3T MRI followed by diagnostic arthroscopy for positive findings; and (2) Diagnostic arthroscopy. The assumption was the detected injuries were treatable by surgical repair or therapeutic arthroscopy. Short-term and long-term outcome were considered as unnecessary arthroscopy avoided and Quality-Adjusted-Life (QALY), respectively. Costs from societal perspective and incremental cost to effectiveness ratio were calculated. Accuracy of MRI in detection of wrist injuries, utility loss due to wrist pain and costs associated with each strategy were estimated from literature and Medicare reimbursement data for 2013. The willingness-to-pay threshold was considered to be $50000. Sensitivity analysis was conducted to examine the model’s stability to variations in the clinically plausible range of the model’s variables.

RESULTS

Sensitivity and specificity of MRI was considered as 74% and 84%, respectively. The prevalence of ligamentous
injuries in the study population was considered as 25%. The analysis showed that using MRI as the primary indicator of necessity of performing arthroscopy cost average of $1425 per patient, while performing arthroscopy in all patients cost $2500 per patient. The incremental cost of using MRI to avoid one unnecessary arthroscopy was estimated as $793. The incremental costs of performing non-selective arthroscopy in all the patients in comparison to using MRI was $82692 per one QALY gained. Considering a subgroup of patients whose ligamentous injury is not amenable by arthroscopy, this amount decreased to $8035. The sensitivity analysis showed the model was stable to variation in clinically plausible ranges of 3T MRI sensitivity and specificity, providing prevalence of repairable wrist injury between the patients with chronic wrist pain did not exceed 34%.

CONCLUSION
Performing 3T MRI to determine the necessity of diagnostic arthroscopy in patients with chronic wrist pain may be cost-effective.

CLINICAL RELEVANCE/APPLICATION
In practices where most patients with wrist pain require no arthroscopic repair; MRI may be cost-effective both in avoiding unnecessary diagnostic arthroscopy and long-term societal perspective.

VSMK21-10 Imaging Techniques for Evaluating Elbow and Wrist Instability
Miriam Antoinette Bredella MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Demonstrate understanding of the complex anatomy, kinematics and injury patterns of the wrist and elbow.
2) Become familiar with routine and novel static and dynamic imaging techniques to assess wrist and elbow instability.

VSMK21-11 Diagnosis of Scapholunate Dissociation: Cine-MR Imaging as a New Approach
Soenke Langner MD, PhD: Nothing to Disclose, Inga Langner MD: Nothing to Disclose, Paul-Christian Krueger MD: Nothing to Disclose, Rebecca Kessler MD: Nothing to Disclose, Andreas Eisenschchenk MD, PhD: Nothing to Disclose, Per-Olaf Behrndt MD (Presenter): Nothing to Disclose

PURPOSE
Posttraumatic injuries of the scapholunate ligament (SLL) may cause scapholunate dissociation (SLD) which bears a high risk of osteoarthritis. Plain radiographs are used for initial diagnostic work up and MR imaging (MRI) is the preferred imaging modality for the assessment of ligamentous injuries. However, dynamic instability can only be assessed by cineradiography. The aim of the study was to evaluate diagnostic accuracy of cine-MRI for the assessment of SLD in comparison to arthroscopy.

METHOD AND MATERIALS
23 Patients with clinically suspected SLD were included. All patients underwent static MRI and cine-MRI of wrist at 3T. We acquired T2-weighted (T2w) images in axial and coronal planes and sagittal T1w images. Cine-MRI was performed from extreme radial to ulnar abduction and during clenching and unclenching of the fist with a temporal resolution of 5 images/s. Cineradiography was performed in all patients with a temporal resolution of 12.5 images/s. Afterwards all patients underwent arthroscopy. Images were evaluated by one hand surgeon and one experienced MSK radiologist blinded for intraoperative finding. Cineradiography and cine-MRI were evaluated for scapholunate (sl) distance, sl alignment, synchronous motion of carpal bones and continuity of Gilula lines. Sensitivity, specificity, positive (pLR) and negative (nLR) likelihood ratio for cine-MRI with respect to intraoperative findings were calculated. Differences between cineradiography and cine-MRI were evaluated using t-test. A p-value

RESULTS
Cine-MRI was of diagnostic quality in all patients. There was no statistical significant difference between cineradiography and cine-MRI (p=0.081). SLD was correctly diagnosed in 5 patients and excluded in 16 patients. SLD was diagnosed false positive and negative in one case each. Sensitivity and specificity of cine-MRI for SLD was 83% and 94%, respectively. PLR and nLR was 13.83 and 0.18 respectively.

CONCLUSION
Cine-MRI has a high sensitivity and specificity for the diagnosis of SLD. It can be easily integrated in conventional MR imaging and may eliminate the need for cineradiography.

CLINICAL RELEVANCE/APPLICATION
CINE-MRI is a safe and feasible method to identify scapholunate dissociation and may prevent exposure of the patients to radiation.

VSMK21-12 Evaluating MRI-detected Tenosynovitis of the Hand and Wrist in Early Arthritis
Wouter Nieuwenhuis MD (Presenter): Nothing to Disclose, Annemarie Krabben: Employee, Johnson & Johnson, Wouter Stomp MD: Speaker, General Electric Company, Johan L. Bloem MD, PhD: Nothing to Disclose, Tom WJ Huizinga: Nothing to Disclose, Annette Van Der Helm-Van Mil: Nothing to Disclose, Monique Reijnierse MD: Nothing to Disclose

PURPOSE
This study evaluated the utility of CINE-MR Imaging (CINE-MRI) in the detection of MRI-detected tenosynovitis in patients with early arthritis.
This study aimed to identify the frequency of MRI-detected tenosynovitis at the metacarpophalangeal (MCP) and wrist joints in early arthritis, the diagnostic value for RA and the association with severity features within RA.

METHOD AND MATERIALS

178 early arthritis patients underwent unilateral 1.5T extremity-MRI at baseline. MRI-scans were made and scored using the RAMRIS-protocol. Tenosynovitis was scored at the wrist and MCP joints by two readers using the method as described by Haavardsholm et al. During the first year 69 patients fulfilled the 2010-classification criteria for RA; patients with and without RA were compared. Within RA-patients comparisons were made for anti-citrullinated-peptide-antibody (ACPA)-positivity and for radiographic progression (increase in Sharp van der Heijde score) during the first year.

RESULTS

65% of the 178 early arthritis patients had MRI-detected tenosynovitis at any of the studied locations. The flexor tendon at MCP-3 and the tendon of the extensor carpi ulnaris were most frequently affected (22% and 34%). Furthermore, tenosynovitis was more often present in RA than non-RA patients (75% versus 59%, p = 0.023). More commonly affected locations in RA than in non-RA were the tendons of the flexors at MCP-5 (odds ratio (OR) 2.8 95% CI 1.2-7.0), the extensors at MCP-2 (OR 9.1 95% CI 1.9-42.8) and MCP-4 (OR 14.2 95% CI 1.7-115.9) and extensor compartment I at the wrist 4.0 (95% CI 1.4-11.1). The specificity for these locations ranged 92-99% and the positive predictive value between 61-89%. The associations between tenosynovitis at these locations and RA were independent of the presence of local synovitis. Within RA-patients, the tenosynovitis scores were not associated with the presence of ACPA or radiographic progression during the first year.

CONCLUSION

MRI-detected tenosynovitis is common in early arthritis and is more common in RA patients than in early arthritis patients with other diagnoses. Locations with a high specificity for RA are the tendons of the flexor at MCP-5, the extensor at MCP-2 and MCP-4 and the first extensor compartment of the wrist.

CLINICAL RELEVANCE/APPLICATION

MRI is a sensitive method to detect tenosynovitis. However, the prevalence of MRI-detected tenosynovitis and its diagnostic and prognostic value in early arthritis patients are unclear.

Opposed-phase Gradient Echo MR Imaging Improves Image Quality and Visualization of Erosions in Arthritis

VSMK21-13

Wouter Stomp MD (Presenter): Speaker, General Electric Company, Johan L. Bloem MD, PhD: Nothing to Disclose, Tom WJ Huizinga: Nothing to Disclose, Annette Van Der Helm-Van Mil: Nothing to Disclose, Monique Reijnierse MD: Nothing to Disclose

PURPOSE

In rheumatoid arthritis, identifying the exact demarcation of erosions on MR images can be difficult because the cortical defect might be obliterated by either synovium or bone marrow edema. Opposed-phase MR imaging might enhance the visibility of this transition by visualizing it as a clear black line due to the presence of both water and fat protons within the same voxel. The purpose of this study was to determine whether opposed phase gradient-echo imaging improves visualization of erosions when compared to regular T1w TSE sequences.

METHOD AND MATERIALS

Unilateral wrist and MCP joints of 14 early arthritis patients were imaged on a 1.5T extremity MRI. T1w TSE and opposed phase T1w gradient-echo sequences were obtained in the coronal plane, both before and after gadolinium contrast administration. T2w TSE images were also obtained and were available to support scoring for both image sets. Images were assessed for image quality on a 0-5 scale and scored according to the OMERACT RAMRIS score for erosions in consensus by two observers blinded to clinical data. A reference score was established using all available images together.

RESULTS

Scanning time was 0:43 for the opposed phase sequence and 3:30 for the TSE sequence. Overall image quality, absence of movement artifacts and sharpness were significantly better using opposed phase images than T1w TSE images. Homogeneity, Signal-to-noise ratio, RAMRIS erosion scores and rater confidence did not differ between sequences. There was a trend towards higher sensitivity of opposed phase images for detection of erosions (85.6%, 95%CI 76.6-91.6% vs 68.0%, 95%CI 57.7-76.9%). Specificity, positive predictive value and negative predictive value were similar between the sequences and all >85%.

CONCLUSION

Our results demonstrate the feasibility of using a fast out-of-phase T1w spoiled-gradient echo sequence to assess erosions according to OMERACT RAMRIS score. It decreases imaging time while providing better image quality and might increase sensitivity for small erosions.

CLINICAL RELEVANCE/APPLICATION
Shorter scanning time of the opposed phase sequence reduces movement artifacts and patient discomfort, and better delineation of the bone–tissue interface may improve reliability of erosion detection.

**Arthritides—What’s Hot in the Rheumatology Literature**

**Eric Y. Chang MD (Presenter):** Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the roles of the radiologist in diagnosis and management of arthropathies. 2) Describe the imaging findings of rheumatoid arthritis and spondyloarthritis based on current literature. 3) Identify the various categories of disease modifying therapies (DMOADs and DMARDs).

**ABSTRACT**

1) Discuss the roles of the radiologist in diagnosis and management of arthropathies. 2) Describe the imaging findings of rheumatoid arthritis and spondyloarthritis based on current literature. 3) Identify the various categories of disease modifying therapies (DMOADs and DMARDs).

**VSPD21**

**Pediatric Series: MSK**

**Series Courses**

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AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50
Mon, Dec 1 8:30 AM - 12:00 PM   Location: S102AB

**Participants**

Moderator
Peter Jackson Strouse MD : Nothing to Disclose
Moderator
J. Herman Kan MD : Nothing to Disclose

**Sub-Events**

**VSPD21-01**  **Evaluation of Pediatric Foot Radiographs**

Tal Laor MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To recognize the radiographic appearance of the normal pediatric foot. 2) To identify and evaluate radiographic alignment abnormalities of the foot in children.

**VSPD21-02**  **T2 and T1 Rho Cartilage Value Variations Based on the Presence or Absence of a Joint Effusion when Morphologically Normal Cartilage is Present on Anatomic Cartilage MR Sequences**

Johanna Monsalve MD (Presenter): Nothing to Disclose, J. Herman Kan MD : Nothing to Disclose, David Chu PhD : Nothing to Disclose

**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 of 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

VSPD21-03

**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. Unadjusted and adjusted odds ratios (OR) with 95% confidence interval [CI] were calculated.

**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.

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

VSPD21-04

**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 MR 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 Gonarthritis: 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 gonarthritis.

METHOD AND MATERIALS
Twenty-five children and adolescents (age 11±5 years, 13 females) with clinically suspected gonarthritis 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 synovia 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 MBCHIR, 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 SIJs 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**

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**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, Mihra 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 3months 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.

**VSPD21-09**  
**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: non-weightbearing 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.

**VSPD21-10**  
**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.

**VSPD21-11**  
**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, 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**

The primary target of disease in juvenile idiopathic arthritis (JIA) is inflamed synovium, which can be objectified with magnetic resonance imaging (MRI) with administration of intravenous (IV) contrast. Adequate differentiation between pathologic from physiologic extent of synovial enhancement has important implications for (dis)continuation of therapy. The purpose of this study was to assess the enhancing synovium on MRI of the knee in asymptomatic children compared to JIA patients.

**METHOD AND MATERIALS**

An axial fat-saturated T1-weighted MRI sequence of the knee of 25 asymptomatic controls and 25 JIA patients was collected, blinded and randomized. The asymptomatic controls were children who underwent MR enterography with IV contrast, had no (history of) joint complaints or signs of joint inflammation and gave permission for an additional sequence of the knee. JIA patients were age/sex-matched and divided in three clinical subgroups: new-active, relapse and inactive. Two readers independently measured enhancing synovium and scored synovial thickening (ST) on a scale from 0-2 (none, mild, moderate/severe) at six locations. Afterwards agreement on incongruent cases was obtained. Differences in ST score and thickness of enhancing synovium between the controls and (subgroups) of JIA patients were assessed.
RESULTS

Mean age of all subjects (42% female) was 13.5 years (SD 2.5). Enhanced thickened synovium was present on knee MRI in 36% of the controls (ST score range 1-3) and 80% of the patients. A significant difference \( (p=0.000) \) in the ST score was found between controls and JIA children. ST score could differentiate controls from all JIA subgroups \( (p=0.003-0.028) \) (Figure 1). Synovial thickness differed between controls (mean 1.4-1.9mm) and patients with clinically active arthritis (mean 1.8-2.6mm) on 4 out of 6 locations \( (p=0.020-0.049) \).

CONCLUSION

This study is the first to objectively quantify enhanced synovial thickening in an asymptomatic population compared to JIA patients. ST score on MRI can adequately differentiate asymptomatic controls from (subgroups of) JIA patients. These findings further establish MRI as diagnostic and disease activity monitoring tool in JIA patients.

CLINICAL RELEVANCE/APPLICATION

Synovial thickening on contrast-enhanced MRI can distinguish between asymptomatic controls and JIA patients in all disease activity stages.

VSPD21-12

Implementation of Novel Ultra-Short TE (UTE) and Conventional Imaging Techniques for Assessment of Blood Degradation Products in Hemophilic Joints - Work in Progress


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 hyperchoic 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 hyperchoic 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 susceptibility artifacts (in contrast to gradient-echo MRI) may improve its accuracy.

CLINICAL RELEVANCE/APPLICATION

Gray-scale and CD US cannot stage timing of blood degradation products in hemophilic joints. UTE holds potential as an accurate MRI technique for detection of subclinical joint bleeds, thus encouraging further investigation.

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.

**CLINICAL RELEVANCE/APPLICATION**

MR-based indexes of fat infiltration and muscle volume can track the progression of DMD in lower limbs, providing background reference data for patients potentially involved in future therapy trials.

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**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 Monsalve 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; TEs of 13*n ms, 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.
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.

SSC08

ISP: Musculoskeletal (Advanced Cartilage Imaging)

Scientific Papers

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Participants

Moderator
Timothy J. Mosher MD: Research Consultant, Medical Metrics, Inc Research Consultant, eImage, Inc Research Consultant, Johnson & Johnson Stockholder, Johnson & Johnson

Moderator
Hollis G. Potter MD: Research support, General Electric Company

Sub-Events

SSC08-01 Musculoskeletal Keynote Speaker: MR Evaluation of Cartilage—Clinical Challenges Drive Imaging Needs

Hollis G. Potter MD (Presenter): Research support, General Electric Company

SSC08-03 T2* Relaxation Time of Acetabular and Femoral Cartilage with and without Intra-articular Gd-DTPA2- in Hip FAI Patients

Shabnam Mortazavi (Presenter): Nothing to Disclose, Mikko Nissi: Nothing to Disclose, John Hughes: Nothing to Disclose, Patrick Morgan MD: Nothing to Disclose, Jutta Ellermann MD, PhD: Nothing to Disclose

PURPOSE

To assess if the presence of intra-articular Gd-DTPA2- during clinical MR arthrography significantly alters the T2* relaxation times of articular cartilage of the hip joint in patients with femoroacetabular impingement (FAI).

METHOD AND MATERIALS

The institutional review board (IRB) approved this study, and informed consents were obtained in this HIPAA compliant study. T2* mapping of ten patient volunteers (F/M: 7/3, age range 14-49, mean±SD = 33.0 ± 12.2 years) with symptomatic FAI was performed before and after diluted injection of intra-articular Gd-DTPA2- (final GD concentration of the injected mixture was 0.78 mmol/L). Overall 323 regions of interest (ROIs) were defined in acetabular and femoral cartilage each, pre- and post-Gd injection. Agreement of the relaxation times between pre- and post-Gd was assessed using Krippendorff’s alpha coefficient and linear regression through the origin.

RESULTS

Pre- and post-Gd T2* relaxation times in both acetabular and femoral cartilage were found to strongly agree. Specifically, the estimated Krippendorff’s alphas were greater than 0.8 for both acetabular and femoral cartilage, indication strong agreement. Furthermore, linear regressions through the origin yielded estimated slopes very close to 1 and R2 values greater than 0.98, which implies that over 98% of the variation in post-Gd T2* is explained by the pre-Gd T2*.

CONCLUSION

The presence of described intra-articular Gd-DTPA2- during clinical MR arthrography does not significantly alter T2* relaxation times of articular cartilage of the hip joint in patients with femoroacetabular impingement.

CLINICAL RELEVANCE/APPLICATION

It is safe to add a T2* relaxation time measurement in standard clinical arthrogram protocol utilizing dilute intra-articular injection of Gd-DTPA2-.
The presented data underline the ability of T2 and T2* mapping to quantitatively assess the acute effect of running, here a mean decrease of 8.1% (T2; p=0.06) and 11.6% (T2*; p=0.03) was noted. The lateral basis of the patella was least effected by the axial load, the mean values decreased from 42.45ms to 37.08ms (12.65%; p=0.02) for T2 and from 32.36ms to 26.87ms (19.14ms (19.4%; p<0.001). The effect of running was higher at the anterior segments than posteriorly, here T2 values were significantly lower than those of pre-operative values in other zones of the injured cartilage area and of control cartilage area. The relationships between the MHHS score and MRI imaging parameters were evaluated using non-parametric regression analysis. Statistical significance was defined as p < 0.05.

RESULTS

The MHHS score was significantly correlated with T1rho values in both the anterior-superior zone (R²=0.712 and p=0.008) and superior-posterior zone (R²=0.667 and p=0.013) of the injured cartilage area. There was also a significant correlation between the MHHS score and the T2 values of the anterior-superior zone of the injured cartilage (R²=0.585 and p=0.016). Comparing the pre-operative and post-operative MRI imaging parameters, except for the T2 values in the anterior-superior zone in the control cartilage, post-operative T1rho values and T2 values were significantly lower than those of pre-operative values in other zones of the injured and control cartilage.

CONCLUSION

T1rho values and T2 values can detect post-operative cartilage change in FAI. T1rho values and T2 values are correlated with the clinical condition of FAI.

CLINICAL RELEVANCE/APPLICATION

Biochemical MRI techniques (T1rho values and T2 values) have potential benefits for evaluating cartilage repair following surgery for FAI.
endurance running on the articular cartilage of the knee. Based on our results, this effect seems to predominate in the anterior and medial articular facet whereas the posterior segments of the femur are not affected in the same level.

**CLINICAL RELEVANCE/APPLICATION**

T2 and T2* show a high concordance in the assessment of acute exercise related changes to the articular cartilage of the knee and can be useful in the detection of initial cartilage degeneration.

**SSC08-06**

**T2 Relaxation Times of Knee Articular Cartilage in Osteoarthritis Patients Are Not Influenced by Gadolinium Contrast Agent**

Joost Verschueren MD (Presenter): Nothing to Disclose, Jasper Van Tiel MD: Nothing to Disclose, Max Reijman : Nothing to Disclose, Esther Bron BSc: Nothing to Disclose, Jan Verhaar : Nothing to Disclose, Sita Bierma-Zeinstra 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, Siemens AG Speakers Bureau Siemens AG, Gyula Kotek PhD : Nothing to Disclose, Edwin H.G. Oei MD, PhD : Nothing to Disclose

**PURPOSE**

Delayed gadolinium enhanced MRI of cartilage (dGEMRIC) and T2-mapping are often used as quantitative imaging biomarkers in osteoarthritis (OA) research to measure proteoglycan content and collagen network integrity, respectively, and together offer comprehensive assessment of biochemical composition and structure of articular cartilage. Pre- and post-contrast T2 relaxation times have shown to be comparable in ex-vivo MRI of human osteochondral samples, but results obtained in OA and intact cartilage in-vivo at 1.5T are contradictory. As acquisition of dGEMRIC and T2-mapping within one post-contrast imaging session improves efficiency and reduces scan time and costs, our purpose was to assess the influence of contrast agent on T2 relaxation times acquired in-vivo at 3T in OA patients.

**METHOD AND MATERIALS**

Ten knee OA patients (Kellgren-Lawrence grade 2-3) underwent dGEMRIC and T2 mapping at 3T. A 3D fast spin-echo sequence with 5 echo times (3, 13, 27, 40, 68 ms) for T2 mapping was performed before and after 75 minutes after intravenous administration of gadolinium dimeglumine (0.2 mmol/kg) for dGEMRIC. Mean T2 relaxation times were calculated in 6 cartilage regions (located medially and laterally in the weight-bearing and posterior cartilage of the femoral condyles and tibial plateaus), using in-house developed post-processing software that incorporates automated rigid registration in 3D for motion correction. Pre- and post-contrast T2 relaxation times were compared with correlation analysis, intraclass correlation coefficient (ICC) and Wilcoxon signed-rank test.

**RESULTS**

Pre- (mean 41.5; range 28.8-64.7 ms) and post-contrast (mean 41.1; range 28.5-73.0 ms) T2 relaxation times were strongly correlated (r=0.87, r²=0.75, p<0.001) with a high ICC (0.92, 95CI: 0.86-0.95), and their mean values were not statistically significantly different (p=0.08).

**CONCLUSION**

The results indicate that pre- and post-contrast T2 relaxation times of in-vivo OA knee cartilage acquired at 3T are strongly correlated and that there is no evidence to suggest a difference in T2 relaxation times. Therefore, T2-mapping can be performed reliably within a single post-contrast imaging session in combination with dGEMRIC acquisition.

**CLINICAL RELEVANCE/APPLICATION**

For comprehensive assessment of articular cartilage structure and biochemical composition, dGEMRIC and T2-mapping can be combined in one imaging session with reliable T2 relaxation time measurement.

**SSC08-07**

**Changes in Delayed Gadolinium-enhanced MRI of Cartilage (dGEMRIC) Indices and the Association with Cartilage Loss in the Tibiofemoral Compartments over 1 Year: a 3.0T MRI Study**

Michel D. Crema MD (Presenter): Shareholder, Boston Imaging Core Lab, LLC, David J. Hunter MD, PhD: Royalties, DJO Global, Inc, Deborah Burstein PhD: Spouse, Employee, Bruker Corporation, Frank W. Roemer MD: Chief Medical Officer, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC, Jose Roberto Silva MD: Nothing to Disclose, Ali Guermazi MD, PhD: President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc

**PURPOSE**

The dGEMRIC technique is capable of detecting early changes in the glycosaminoglycan content of cartilage, which may potentially lead to changes in cartilage morphology. The aim of this study was to assess the associations of baseline dGEMRIC as well as changes in dGEMRIC indices with cartilage loss in the same region of the knee over one year, in a sample of middle-aged women.

**METHOD AND MATERIALS**
A total of 140 women (1 knee per subject) aged ≥ 40 years were prospectively included. 3.0T MRI of the knee was performed at baseline and at one year follow-up. T2-weighted fat-suppressed sequences were used to assess cartilage morphology using the BLOKS scoring system. Cartilage morphology and dGEMRIC were assessed at baseline and follow-up MRIs in four distinct regions of tibiofemoral compartments: medial femur, medial tibia, lateral femur, and lateral tibia. A decrease in dGEMRIC indices over one year was considered as the predictor of cartilage loss (considered here as any increase of grade in BLOKS - outcome). The association of any decrease in dGEMRIC indices from baseline to follow-up with cartilage loss in the same region was assessed using logistic regression. In addition we used the maximal statistical approach to determine at which cut-off value baseline dGEMRIC would be most predictive for cartilage loss after one year.

RESULTS

A total of 433 regions were included in the analyses; 25 (5.8%) had cartilage loss over one year and 408 (92.2%) did not. Furthermore, 153 (35.3%) regions had a decrease in dGEMRIC indices over one year and 280 (64.7%) did not. No significant associations between change in dGEMRIC indices over time and cartilage loss were observed. A cut-off value of dGEMRIC predicting cartilage loss could not be established.

CONCLUSION

The predictive effect of changes in dGEMRIC on cartilage loss in the tibiofemoral compartments over one year could not be demonstrated in this sample of middle-aged women.

CLINICAL RELEVANCE/APPLICATION

The monitoring of changes in dGEMRIC indices over time still need to be validated before it can be applied as an imaging biomarker of longitudinal cartilage loss.

SJC08-08

MRI in the Follow Up of Patients after Matrix Based Autologous Chondrocyte Transplantation of the Hip Using 3 Tesla High Resolution Techniques and dGEMRIC

Andrea Lazik MD (Presenter): Nothing to Disclose, Oliver Kraff MSc: Nothing to Disclose, Konrad Koersmeier: Nothing to Disclose, Stefan Landgraebner: Nothing to Disclose, Thomas C. Lauenstein MD: Nothing to Disclose, Jens Matthias Theysohn MD: Nothing to Disclose

PURPOSE

Matrix based autologous chondrocyte transplantation (MACT) has become common in the therapy of focal cartilage lesions in the knee and can be monitored by high resolution MR imaging and quantitative MR analysis, such as delayed gadolinium enhanced MR imaging of cartilage (dGEMRIC). This T1 mapping technique represents the glycosaminoglycane content of the cartilage. MACT is an upcoming therapy for focal cartilage lesions in the hip as well, with only few publications up to now. The aim of this study was to follow up patients after acetabular MACT with high resolution MRI and to evaluate the potential of dGEMRIC in imaging cartilage transplants in the hip.

METHOD AND MATERIALS

24 patients were examined 6 - 31 months after acetabular MACT using 3D as well as sagittal and coronal 2D high-resolution proton density weighted (PD) sequences (slice thickness 2.5 mm, in plane resolution 0.5 x 0.5 mm and 0.8 x 0.8 mm, respectively), and furthermore 3D T1 mapping in dGEMRIC technique at 3 Tesla. The cartilage transplant was evaluated using an adapted MOCART score (maximum 85 points). T1 relaxation times were measured in the cartilage transplant and adjacent healthy regions. Correlations between the registered parameters were calculated using the Spearman rank correlation.

RESULTS

The cartilage transplant was morphologically definable in the PD-weighted sequences of 23 patients with a mean MOCART score of 69 points (60 - 80 points, SD 6.5). In T1 maps clear differentiation between acetabular and femoral cartilage was possible, but correlation with PD-weighted images was necessary in order to identify the transplant. A statistically significant correlation was found between T1 relaxation times of the transplant and the adjacent healthy cartilage (616.4 ms vs. 574.5 ms; p = 0.011), but not between MOCART score and T1 relaxation times of the transplant.

CONCLUSION

High-resolution PD-weighted imaging with adapted MOCART scoring and dGEMRIC are feasible after acetabular MACT. Further studies with long-term clinical follow-up are necessary to verify the efficacy of these techniques for the prognosis of acetabular MACT.

CLINICAL RELEVANCE/APPLICATION

dGEMRIC has the potential to become a complementary technique in the assessment of cartilage transplant vitality in the hip.

SJC08-09

Non Invasive in Vitro Evaluation of Tissue Engineered Cartilage through dGEMRIC

Francesco Santini PhD: Nothing to Disclose, Michele Pansini MD: Nothing to Disclose, Lukas Daniel Iselin MD: Nothing to Disclose, Marina Barandun MD: Nothing to Disclose, Dirk Schaefer: Nothing to Disclose
PURPOSE
This study aims to investigate whether glycosaminoglycans (GAG) concentration in the cartilage layer of engineered osteochondral (OC) grafts and native cartilage tissues evaluated by the dGEMRIC method correlates with the biochemically measured GAG content in the same specimens.

METHOD AND MATERIALS
Chondrocytes isolated from 5 donors (mean age 36 years) were expanded in monolayer and then seeded onto collagen matrices. The constructs were combined with a processed bone scaffold after 3 days of pre-culture in chondrogenic medium. Combined constructs were further cultured in chondrogenic medium for a total time of 4 weeks. Control samples were generated by gluing native articular cartilage tissues on the top of the bone scaffold. The samples were scanned on a whole-body 3T MRI scanner with a 3D variable flip angle gradient echo sequence for T1 quantification [2] (flip angles 4° and 15°, resolution 0.6x0.6x0.6mm3, FOV 150x37x34mm3, NEX 32) in a phosphate-buffered saline bath, before and 4 hours after addition of Gd-DTPA to a concentration of 1mM. Absolute GAG concentration was calculated from the measured T1 values in a middle slice of each sample using Donnan equilibrium theory [1]. The samples were subsequently extracted and the GAG content for each sample was biochemically calculated as mg\text{GAG}/mg\text{DNA}.

RESULTS
The dGEMRIC-estimated GAG concentrations averaged 32.7±4.2 mg/ml for native cartilage and 4.9±1.9 mg/ml for the engineered cartilage (p<0.001). The biochemically measured GAG contents averaged 363.3±32.2mg/mg for the native and 22.7±4.4mg/mg for the engineered cartilage. There was a moderate correlation between the two techniques (R2=0.59).

CONCLUSION

CLINICAL RELEVANCE/APPLICATION
Noninvasive radiological assessment of the health status of implanted tissue-engineered cartilage graft is important for patient recovery monitoring and therapeutical decisions.
anteromedial subluxation of the LHBT in 8 patients with Type II lesion and an anteromedial subluxation of the LHBT in all patients with Type III and Type IV lesions. ABER position showed gleno-humeral antero-superior malalignment in 14 cases. The dynamic tests during arthroscopy, confirmed LHBT instability and ASI features in patients with Type III and Type IV lesions and antero-superior malalignment only in 9 cases.

CONCLUSION

Only high grade lesions of the biceps pulley can be associated with LHBT instability and antero-superior gleno-humeral malalignment. MRI external and internal rotation led to a better identification of structures of the biceps pulley and the detection of LHBT instability could suggest the presence of ASI.

CLINICAL RELEVANCE/APPLICATION

"Functional" MRI images allow a dynamic evaluation of the LHBT and of the antero-superior aspect of the gleno-humeral joint; these structures often result unstable in presence of an ASI type III and type IV confirmed by arthroscopic dynamic tests.

Delaminated Tears of the Rotator Cuff: Prevalence, Characteristics and Diagnostic Accuracy on Indirect MR Arthrography (Station #2)

Hye Jung Choo MD : Nothing to Disclose, Gi Won Shin MD (Presenter): Nothing to Disclose, Sun Joo Lee MD : Nothing to Disclose, Young Mi Park MD, PhD : Nothing to Disclose, Young Jun Cho : Nothing to Disclose, Seok Jin Choi : Nothing to Disclose

PURPOSE

The presence of delaminated tears of the rotator cuffs has been reported as a negative prognostic factor after rotator cuff repairs. However, there are a few radiologic reports about delaminated tears of the rotator cuff. In this study, the prevalence, characteristics, and diagnostic accuracy of delaminated tears at the supraspinatus-infraspinatus tendons (SST-IST) were evaluated on indirect MR arthrography.

METHOD AND MATERIALS

Indirect MR arthrography of 231 shoulders with tears at the SST-IST were included. On MR images, the delaminated tears at the SST-IST, defined as an intratendinous horizontal splitting between the articular and bursal layers of the SST-IST and/or different degree of retraction between the two layers, were identified and classified into six types: articular-delaminated full-thickness tear, bursal-delaminated full-thickness tear, interstitial-delaminated full-thickness tear, articular-delaminated partial-thickness tear, bursal-delaminated partial-thickness tear and interstitial-delaminated partial-thickness tear. Other radiologic findings such as the presence of intramuscular cysts and footprint tears were evaluated. Based on the review of video records of 127 arthroscopic surgeries, the diagnostic accuracy of indirect MR imaging for the detection of the delaminated tears was determined.

RESULTS

On MR imaging, 56% (129/231) of shoulders with SST-IST tears had delaminated tears. Articular-delaminated full-thickness tears (n = 58) and articular-delaminated partial-thickness tears (n = 64) were the most common types. About 82% (36/44) of articular-delaminated full-thickness tears occurring at the SST were combined with articular-delaminated partial-thickness tears at the IST. SST-IST footprint tears and intramuscular cysts were significantly more common in the shoulders with delaminated tears (p = 0.007 and 0.01 respectively). The sensitivity and specificity of indirect MR arthrography for detection of delaminated tears were 93% and 95%, respectively.

CONCLUSION

On MR imaging, about half of the shoulders with SST-IST tears were combined with delaminated tears. The diagnostic accuracy of indirect MR arthrography for detection of delaminated tears was high.

CLINICAL RELEVANCE/APPLICATION

On MR imaging, about half of the shoulders with SST-IST tears were combined with delaminated tears. The diagnostic accuracy of indirect MR arthrography for detection of delaminated tears was high.

Serial Ultrasonography after Arthroscopic Repair of Rotator Cuff Tear: Temporal Evolution of Sonographic Findings (Station #3)

Hye Jin Yoo MD (Presenter): Nothing to Disclose, Ja-Young Choi MD : Nothing to Disclose, Sung Hwan Hong MD : Nothing to Disclose, Yusuhn Kang MD : Nothing to Disclose, Jina Park MD : Nothing to Disclose, Ji Young Kim MD : Nothing to Disclose

PURPOSE

To evaluate the serial changes in the sonographic findings of repaired tendon after rotator cuff repair with serial ultrasound examinations.

METHOD AND MATERIALS

Sixty five arthroscopically repaired rotator cuff tears (44 full-thickness tears, 21 partial-thickness tears) were retrospectively included in this study. Serial ultrasound examinations were performed at 5 weeks, 3 months, and
RESULTS

Four recurrent tears were occurred within 3 months of surgery. Postoperative tendon thickness decreased from 5 weeks to 6 months following surgery ($r=-0.245; p=0.001$). There were significant changes in the morphologic tendon characteristics including echotexture, fibrillar pattern, and surface irregularity of repaired tendon from 5 weeks to 6 months following surgery. The subacromial subdeltoid (SDAD) bursitis and vascularity of repaired tendon were also decreased postoperatively over time.

CONCLUSION

Serial ultrasound examinations after arthroscopic rotator cuff repair were useful to monitor the postoperative changes of repaired tendon. Morphologic appearances of repaired tendon and peritendinous soft tissue changes were improved over time and nearly normalized within 6 months of surgery.

CLINICAL RELEVANCE/APPLICATION

Serial ultrasound examinations can monitor the postoperative changes of repaired tendon and is recommended as a follow-up imaging modality in the early postoperative period after arthroscopic rotator cuff repair.

MKS354

Ultra-high Field Analysis of Knee Cartilage in a Sheep Model by Means of Quantitative T2 Mapping Using 7T MRI and Histological Validation (Station #4)

Milen L. Pachowsky MD (Presenter): Nothing to Disclose, Siegfried Trattnig MD: Nothing to Disclose, Kolja Gelse MD: Nothing to Disclose, Joachim Friske: Nothing to Disclose, Martin Brix: Nothing to Disclose, Goetz Hannes Welsch MD: Nothing to Disclose

PURPOSE

T2 mapping at 7T might help to understand the development of osteoarthritis (OA) and of integration processes after cartilage repair procedures, i.e. autologous chondrocyte transplantation (ACT). Purpose of this study is to determine biochemical properties of cartilage in a sheep model, using biochemical MRI by means of quantitative T2-mapping and establish a histological validation.

METHOD AND MATERIALS

Three groups of sheep (healthy cartilage, $n=30$, a model of osteoarthritis (post meniscectomy), $n=30$, and sheep with cartilage defects at the femoral condyle treated by ACT, $n=15$) were examined. MR scans were achieved at 7T MR whole body system (Magnetom, Siemens Healthcare, Erlangen, Germany) using a 28-channel transmit/receive knee array coil. T2 relaxation maps were measured by a sagittal multi-echo spin sequence. TR 5260ms; TE 12, 24, 36, 48, 60, and 72ms; FOV 145x145mm, 716x869 matrix size; BW 180 Hz/pixel, slice thickness 2mm; flip angle 145°. Semi-automatic region-of-interest analysis was performed. For stratification with regards to anatomical (collagen) structure, subregional analysis was done (deep - superficial cartilage layer). Results were compared to histological findings. Statistical analysis-of-variance was performed.

RESULTS

In healthy cartilage, T2 values averaged 41.92ms (SD 11.7) in the superficial layer and 32.69ms (SD 9.74) in the deep layer. OA showed results of 60.90ms (SD 14.34) in the superficial layer and 47.28ms (SD 13.54) in the deep layer. After ACT results averaged at 58.41ms (SD 15.53) in the superficial and 45.66 (SD 20.81) in the deep layer. Increase of T2 values between deep and superficial zone was highly significant in the group with healthy cartilage, significant in the OA model and the ACT group. OA and ACT group showed significantly higher values compared to healthy cartilage. Comparison between histological scoring and MR findings showed a significant correlation.

CONCLUSION

The sheep model shows differences between healthy cartilage, OA and cartilage repair sites in T2 mapping. Our new approach at 7T gives additional information about the imaging techniques of the ultra-structure of cartilage and provides one of the very few histological validations of T2 mapping in vitro.

CLINICAL RELEVANCE/APPLICATION

The presented study of T2 mapping in a sheep model and histological validation is an important approach towards establishing T2 mapping of articular cartilage in clinical application.

MKS355

Diffusion Tensor Imaging, T2 Mapping, and Various Fat Suppression Imaging in Early State of Denervated Skeletal Muscle: Experimental Study in Rats (Station #5)

Dong-Ho Ha (Presenter): Nothing to Disclose, Hwan Tae Park: Nothing to Disclose, Sunseob Choi MD, PhD: Nothing to Disclose

PURPOSE

To simultaneously evaluate the sequential alteration of the DTI indices, T2 values and subjective visual signal intensity change on various fat suppression techniques in the early state of denervated skeletal muscle in the rat model.
METHOD AND MATERIALS

Institutional animal use and care committee approval was obtained. Complete neurotmesis of the sciatic nerve of 8 white rats was performed. We examined MR studies of the normal muscle and follow-up studies at 3 days, 1 week, and 2 weeks after surgery. FA, mADC and T2 values were measured at the calf muscles. We also subjectively graded visual signal intensity change on CHESS, STIR and IDEAL imaging. Statistical significances were obtained.

RESULTS

FA values at 3 days (0.35±0.06, P=0.012), 1 week (0.29±0.04, P=0.017), 2 weeks (0.34±0.05, P=0.017) were significantly lower than that in control group (0.54±0.17). The mADC of the all follow up periods decreased, but statistically insignificant. T2 values began to increase at three days without statistical significance (34.08±1.42, P=0.069), significantly increased at 2 weeks (38.11±6.41, P=0.017) and marked increased at 2 weeks (46.53±3.17, P=0.012), compared with control group (32.71±1.33). Visual signal intensity changes were variously at 1 week and more prominent at 2 weeks. Grading the lesions was identical in all cases.

CONCLUSION

FA and T2 values will be effective parameters to observe the early state of denervated skeletal muscle.

CLINICAL RELEVANCE/APPLICATION

The calculation of FA and T2 value will be effective noninvasive methods for the evaluation of acute skeletal denervated muscle, even though it has various limitations. Fat suppression techniques did not affect the early detection of high signal abnormality on T2 weighted image and grading of lesion.

MKS356

Tarsal Navicular Bone Size in Diabetics: Radiographic Assessment (Station #6)

Elie Harmouch (Presenter): Nothing to Disclose , Douglas D. Robertson MD, PhD : Nothing to Disclose , Geza Kogler PhD, DPhil : Nothing to Disclose , Minzhi Xing MD : Nothing to Disclose , Tharwat Mahmoud El Zahran MD : Nothing to Disclose , Michael R. Terk MD : Nothing to Disclose

PURPOSE

To test the anecdotal observation that isolated navicular collapse is associated with diabetes mellitus, we quantified the size of the tarsal navicular in subjects with and without diabetes and tested for association of size with age, height, weight, body mass index (BMI), gender, smoking, bone mineral density (BMD), duration and level of control of diabetes.

METHOD AND MATERIALS

Ankle radiographs of 200 patients (122 females; 78 males; mean age 58 years [27-89]), 100 with type II diabetes and 100 age-gender matched controls were selected and reviewed. The anteroposterior (AP) dimension of the mid navicular bone was measured from lateral radiographs. For standardization, the superoinferior (SI) dimension of the calcaneal was measured and the navicular-calcaneus ratio calculated. Statistical evaluation included independent sample t- tests and linear regression analyses.

RESULTS

Diabetic subjects had a significantly smaller navicular AP dimension and navicular-calcaneus ratio compared to controls (p=0.02 and p=0.0001, respectively). Age, gender, height and duration of diabetes had no association with the navicular-calcaneus ratio. Navicular-calcaneus ratio was inversely correlated with weight (p=0.01) and BMI (p<0.001) and directly correlated with smoking (p=0.04).

CONCLUSION

The navicular anteroposterior dimension is smaller in type II diabetic subjects compared to age-gender matched controls. We hypothesize that this is due to navicular collapse whose cause is multifactorial.

CLINICAL RELEVANCE/APPLICATION

This study associates diabetes with dimensional changes in the tarsal navicular and expands our knowledge of the effect diabetes on the bony foot.

MKS357

Evaluation of a Simplified Version of the Rheumatoid Arthritis Magnetic Resonance Imaging Score (RAMRIS) Comprising 5 Joints (RAMRIS5) (Station #7)

Christoph Schleich (Presenter): Nothing to Disclose , Falk Roland Miese MD : Nothing to Disclose , Philipp Sewerin : Nothing to Disclose , Benedikt Ostendorf : Nothing to Disclose , Gerald Antoch MD : Speaker, Siemens Medical AG Speaker, Bayer AG Speaker, BTG International Ltd , Christian Buchbender : Nothing to Disclose

PURPOSE

Semi-quantitative measurement of inflammatory pathologies of the hand in magnetic resonance images (MRI) is a mandatory, but time-consuming task for MRI controlled studies in Rheumatoid Arthritis (RA). The objective
of this study was to evaluate a simplified version of the Rheumatoid Arthritis Magnetic Resonance Imaging Score (RAMRIS) reduced to five joints of the hand (RAMRIS5).

**METHOD AND MATERIALS**

94 patients with rheumatoid arthritis (62 female, 32 male; age 59 ±12 years, range 25 - 83 years; disease duration 5 ±7.5 years) from the REMISSION PLUS study cohort who had complete files on C-reactive protein (CRP) levels and Disease Activity Score of 28 joints (DAS28) and completed MRI of the clinical dominant hand at baseline and after one year under anti-rheumatic therapy (follow-up time 12.5 ± 3.5 months) in a dedicated extremity MRI scanner at 0.2T were included in this retrospective study. MR images were scored according the RAMRIS criteria by two readers in consensus. Spearman correlations of the RAMRIS sum-score, subscores for RAMRIS of the metacarpophalangeal joints (RAMRIS MCP), wrist (RAMRIS wrist) and a reduced score comprising the MCP 2 - 5 and the intercarpal joint were assessed. Additionally, Spearman correlations of MRI scores, CRP levels and DAS28 were calculated.

**RESULTS**

There was a strong correlation between RAMRIS5 and the RAMRIS sum-score for all patients (r =0.88, p<0.05) at baseline and follow up (r =0.83, p<0.05). Among the subscores there was a good correlation between RAMRIS5 and RAMRIS MCP (baseline: r=0.64, p<0.05; follow-up: r=0.74, p<0.05) as well as between RAMRIS5 and RAMRIS wrist (baseline: r=0.75, p<0.05; follow-up: r =0.63, p<0.05) at baseline and follow up. The correlation between RAMRIS5 and CRP (baseline: r=0.13, p<0.05; follow-up: r=0.03, p<0.05) or DAS28 (baseline: r=0.15, p<0.05; follow-up: r=0.30, p<0.05) were weak, just like it was observed for regular RAMRIS (CRP baseline: r=0.18, p<0.05; follow-up: r=0.11, p<0.05; DAS28 baseline: r=0.21, p<0.05; follow-up: r=0.33, p< 0.05).

**CONCLUSION**

RAMRIS5, a modified shorter RAMRIS score based on five joints of the hand is a viable tool for semi-quantitative assessment and monitoring of joint damage in RA.

**CLINICAL RELEVANCE/APPLICATION**

RAMRIS5 can be used as a time and resource saving alternative for semi-quantitative description of inflammatory joint changes and therapy monitoring in MRI-controlled studies in RA and for clinical therapy response assessment in RA .
1. Recognize the advantages of ultrasound-guided over landmark-based or fluoroscopically-guided approaches to joint injection with gadolinium prior to arthrography.

2. Gain knowledge of pre-procedural considerations and contraindications.

3. Become familiar with the step-by-step procedure for ultrasound-guided gadolinium shoulder, elbow, wrist, hip and knee injections prior to magnetic resonance arthrography, including technical factors such as ultrasound probe selection and imaging parameters.

**TABLE OF CONTENTS/OUTLINE**


**MKE128**

**MSK Imaging: Manifestations of Granulomatous Disease (Station #10)**

Mariko Fitzgibbons MD (Presenter): Nothing to Disclose, Kira Chow MD: Nothing to Disclose, Masih Masih MD: Nothing to Disclose

**TEACHING POINTS**

1) Review the immunologic basis of granulomas 2) Review of the pathogens and immune processes leading to granuloma formation 3) Case-based review of musculoskeletal manifestations of granulomatous disease such as sarcoidosis, tuberculosis, coccidioidomycosis, and epidermal inclusion cysts.

**TABLE OF CONTENTS/OUTLINE**

Discussion will begin with the definition of a granuloma and a discussion of the types of granulomatous disease. This will be a case based presentation of various MSK granulomatous process. Imaging modalities: XR, US, PET/CT, CT, MRI 1) Sarcoidosis Bone marrow, soft tissue changes 2) Atypical Mycobacterial Septic arthritis 3) Tuberculosis Various manifestations including: Dactylitis, osteomyelitis, Pott’s disease, soft tissue infections 4) Coccidioidomycosis Septic arthritis, lytic lesions 5) Epidermal inclusion cyst

**MKE313**

**Dermatofibrosarcoma Protuberans, A Rare Skin Lesion That Radiologists Should Think about (Station #11)**

Claudia Leticia Hernandez Mejia (Presenter): Nothing to Disclose, JESUS JIMENEZ DEL RIO: Nothing to Disclose, Maria Isabel Fernandez Martinez: Nothing to Disclose, Angeles Ramirez Escobar: Nothing to Disclose, MARIA SANCHEZ PEREZ: Nothing to Disclose, Johanna Marisol Silva MD: Nothing to Disclose

**TEACHING POINTS**

To review the dermatofibrosarcoma protuberance tumor and discuss its key radiological findings. To explain the role of radiology in the follow-up and gain awareness of skin lesions found in different imaging techniques.

**TABLE OF CONTENTS/OUTLINE**

When we come across a soft tissue mass identifying its origins (epidermis, dermis or hypodermis) can be of help. Also we have to consider the location within the body and the age of the patient in order to narrow down the differential diagnosis. Dermatofibrosarcoma protuberance (DFSP) is the most common mesenchymal superficial malignancy. It originates from the dermis. The peak age is between 20 and 40 years old. It affects more frequently men than woman (not in our series) and is most commonly seen on the trunk. It can recur and rarely metastasizes. We will show its key feature image on MR, CT and ultrasonography with a series obtained at our institution. We reviewed 40 cases from January 1998 until mars 2014. We found 20 males and 20 females (mean age 44 years, age range 22 to 71 years). Only 1 recurrence has been reported (9 years after the original lesion). It is important to have free margins after resections otherwise a recurrence could happen and long term follow up is needed. That is why we need to understand post treatment imaging changes and differentiate it from local recurrence.

**MKE286**

**Maneuvering Around Metal: Total Joint Arthroplasty Imaging and MR Metal Suppression Sequences (Station #12)**

Brett S. Talbot MD (Presenter): Nothing to Disclose, Eric P. Weinberg MD: Nothing to Disclose

**TEACHING POINTS**

The purpose of this educational exhibit is to:

1) Provide an overview of current metal suppression sequences, including a discussion of key concepts in the associated MR physics.

2) Demonstrate an extensive series of cases where metal suppression plays a key role in the diagnosis of total arthroplasty complications.

3) Place emphasis on specific findings in total knee and total hip arthroplasty on metal-suppressed MR imaging.

**TABLE OF CONTENTS/OUTLINE**

- Basic approaches to metal suppression such as metal artifact reduction sequence (MARS). - Discussion of more contemporary approaches including WARP (MARS with view angle tilting - VAT), SEMAC, and MAVRIC. - MR physics discussion including limitations (inability to perform fat saturation, possibility of increased imaging time). - Field strength comparison including degrees of susceptibility artifact at 1.5 and 3.0 T. Specific complications to be discussed include: Metallosis Particle Disease Infection (acute and chronic) Loosening
**Evaluation of the Intraarticular Portion of the Biceps Brachii Tendon at the Shoulder with Ultrasound: Anatomy, Pathology and New Maneuver of Mick Jagger Position (Station #13)**

Guillermo Andres Azulay MD : Nothing to Disclose, Patrick Omoumi MD (Presenter): Nothing to Disclose, Daniel Postan : Nothing to Disclose, Gabriel Hector Aguilar MD : Nothing to Disclose, Rafael Barousse MD : Nothing to Disclose, Ignacio Rossi : Nothing to Disclose, Ariel Franz Gonzalez Nogales MD, PhD : Nothing to Disclose

**TEACHING POINTS**

It is essential to understand the dynamics of the intraarticular portion of the biceps tendon in relation to shoulder movement for the ultrasound examination. A maneuver in abduction and internal rotation (Mick Jagger position) can help to visualize the intraarticular portion of the biceps tendon and its pathology.

**TABLE OF CONTENTS/OUTLINE**

1. Anatomy: - Cadaveric study illustrating the anatomy of the intraarticular portion of the biceps tendon, the relationship between the tendon and its surrounding structures, the position of the technique in relationship to the shoulder movements.  
2. Detailed ultrasound technique: - Description of the Mick Jagger position - Optimal acoustic window  
3. Normal ultrasonographic aspects  
4. Pathological ultrasonographic aspects

**Basic Principles and Applications of Dual Energy Computed Tomography (DECT) in Gout (hardcopy backboard)**

Shima Aran MD (Presenter): Nothing to Disclose, Frank J. Simeone MD : Nothing to Disclose, Khalid Walid Shaqdan MD : Nothing to Disclose, Elmira Hassanzadeh MD : Nothing to Disclose, Efren Jesus Flores MD : Nothing to Disclose, Hani H. Abujudeh MD, MBA : Research Grant, Bracco Group Consultant, RCG HealthCare Consulting Author, Oxford University Press

**TEACHING POINTS**

There are many exciting new applications for advanced imaging in gout. Dual energy CT (DECT) can differentiate urate crystals from calcium by using specific attenuation characteristics and reveal even small occult tophaceous deposits. DECT can also be used for serial volumetric quantification of subclinical tophi to evaluate response to treatment. We plan to expose radiologists to a series of challenging cases to understand how this unique and clinically relevant modality can facilitate diagnosis and management of gout.

**TABLE OF CONTENTS/OUTLINE**

1. Physical principles of DE or spectral CT on basis of photoelectric and Compton interactions as well as material decomposition.  
2. Available techniques of DE data acquisition, for example, dual source CT scanners, fast kilovoltage switching and sandwich detector techniques.  
3. Image processing and reconstruction of DECT data.  
4. Clinical application of DECT for diagnosis and management of gout.  
5. Sample cases.  
6. Limitations of DECT in the musculoskeletal imaging such as the effects on image quality, artifacts and radiation dose.

**Quantification of Rotator Cuff Muscle Atrophy: A Retrospective Study Comparing Ultrasound to MRI (Station #1)**

Christian Sander Geannette MD : Nothing to Disclose, Yoshimi Endo MD (Presenter): Nothing to Disclose, Ronald Steven Adler MD, PhD : Nothing to Disclose

**PURPOSE**

Assessment of echogenicity provides a measure of muscle atrophy during routine shoulder US. However, muscle echogenicity is subjective with significant inter- and intra-observer variability. This study sought to determine the value of quantifying muscle echogenicity in order to estimate the degree of rotator cuff atrophy as determined by MRI.

**METHOD AND MATERIALS**

This was a retrospective review of patients who underwent ultrasound and MR shoulder examinations. The supraspinatus (SSM), infraspinatus (ISM) and teres minor (TM) muscles were evaluated. Muscle echogenicity was quantified using image analysis software and represented as dB (decibels)/mm². 5 mm ROIs were randomly placed in the short-axis view of each muscle group, avoiding the myotendinous junction. On MR, muscle atrophy was scored in two ways: degree of fatty infiltration (Goutallier classification) and loss of muscle...
bulk (occupational ratios), provided by consensus of two musculoskeletal radiologists.

RESULTS
A total of 27 SSM, 32 ISM, and 32 TM muscles were evaluated. Goutallier scores were scored: 0: normal, 1: more muscle than fat, 2: equal muscle and fat, 3: more fat than muscle. Muscle echogenicity means were: SSM (mean: 42.7), ISM (53.81) and TM (46.89) dB/mm². Spearman's rank correlation coefficient demonstrates moderate positive correlation between SSM and ISM gray values and Goutallier scores (0.54). Spearman's rank correlation coefficient demonstrates weak positive correlation between TM and Goutallier score (0.33). Spearman's rank correlation was weak between SSM and ISM gray value and occupational ratio.

CONCLUSION
Muscle echogenicity on US demonstrates moderate correlation of the supraspinatus and infraspinatus muscles when compared to MRI Goutallier classification.

CLINICAL RELEVANCE/APPLICATION
Muscle echogenicity on US relates in part to rotator cuff fatty infiltration and may provide valuable information during routine shoulder ultrasound. The paucity of Goutallier grade 2 and 3 muscles may account for the absence of a stronger correlation with muscle echogenicity and should be further investigated.

MKS359
Longitudinal Follow-up of Incidentally Detected Pseudotumors in Patients with Metal on Metal Implants: A Prospective Study (Station #2)
Khushboo Pilania MD (Presenter): Nothing to Disclose, Bhavin Jankharia MD: Stockholder, Pfizer Inc Stockholder, Cipla Ltd Stockholder, Glenmark Pharmaceuticals Ltd, Rishab Bilala MBBS: Nothing to Disclose

PURPOSE
The purpose of this study is to describe the significance and temporal evolution of incidentally detected, presumed, metal induced reactive periprosthetic masses in patients with metal on metal (MoM) hip arthroplasty and thus help decide the further plan of management.

METHOD AND MATERIALS
Patients with MoM hip replacements fitted with a recalled implant (ASR, DuPuy) often undergo MRI with metal artifact reduction sequences (MARS) to look for complications. From a cohort of 136 asymptomatic patients, with 181 MoM hips, patients with a mention of periprosthetic soft tissue mass in their reports at first presentation were selected. Ethics committee approval is not required in our institution for retrospective studies. Eighty patients were selected. Those with complex masses and complications like loosening, osteomyelitis, focal particle disease, tendon tear were excluded. A search was then made amongst the rest for those who had a repeat scan within 6 months to 2 years. Twenty patients with 23 MoM hips fit these criteria. The two scans were then compared by two expert radiologists and all findings were arrived at by consensus. Progression was defined as increase in the size of collection or change in morphology i.e. increase in wall thickness, development of septae or altered signal intensity. Meticulous review for any new collection or complication in the interim was also made.

RESULTS
Twenty asymptomatic patients with 23 MoM hips and 25 periprosthetic masses were evaluated. Comparison revealed that 13 of 25 reactive masses remained unchanged in shape, size and morphology over time. Eight of the 25 masses regressed, 2 of which completely resolved. Only 4 of the 25 lesions showed an increase in size. New periprosthetic mass was found in only 1 of the 23 hips. No significant new complication was noted in any of the patients. None of the patients turned symptomatic.

CONCLUSION
Periprosthetic soft tissue masses are not uncommon in patients with MoM hips. The majority of them in asymptomatic individuals remain stable or regress in the short to medium term and close follow-up or decisions on revision surgery may not be warranted in asymptomatic patients.

CLINICAL RELEVANCE/APPLICATION
Our study reveals that most of pseudotumors in patients with MoM hips, remain stable or regress, thereby stressing that decisions on revision may not be warranted in asymptomatic patients.

MKS360
The Incipient Breach of the Midline Pubic Plate: Is this MRI Finding Key to Early Diagnosis and Prevention of Athletic Pubalgia? (Station #3)

PURPOSE
Anecdotally, we noted a focal soft tissue breach located anterior to the midline pubic symphysis with horizontal orientation on sagittal MR imaging in patients with clinical athletic pubalgia. We sought to establish the incidence of this “incipient breach” and explore its clinical and MR associations, as well as explore its role in the...
evolution of athletic pubalgia injuries.

**METHOD AND MATERIALS**

80 consecutive cases referred for MR from an athletic pubalgia specialty clinic were reviewed. The presence of an incipient breach, as well as any rectus abdominis/adductor (RA-AL) aponeurosis or midline pubic plate lesion were recorded and localized, as were presence of a secondary cleft, subapophyseal defect and osteitis pubis (classified as mild, moderate, severe). Age and gender were recorded along with any athletic activity, clinical examination findings and treatment planning, and all were correlated with the presence of an incipient breach. A control group of 20 subjects imaged for hip lesions was reviewed.

**RESULTS**

79/80 study subjects had athletic pubalgia lesions at MRI. The incipient breach was identified on sagittal images in 61% (49/80) of study subjects. In patients with primary midline pubic plate lesions, 82% (42/51) showed an incipient breach. In patients with a primary unilateral RA-AL aponeurosis lesions, the incidence of an incipient breach was 21% (6/28). Moderate or severe osteitis pubis was identified in 49% of patients with an incipient breach (24/49), compared with 35% of patients without the lesion (11/31). 20/25 patients with an incipient breach were also noted to have a secondary cleft by MR. Football players accounted for majority of referred patients at 45% with 25/36 (69%) showing an incipient breach, while baseball and soccer players each accounted for 7.5% of the study group with 66% and 50% having incipient breaches respectively. 44/49 of patients with an incipient breach were treated with surgical pelvic floor repair.

**CONCLUSION**

An incipient breach is a common and potentially important observation in an athletic pubalgia patient population. This finding should be observed on sagittal imaging at midline and reported.

**CLINICAL RELEVANCE/APPLICATION**

The genesis of athletic pubalgia is long debated with many focusing on a musculoskeletal source. The incipient breach may reflect this initial injury, particularly in patients with midline lesions.

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**The Different Changes of Running and Stair Activity on Knee Articular Cartilage: Quantitative MRI Using T1 rho and T2 Mapping (Station #4)**

**MENG CHEN (Presenter):** Nothing to Disclose, SIRUN LIU: Nothing to Disclose, LIN QIU: Nothing to Disclose, XIANG-RAN CAI: Nothing to Disclose, SI SHEN: Nothing to Disclose, FEI WANG: Nothing to Disclose, JING ZHANG: Nothing to Disclose, CICI ZHANG: Nothing to Disclose

**PURPOSE**

To measure the changes on T1 rho and T2 relaxation times of knee articular cartilage immediately after 30 minutes running and stair activity

**METHOD AND MATERIALS**

3.0T MRI scans were performed in thirty young healthy adults immediately after 30 minutes rest and running respectively. After a week, 3.0T MRI scans were performed again after 30 minutes stair activity. The T1 rho and T2 mapping sequences were used to evaluate the knee articular cartilage. The cartilage was divided into 6 regions: media and lateral femoral condyle, medial and lateral tibial plateau, patella and trochlea. The patella cartilage was further divided 2 regions: superficial and deep parts. Analysis of variance for random block design data and paired samples t test were performed to estimate the changes on T1 rho and T2 relaxation times.

**RESULTS**

The T1 rho and T2 value after running and stair activity showed consistent decrease in all region of the knee articular cartilage. The superficial parts of patella cartilage, the lateral trochlea cartilage and the medial tibial plateau cartilage showed significant reduction. The superficial parts of lateral patella cartilage (T1 rho value after 30 min rest, running and stair activity were 54.41±4.15, 48.13±2.17 and 45.73±1.82 respectively, p=0.017) experienced the greatest reduction. The T1 rho and T2 value after stair activity had reduction when compared with the condition after running, but the data did not have statistic significance. The T1 rho and T2 value of the superficial parts experienced significant reduction when compared with the deep parts (p=0.000).

**CONCLUSION**

T1 rho and T2 value on knee articular cartilage showed reduction consistently after running and stair activity, suggesting running and stair activity had consistent load distribution on knee articular cartilage. The changes after stair activity were more obvious than running. The lateral patella cartilage, the lateral trochlea cartilage and the posterior part of medial tibial plateau cartilage experienced greater reduction, suggesting greater loads were shared in these areas during running and stair activity.

**CLINICAL RELEVANCE/APPLICATION**

The research exploited articular cartilage changes and loads distribution to physiologic exercise. The study results would be valuable in sports medicine, osteoarthritis and chondromalacia patellae.
MR Neurography (MRN) Technique for Lumbosacral Plexus Evaluation (Station #5)
Avneesh Chhabra MD (Presenter): Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc, Jared Kasper MD: Nothing to Disclose

PURPOSE
Evaluate relative merits of SHINKIE over conventional 3D inversion recovery (IR) turbo spin echo (TSE) imaging used for LS plexus MRN.

METHOD AND MATERIALS
Prospectively acquired 21 consecutive LS MRN exams on 3 Tesla scanner using both 1.5mm isotropic 3DIR TSE and SHINKIE techniques were analyzed. Two trained observers evaluated all images for motion and pulsation artifacts, nerve signal to noise (SNR), contrast to noise (CNR), nerve-fat ratio, quality as well as degree of fat suppression (muscle-fat ratio) and depiction of various segments of the LS plexus.

RESULTS
4 exams were excluded due to prior spine surgery. Bowel motion artifacts, pulsation artifacts, inhomogeneous fat saturation and patient motion were seen in 16/17, 0/17, 17/17, 2/17 in 3DIR TSE and 0/17, 0/17, 0/17, 1/17 in SHINKIE, respectively. The p values were significant in SHINKIE for nerve SNR (<0.01), CNR (<0.01), nerve to fat (<0.01) and degree of fat saturation, muscle to fat ratio (p<0.01). Both 3D IRTSE and SHINKIE showed all LS plexus nerve roots, sciatic and femoral nerves universally. Smaller branches including obturator nerves, ilioinguinal and iliohypogastric were seen in 10/17, 5/17, 1/17 in 3DIR TSE and 17/17, 16/17, 7/17 in SHINKIE exams, respectively.

CONCLUSION
In addition to the benefit of effective vascular signal and bowel artifact suppression, the SHINKIE MRN technique demonstrates increased conspicuity of smaller LS plexus branches.

CLINICAL RELEVANCE/APPLICATION
SHINKIE sequence should be incorporated in LS plexus imaging for better nerve identification and pre-surgical planning.

Early Findings of Charcot Arthropathy on MR Imaging (Station #6)

PURPOSE
To identify early findings of Charcot arthropathy on MR imaging.

METHOD AND MATERIALS
The MR imaging reports database was searched for the words "Charcot" and "Neuropathic"; resultant patient list was reviewed for the following inclusion criteria: 1) documented early Charcot arthropathy by clinical exam; or 2) follow-up imaging showing evolution into classic Charcot arthropathy. Images were reviewed for location of Charcot, as well as marrow, articular, ligamentous, tendinous and soft tissue findings on the initial MR exam. Findings on follow-up were documented.

RESULTS
Results: Fifteen feet in fourteen patients were identified with MR imaging of early Charcot. Seven were located at the Lisfranc joint and eight at the Chopart joint. Initial findings included subchondral bone marrow edema in 10/15; subchondral fracture in 3/15; tear of a supporting ligament in 10/15; tendinopathy in 5/15; and muscle atrophy in 7/15. In cases of early Charcot at the Lisfranc joint, tearing of the inferior capsule of the first TMT joint was followed by midfoot collapse; in cases of early Charcot at the Chopart joint, tearing of the spring ligament was followed by hind foot collapse.

CONCLUSION
MRI can be successfully used to predict future risk for rapidly progressive arthropathy at both the Chopart and Lisfranc joints.

CLINICAL RELEVANCE/APPLICATION
Identification of initial ligamentous injuries preceding Charcot arthropathy in the diabetic population could assist surgeons in early intervention and prevention of late deformity.

Dorsovolar Position of the Distal Radius and Ulna at the Distal Radioulnar Joint in Asymptomatic Volunteers on MRI (Station #7)
Seema M. Meraj MD (Presenter): Nothing to Disclose, Nidhi Jain MD: Nothing to Disclose, Catherine Niyada Petchprapa MD: Nothing to Disclose

PURPOSE
To identify the dorsovolar position of the distal radius and ulna at the distal radioulnar joint (DRUJ) in asymptomatic volunteers.
Evaluate the dorsovolar position of the distal radius and ulna at the distal radioulnar joint (DRUJ) in forearm pronation, supination, and neutral in asymptomatic volunteers on MRI.

METHOD AND MATERIALS

Twenty wrists in ten asymptomatic volunteers (five men, five women; mean age 29.6 years; range 27-32 years), without history of pain, prior trauma or previous hand/wrist surgery were imaged utilizing axial proton density weighted MRI with the wrist pronated, supinated, and in the neutral position. Three methods were used to quantify the presence/absence/degree of subluxation of the DRUJ: Mino criteria, subluxation ratio, and radioulnar ratio.

RESULTS

None of the volunteers had clinical DRUJ instability. Using the Mino criteria, DRUJ instability was suspected in 55% (11/20) of the wrists in pronation, 45% (9/20) in neutral, and 45% (9/20) in supination. Using the subluxation ratio method, only 2 of the wrists fit the criteria for subluxation in pronation and 1 in supination. Only 1 wrist fit the criteria for subluxation using the radioulnar ratio method in supination. The ulna was dorsally positioned in 7/20 with respect to the radius in pronation and volarly positioned in 5/20 in supination. The mean values for the radioulnar ratio method were 0.530 in pronation and 0.481 in supination.

CONCLUSION

Established methods for evaluating DRUJ alignment were abnormal in our study of asymptomatic subjects, raising concern for their reliability for detecting true DRUJ instability.

CLINICAL RELEVANCE/APPLICATION

There is some degree of normal dorsovolar translation between the radius and ulna in pronation and supination. Further study of normal wrists is necessary to avoid overdiagnosing DRUJ instability on cross sectional imaging.

MKE152

US of the Knee: What to Look for (Station #8)

Maria Dolores Lopez Parra MD (Presenter): Nothing to Disclose, Jose Acosta Batlle : Nothing to Disclose, Blanca Palomino : Nothing to Disclose, Catalina Maria Garcia Barrio : Nothing to Disclose, Belen Lopez Parra MS : Nothing to Disclose

TEACHING POINTS

- to review the sonographic anatomy and scanning technique knee.
- to describe those pathological conditions in which ultrasound (US) has a similar or even higher sensitivity and specificity than MRI

TABLE OF CONTENTS/OUTLINE

Understanding of the anatomy, scanning technique and appearance of pathological conditions is essential for proper interpretation of US findings. We review US and MRI studies performed in 245 patients with symptoms referred to a specific knee area; those patients with diffuse or meniscal symptoms were excluded. We describe the sonographic appearance of the four anatomic compartments in which knee is divided: anterior, medial, lateral and posterior. We explain how to perform a dynamic US study (with active and passive mobilization) and to obtain images of the full course of the tendons and collateral ligaments in different planes. Illustrative examples of main tendinous, ligaments and recess diseases are shown. US imaging of other structures, such as patellar cartilage, supra patellar recess and peroneal/ tibial nerve. We emphazise the advantages of US exam compared to MRI. US is especially useful in the study of tendons of anterior compartment, particularly in child in which MRI will be subject to the effects of anisotropy and in the evaluation of posterior compartment and collateral ligaments.

MKE258

The Postoperative Shoulder: A Meeting Point between Radiologists and Orthopedic Surgeons (Station #9)

Maria Jose Ereno Ealo MD (Presenter): Nothing to Disclose, Alberto Sanchez Sobrino : Nothing to Disclose, Oscar Luis Casado Verdugo : Nothing to Disclose, Rosa Monica Rodrigo Del Solar : Nothing to Disclose, Estibaliz Montejo : Nothing to Disclose, Begona Sancho Garaizabal : Nothing to Disclose

TEACHING POINTS

1. Describe in a didactic way the main surgical procedures used for the treatment of shoulder pathology 2. Explain the imaging findings in each post-operative situation 3. Review the most common post-operative complications

TABLE OF CONTENTS/OUTLINE

Postoperative imaging of the shoulder is challenging. In order to reduce the distance between radiologists and orthopedic surgeons it is important to know the main shoulder surgical procedures. We describe in a didactic way the techniques, indications and contraindications, normal temporal evolution and complications from the point of view of the image and from arthroscopic or surgical perspective. Our topics will be: 1. Rotator cuff Surgery a. Subacromial decompsession - Anterior acromioplasty - Mumford procedure b. Rotator cuff repair 2. Biceps Tendon Surgery a. Biceps tenodesis b. Biceps tenotomy 3. Labral-Ligamentous Complex Surgery a. SLAP repair b. Bankart repair c. Capsular shift 4. Shoulder Arthroplasty

MKE135

Do They Follow Rules and Regulations? Association of Soft Tissue Injury and Bone Edema Patterns in Acute Knee Injuries (Station #10)

Sridhar Devu DMRD, FRCR (Presenter): Nothing to Disclose, Umamahesh Matapathi MBBS,MD : Nothing to Disclose, venkata rama subramanyam muddana MBBS : Nothing to Disclose
TEACHING POINTS
The intention of the exhibit: 1. To understand the dynamic anatomy of knee joint. 2. To organise the pattern of bone contusions and fractures in acute injuries around the knee joint. 3. To evaluate the stabilising structures of the knee joint. 4. To correlate the specific patterns of bone and soft tissue injuries. 5. To establish a protocol of reporting in acute injuries of knee joint.

TABLE OF CONTENTS/OUTLINE

Sonography and Ultrasound Interventions in Gout (Station #11)
Alberto Andres Simoncini MD (Presenter): Nothing to Disclose, Guillermo P. Sangster MD: Nothing to Disclose, Carlos Humberto Previgliano MD: Nothing to Disclose, Cinzia Andrea Bartoletti MD: Nothing to Disclose, Anne Hollister MD: Nothing to Disclose, Justin Wayne Skweres MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To review the pathophysiology of gout and the resulting specific and nonspecific sonographic findings.
2. To analyze the value of ultrasound interventions to confirm the disease.
3. To discuss the roll of ultrasound to monitor disease activity and treatment response.
4. To compare ultrasound with other imaging modalities.

TABLE OF CONTENTS/OUTLINE
1) Pathophysiology of gout. 2) Non-specific sonographic findings: - Soft tissue edema. - Synovitis (Joint effusion, h yperemia, s ynovial proliferation). - Hyperechoic foci. 3) Specific sonographic findings: - Double contour sign. - Tophus. 4) Ultrasound as a tool to evaluate disease activity and monitoring treatment. 5) Ultrasound guided interventions in gout. 6) Differential diagnosis. 7) Comparison between ultrasound, radiography and other advanced modalities (CT, Dual Energy CT, MRI). 8) Summary.

The Posterior Rotator Interval of the Shoulder, Normal Anatomy and MR Findings (Station #12)

TEACHING POINTS
Appreciate the anatomy of the posterior rotator interval Recognize posterior rotator interval MR signal abnormalities Appreciate the configuration of posterior rotator interval signal abnormalities in light of the underlying anatomy

TABLE OF CONTENTS/OUTLINE
Anatomy of the posterior rotator interval Review of current literature Cadaver dissection with histologic slides Sample MRI and MR arthrogram cases Discussion of the signal abnormalities in the posterior rotator interval as seen on MRI and their potential association with the anatomy of the posterior rotator interval.

Challenges in Imaging a Post Surgical Meniscus - Where Do We Stand Today? (hardcopy backboard)

TEACHING POINTS
The purpose of this exhibit is: 1. To review the morphology of the normal post surgical meniscus on imaging and how it differs to the normal meniscus. 2. To discuss the utility and imaging findings in assessment of post surgical meniscal tears/ retears. 3. To discuss the utility and imaging findings in assessment of meniscal implants.

TABLE OF CONTENTS/OUTLINE
**SSE14**

**Musculoskeletal Imaging (Central, Plexus, Nerve and Disc Imaging)**

**Scientific Papers**

**Sub-Events**

**SSE14-01**

**DTI-derived Measurements and Three-dimensional Tractography in Neoplastic Conditions of Brachial Plexus**

Yifang Bao (Presenter): Nothing to Disclose, Weijun Tang MD: Nothing to Disclose, Dao-Ying Geng MD, PhD: Nothing to Disclose

**PURPOSE**

To explore diffusion tensor imaging (DTI) and tractography in directly demonstrating nerve fiber changes of brachial plexus neoplastic lesions.

**METHOD AND MATERIALS**

Ten patients with neoplastic lesions and 1 patient with tumor-like lesion underwent DTI on a 3.0-T system in addition to conventional MR protocol, including 8 cases of schwannoma, 1 case of invasive fibrous tumor and 1 case of synovial sarcoma, which were proved pathologically. Fractional anisotropy (FA) and tractography of brachial plexus were obtained.

**RESULTS**

The lesions were clearly delineated with tractography, and the nerve fibers were displaced and deformed obviously. Mean FA values of lesions, nearby nerve fibers and the opposite normal nerve fibers were obtained as follows: 0.235±0.031, 0.352±0.074 and 0.403±0.108 in 8 cases of schwannoma, 0.229±0.062, 0.272±0.075, 0.352±0.046 in the invasive fibrous tumor, 0.289±0.153, 0.383±0.001 and 0.412±0.104 in the synovial sarcoma, respectively. Mean FA value of the tumor-like lesion was 0.308±0.095, and its opposite normal nerve fiber was 0.409±0.003.

**CONCLUSION**

DTI could clearly show the relationship between neoplastic lesions and brachial plexus nerve fibers, and FA value could provide more accurate information for diagnosis of tumor lesions.

**CLINICAL RELEVANCE/APPLICATION**

DTI-derived measurements and three-dimensional tractography could clearly show the relationship in neoplastic conditions of brachial plexus, and FA value could provide more accurate information for diagnosis of tumor lesions.

**SSE14-02**

**Diagnostic Value of Diffusion Tensor Imaging (DTI) and Tractography (DTT) of Lumbar Nerve Roots on Lumbar Disc Herniation Assessment**

Qingwei Song BS, BEng (Presenter): Nothing to Disclose, Meiyu Sun: Nothing to Disclose, Qiang Wei: Nothing to Disclose, Shao Wu Wang MD: Nothing to Disclose, Ziheng Zhang: Nothing to Disclose, Minting Zheng: Nothing to Disclose, He Qing Wang MSc: Nothing to Disclose

**PURPOSE**

To evaluate the DTI and DTT of lumbar nerve roots in the diagnosis of lumbar disc herniation through all the related qualitative info from tractography and quantitative measures of the fraction anisotropy (FA) and apparent diffusion coefficient (ADC) values.

**METHOD AND MATERIALS**

This prospective study was approved by our Institutional Review Board and written informed consent was obtained. Twenty patients (age=27-67 years; 10 males, 10 females) with clinically confirmed lumbar disc herniation and without a previous history of spinal trauma, surgery, or neurological diseases (left: 11; right: 9) and 20 normal controls (age=26-63 years; 10 males, 10 females) were performed DTI, DTT and axial T2W MRI scanning on a GE Signa HDxt 3.0T MR scanner. All fiber tracking images were taken in lumbar nerve roots with fused T2WI image as an anatomic background and the FA and ADC values of left- and right-side nerve roots
RESULTS

A high success rate (>90%) of achieving the DTI with tractography of lumbar nerve roots was obtained. At the pressurized areas of the lumbar nerve roots, a high signal intensity was observed in the T2WI of DTI from the patients comparing with the contralateral and from the controls. In addition, apparent morphological changes were observed at the corresponding regions in a pattern of shift, bending, sparsity in number and so on. No significant difference in the mean FA and ADC values between the left- and right-side nerve roots at same level (L3 and S1) and in between. However, the mean FA values of compressed nerve roots were statistically lower (p

CONCLUSION

DTI with tractography provides an abundant diagnostic information with specificity on qualitative- and quantitative-wise, which is great helpful to assess the disorders with lumbar nerve root compression.

CLINICAL RELEVANCE/APPLICATION

A strong suggestion of putting DTI scan into the clinical MRI setting for lumbar nerve roots related examinations.

SSE14-03

Qualitative and Quantitative Properties of the Human Annulus Fibrosus Using DTI Followed by Fiber Tracking

Dan Stein (Presenter): Nothing to Disclose, Yaniv Assaf : Nothing to Disclose, Gali Dar : Nothing to Disclose, Haim Cohen MSc : Nothing to Disclose, Viviane Slon MSc : Nothing to Disclose, Bahaa Medlej MD : Nothing to Disclose, Israel Herskovitz PhD : Nothing to Disclose

PURPOSE

To explore the 3D architecture of the intervertebral discs' (IVD) annulus fibrosus (AF) via Diffusion Tensor Imaging (DTI) followed by fiber tracking in order to provide qualitative as well as quantitative information regarding its structure.

METHOD AND MATERIALS

Eight segments of the AF taken from human lumbar cadavers were scanned on a 7T\30 MRI scanner followed by fiber tracking. The data was then quantitatively analyzed and the structure is presented three dimensionally.

RESULTS

The mean fractional anisotropy (FA) and mean diffusivity (MD) for the fibers were respectively in the range of 0.35-0.58/ 1.3±0.7 . Mean fiber density for all samples was 84 Mean length found was 2.6mm ±1.9mm and the mean interlamellar angle was in the range of 28°-61°.

CONCLUSION

To our knowledge this is the first time the annulus fibrosus, or any other fibrocartilage tissue has undergone DTI followed by fiber tracking. This has enabled to see for the first time the 3D structure as well as generate quantitative information to characterize the structure, its frequent failure and explore biological variations as well as a source for better computer based models of the IVD.

CLINICAL RELEVANCE/APPLICATION

The exploration of the 3D structure and the quantitative characteristics of the AF using DTI and fiber tracking could be used for objective assessment of the IVD's condition.

SSE14-04

Assessment of Glycosaminoglycan Content in Lumbar Intervertebral Discs with Chemical Exchange Saturation Transfer Imaging: Comparison with T1-rho Measurement

Osamu Togao MD, PhD (Presenter): Nothing to Disclose, Akio Hiwatashi MD : Nothing to Disclose, Koji Yamashita MD, PhD : Nothing to Disclose, Kazufumi Kikuchi MD : Nothing to Disclose, Tatsuhiro Wada : Nothing to Disclose, Jochen Keupp PhD : Employee, Koninklijke Philips NV, Hiroshi Honda MD : Nothing to Disclose

PURPOSE

Glycosaminoglycan CEST (gagCEST) imaging is an emerging molecular MR imaging technique to measure in-vivo glycosaminoglycan content in cartilaginous tissue. The purpose of this study was to evaluate the utility of this method in assessments of lumbar intervertebral disc degeneration (IDD) by comparing with T1-rho, an established quantitative biomarker of IDD, and conventional morphological assessments.

METHOD AND MATERIALS

Thirty-six intervertebral discs in nine volunteers (age 32.7 ± 5.9 years; 8 males, 1 female) were examined with both gagCEST imaging and T1-rho measurements. GagCEST imaging was conducted on a 3T MR scanner using a 32-channel torso coil for signal reception and 2-channel parallel transmission via the body coil. A sagittal image covering L2/3, 3/4, 4/5, and L5/S1 levels was acquired using 2D turbo spin-echo sequences with driven equilibrium refocusing. Saturation pulses were irradiated with duration of 1.0 s, and B1 power of 0.8 μT. Other parameters were as follows: TR/TR=5s/6ms, FOV=2302mm2, resolution=1.8×1.8×5mm3, 25 frequency offsets Ω=−3..3ppm (step 0.25ppm) and Ω = −160 ppm. B0 maps were acquired separately for B0 inhomogeneity correction. CEST effect was defined as: MTR asym = (S[−Ωppm]−S[+Ωppm])/S0. GagCEST value was defined as
the average CEST effects from 0.5 to 1.5 ppm. For T1-rho measurements, 3D gradient-echo sequence was performed with five spin-lock times (1, 25, 50, 75, 90 ms). A region-of-interest was placed in nucleus pulposus of each intervertebral disc. In addition, T2-weighted images were obtained to assess Pfirrmann grading for morphological assessment of IDD.

RESULTS

The number of intervertebral discs with Pfirrmann grading 1, 2, 3, 4, 5 was 13, 13, 1, 7, 2, respectively. GagCEST values significantly correlated with T1-rho ($r = 0.63$, $P < 0.0001$, linear regression) in lumbar intervertebral discs. Both gagCEST values ($r = -0.76$, $P < 0.0001$, Spearman rank correlation) and T1-rho ($r = -0.65$, $P < 0.0001$, Spearman rank correlation) correlated with Pfirrmann grades.

CONCLUSION

GagCEST correlated with T1-rho and Pfirrmann grades in lumbar IDD. GagCEST can provide a quantitative measure to assess IDD.

CLINICAL RELEVANCE/APPLICATION

GagCEST imaging correlated with both quantitative T1-rho measurements and qualitative morphological assessments of IDD in the lumbar spine, and thus GagCEST can be a noninvasive and quantitative biomarker of IDD.

SSE14-05

Diffusion Tensor Imaging Focusing on Lower Cervical Spinal Cord Using 2D Reduced FOV Interleaved Multislice Single-Shot Diffusion-weighted Echo-Planar Imaging: Comparison with Conventional Single-Shot Diffusion-weighted Echo-Planar Imaging

Eun Hae Park, Seok Hahn MD (Presenter), Young Han Lee MD, Sungjun Kim MD, Ho-Taek Song MD

PURPOSE

To evaluate the performance of diffusion tensor imaging (DTI) in the cervical spinal cord by comparing 2D ss-IMIV-DWEPI (interleaved multisection inner volume) and custom made 2D ss-DWEPI in a clinical population with focusing at lower cervical spinal cord.

METHOD AND MATERIALS

From July to November 2013, total 21 patients who underwent cervical spinal MR with DTI were retrospectively enrolled (M:F = 7:14, mean age 45.5 years, range 24-76). All MRI examinations were performed using a 3.0 T with a phased-array spine coil including two different 2D reduced FOV DTI sequences: 2D ss-IMIV-DWEPI(iDTI) and 2D ss-DWEPI without interleaved(cDTI). For quantitative analysis, two musculoskeletal radiologists blinded to sequence measured fractional anisotropy (FA), and apparent diffusion coefficient (ADC) value throughout the whole cervical spinal cord (C1-T1). For qualitative analysis, the readers rated each image based on spinal cord distortion, dural margin delineation, depiction of intervertebral disc. Both quantitative and qualitative evaluations were analyzed as upper and lower segment. For quantitative analysis t-test was used and for qualitative analysis, Two-way analysis of variance(ANOVA) and t-test were performed.

RESULTS

FA were significantly higher and ADC value were significantly lower at iDTI than those of cDTI (0.679 versus 0.563, respectively for FA, 631 versus 1026, respectively for ADC value, $P<0.0001$), and this was consistent at lower segment of spinal cord. The reviewers rated iDTI superior in terms of all assessed characteristics. And the mean score of iDTI of lower segment was significantly higher compared with cDTI aswell as higher segment($<0.0001$).

CONCLUSION

2D rFOV ss-IMIV-DWEPI can be used to acquire higher performance in terms of improving image quality even in lower segment of cervical spinal cord and is preferred to conventional 2D rFOV ss-DWEPI.

CLINICAL RELEVANCE/APPLICATION

2D rFOV ss-IMIV-DWEPI can be used to acquire higher performance in terms of improving image quality even in lower segment of cervical spinal cord and is preferred to conventional 2D rFOV ss-DWEPI.

SSE14-06

Whole Body MR Neurography - Initial Results


PURPOSE

1. Evaluate the quality and feasibility of 3D whole body MR neurography (MRN) imaging. 2. Assess disease burden (nerve thickening and hyperintensity) in the diffuse known neuropathy cases and compare with controls. 3. Evaluate differences among the different types of diffuse neuropathies.
METHOD AND MATERIALS
Patients and healthy controls were all imaged on 3 Tesla MR scanner, 2-3 sets of 3D anatomic MRN (1.5mm isotropic from the base of skull to proximal thighs), contiguous axial T2W SPAIR of the symptomatic extremity, and DTI of brachial and LS plexuses was obtained with a total imaging time of upto 1hr-15 minutes. Two readers assessed the quality in consensus and independently performed all the measurements. Nerve diameter and signal intensity ratios was measured for C5-7 nerves, L4-S1 nerves, sciatic and femoral nerves bilaterally. FA and ADC values were also measured. Tractography was obtained in all cases. Descriptive analysis and analytic methods (paired t test, weighted kappa calculation for differences) were used.

RESULTS
18 subjects [7 controls (6 men, 1 women, age 28+/-3 yrs) and 11 patients with neuropathy (4 men, 7 women; mean age 45+/-4 yrs)] were studied. The diagnosis included- Charcot Marie Tooth disease (CMT) type 1A (7/11), CMT type II (1/11) CMT type III: HNPP (2/11) and MMN (1/11). Most exams (95%) recieved good-excellent imaging quality. The nerve thickening was significant in LS plexus, sciatic and femoral nerves (p<0.05); while hyperintensity was significant in brachial and LS plexuses (p<0.05). The most thickening was seen in CMT type 1A. MMN showed patchy bilateral nerve thickening. Pseudomasses were seen in CMT 1A. Nerve entrapments in extremity were seen in (4/11) cases. Mean left to right differences in DTI values were not significantly different. ADC of brachial plexus, LS plexus and FA values of LS plexus were significant (p<0.05). Tractography differences were observed among normal and abnormal subjects. Interobserver performance was good to excellent.

CONCLUSION
Whole body MRN is feasible method with good to excellent interobserver performance that can be objectively used to evaluate disease burden and detect differences among diffuse neuropathies.

CLINICAL RELEVANCE/APPLICATION
Whole body MR neurography is a non invasive method that can be applied to diffuse neuropathy cases to evaluate the disease burden, differentiate among various causes of diffuse neuropathy and to detect superimposed entrapments.

SSE15
Musculoskeletal (Foot and Ankle)

Scientific Papers

SSE15-01 Imaging of Adult Flatfoot: Correlation of Radiographic Measurements with MRI

Yu-Ching Lin MD (Presenter): Nothing to Disclose, Jennifer Nimhuircheartaigh MBCh: Nothing to Disclose, Joshua Lamb: Nothing to Disclose, Justin Wen-Jseng Kung MD: Nothing to Disclose, Corrie Marlene Yablon MD: Nothing to Disclose, Jim Sweg-Hong Wu MD: Research Grant, Kaneka Corporation

PURPOSE
The purpose of this study is to determine if radiographic foot measurements can predict injury of the posterior tibial tendon (PTT) and the supporting structures of the medial longitudinal arch as diagnosed on MRI.

METHOD AND MATERIALS
Following institutional review board approval, 100 consecutive patients with radiographic and MRI exams performed within a 2 month time period were enrolled. Thirty-one patients had PTT dysfunction clinically and 69 patients had other causes of ankle pain. Talonavicular uncoverage angle, incongruency angle, calcaneal pitch angle, Meary's angle, cuneiform-to-5th metatarsal height, and talar tilt were calculated on standing foot/ankle radiographs. MRI was used to assess for abnormalities of the PTT (tenosynovitis, tendinopathy, tear) and supporting structures of the medial longitudinal arch (spring ligament, deltoid ligament, sinus tarsi). Statistical analysis was performed using the chi-squared and Fisher's exact tests for categorical variables; t-test was used for continuous variables.

RESULTS
There was a significant association of PTT tear with abnormal talonavicular uncoverage angle, calcaneal pitch angle, Meary's angle, and cuneiform-to-5th metatarsal height. PTT tendinopathy and isolated tenosynovitis had a poor association with most radiologic measurements. If both calcaneal pitch and Meary's angles were normal, no PTT tear was present. An abnormal calcaneal pitch angle had the best association with injury to the...
supporting medial longitudinal arch structures.

CONCLUSION

Radiographic measurements, especially calcaneal pitch and Meary's angles, can be useful in detecting PTT tears. Calcaneal pitch angle provides the best assessment of injury to the supporting structures of the medial longitudinal arch.

CLINICAL RELEVANCE/APPLICATION

Knowledge of this information can help guide the clinician and radiologist to determine which patients may benefit from additional clinical and imaging workup.

SSE15-02

New Type of Talocalcaneal Coalition with Os Sustentaculi: The Continued Necessity of Revision of Classification

Seong Jong Yun (Presenter): Nothing to Disclose, Wook Jin: Nothing to Disclose, Gou Young Kim MD, PhD: Nothing to Disclose, Jae Hoong Lee MD: Nothing to Disclose, Woo Jin Yang: Nothing to Disclose, Kyung Jin Lee MD: Nothing to Disclose, Ji Su Kim: Nothing to Disclose, Sohee Yoon MD: Nothing to Disclose, So Young Park: Nothing to Disclose

PURPOSE

To retrospectively determine the prevalence and image findings of extra-articular talocalcaneal coalition with os sustentaculi (extra-articular TCC with OS), which is an undescribed type of the TCC.

METHOD AND MATERIALS

This retrospective two-center study was approved by the Institutional Review Board and written informed consent was waived for adult patients. This study was queried through a database containing the radiology reports of CT or MR imaging that was performed during August 2001 to November 2013. Patients in our study were identified through a keyword search in our database for “TCC,” “tarsal coalition,” “coalition,” or “OS”. All radiologic examinations of patients with reports indicating a coalition in each institution were reviewed, based on the consensus of two musculoskeletal radiologists. Chart review was used to identify demographic information by one independent radiologist who did not involve image evaluation.

RESULTS

At two institutions, coalition was diagnosed in 81 patients. Among them, TCC was diagnosed in 66.7% (54/81) and naviculo-medial cuneiform coalition was diagnosed in 16.0% (13/81). The extra-articular TCC with OS was diagnosed in 13 patients (9 men, 4 women), which represents an incidence of 16.0% (13/81) in all coalitions and 24.1% (13/54) in all TCCs. The mean age of the patients was 27.8 years. Four of 13 patients underwent surgical resection and histology was obtained in 3 patients. Eight of 9 atraumatic patients were symptomatic and all patients with bone marrow edema at coalition sites on MR were symptomatic. Coexistence of extra-articular TCC with OS and other type TCCs was in 11 of 13 patients.

CONCLUSION

The OS has been diagnosed simply as an accessory ossicle or misdiagnosed as an old fracture. However, the OS may be a component of extra-articular TCCs, and was usually related to the presence of symptoms.

CLINICAL RELEVANCE/APPLICATION

If a patient with OS has symptoms in the medial talocalcaneal joint area, a new type of extra-articular TCC with OS should be considered.

SSE15-03

Plantar Talar Head Contusions and Osteochondral Fractures: A Predictor of Ligamentous and Osseous Injury in Ankle Trauma?

Bing Hu MD (Presenter): Nothing to Disclose, Tetyana A. Gorbachova MD: Nothing to Disclose, Peter S. Wang MD: Nothing to Disclose, Jay C. Horrow: Research Consultant, Johnson & Johnson Research Grant, Merck & Co, Inc

PURPOSE

Several patterns of marrow edema in the ankle have been identified in setting of acute trauma. We encountered a distinct pattern of focal bone bruising and osteochondral fractures of the plantar aspect of the talar head that has not been previously studied. The purpose of this study is to examine the relationship between bone bruises and/or osteochondral fractures involving the plantar aspect of the talar head. Cases of diffuse midfoot marrow edema, diffuse talar head edema, talar osteonecrosis, calcaneonaviculat coalition, gross talar fractures, inflammatory arthropathy, and infection were excluded. Osseous and ligamentous structures were evaluated by two
radiologists in consensus.

RESULTS

Injuries of the plantar aspect of the talar head have a high association with other concurrent osseous injuries, 86% (32/37), most commonly involving the anteromedial (68%) and posteromedial talar body (49%), and medial malleolus (43%). There is a high prevalence of lateral ankle ligamentous sprain (76%) with multiligamentous injury seen in 51%. Spring ligament was injured in 14%. Strain or avulsion of the extensor digitorum brevis muscle was seen in 27%. 5 of 9 patients age 16 and below had Salter-Harris type fractures of the distal fibula.

CONCLUSION

Injury of the plantar talar head has a high association with medial sided bone contusions and lateral ligamentous sprains, which suggests an inversion mechanism of this injury. A higher prevalence of multiple bone contusions and multiligamentous sprains also indicates a greater severity of injury in this cohort.

CLINICAL RELEVANCE/APPLICATION

Plantar talar head contusions and osteochondral fractures suggest more severe ankle injury that should prompt search for concurrent osseous and ligamentous injuries. In adolescents, they can be associated with Salter-Harris type injury to distal fibula.

SSE15-04

Bone Marrow 3T Proton MR Spectroscopy Provides Biomarkers of Disease Activity in Acute Charcot Osteo-arthropathy

Ettore Squillaci MD (Presenter): Nothing to Disclose, Francesca Bolacchi: Nothing to Disclose, Marco Antoniccoli: Nothing to Disclose, Simone Altobelli: Nothing to Disclose, Marco Nezzo MD: Nothing to Disclose, Giovanni Simonetti MD: Nothing to Disclose

PURPOSE

Charcot osteo-arthropathy (COA) occurs in the foot/ankle in diabetic patients with sensory neuropathy and it is a common cause of morbidity in this population. Although local clinical signs are useful indicators of disease activity, they are affected by poor sensibility and reproducibility. We aimed to evaluate whether bone marrow 1H magnetic resonance spectroscopy (MRS) might provide a quantitative parameter able to assess disease activity in acute CN.

METHOD AND MATERIALS

Twenty two diabetic patients with stage 0 CN were prospectively evaluated at clinical onset and during treatment follow-up. The MRS lipid spectrum was analysed and a lipid polyunsaturation index (PUI) was calculated. Disease recovery was defined as the disappearance of bone marrow oedema as demonstrated on MRI short-tau-inversion-recovery (STIR) images. A 3-T MRI was used.

RESULTS

Inter and intra-individual PUI measurements generated reproducible results with approximately 7% and 6% variation respectively. Baseline PUI values were significantly higher in patients with acute CN compared with controls. Also, a significant positive correlation was observed between baseline PUI values and serum levels of IL-6 and TNF-α. During follow-up a gradual decrease in PUI was observed. The percentage reduction of PUI values at 3 months' follow-up with respect to baseline values showed a negative correlation with recovery time.

CONCLUSION

Bone marrow MRS provides a measurable index that allows progressive evaluation of disease activity in acute COA. MRS may be a complementary tool that can be used to guide clinicians in the management of acute COA patients.

CLINICAL RELEVANCE/APPLICATION

Bone marrow 1H-MRS provides biomarkers of disease activity in acute Charcot osteo-arthropathy.

SSE15-05

Predictive MRI Correlates of Lesser Metatarsophalangeal Joint (MPJ) Plantar Plate (PP) Tear

Rachel Umans BA (Presenter): Nothing to Disclose, Benjamin Umans BA, MSc: Nothing to Disclose, Hilary Ruth Umans MD: Nothing to Disclose, Elisabeth Elsinger: Nothing to Disclose

PURPOSE

To identify qualitative and quantitative MRI findings correlated with lesser MPJ PP tear.

METHOD AND MATERIALS

Non-contrast MRI (10/2012-01/2014, 1.5 or 3.0 T) of 50 PP tear cases (35 female, 15 male, av 52 yrs) and 50
controls (41 female, 9 male, av 35 yrs) were randomized and reviewed. All cases of PP tear demonstrated accepted MRI criterion of a bright T2 signal defect at the insertion of the PP. An MSK radiologist, blinded to diagnosis, reviewed potential qualitative correlates of PP tear including: metatarsal (MT) axis rotation, toe deviation, intermediate signal pericapsular soft tissue thickening (STT), toe enthesitis and flexor tendon subluxation or tenosynovitis. A trained, similarly-blinded non-physician, unfamiliar with MRI diagnosis of PP tear, measured MT axis rotation, 2nd MT protrusion, submetatarsal fat pad thickness and toe rotation. Each blindly double-read 20 MRI (11 cases, 9 controls) to evaluate intra-observer agreement for the qualitative findings and quantitative measures, respectively. Kappa statistic, t-test, Wilcoxon rank sum test were used as appropriate; p<0.05 was considered significant. Classification trees were created to identify combinations of findings correlated with PP tear.

RESULTS

There were significant, reproducible differences in measured MT axis rotation and 2nd MT protrusion between PP tear and control groups. Lesser MT supination >36° or 2nd MT protrusion >4mm trend toward a correlation with PP tear. Lesser MT supination <24° is a strong negative predictor of PP tear. Lesser MT protrusion > 4.5mm is a strong positive predictor of PP tear. Among qualitative correlates, pericapsular STT correctly classified 95% of cases and controls, though there may be an element of diagnostic heterogeneity in assessment of this finding. Excluding pericapsular STT, 94% correct classification was achieved by a combination of 2nd toe enthesitis, 2nd flexor tendon subluxation and splaying of the 2nd and 3rd toes. Both quantitative measures (concordance=0.88-0.99) and qualitative assessments (kappa=0.71-1.0) were highly reproducible.

CONCLUSION

PP tear can be determined with high accuracy using a combination of correlated qualitative findings and quantitative measurements.

CLINICAL RELEVANCE/APPLICATION

Correlative signs of PP tear are clinically important since primary MRI signs for diagnosis of PP tear may be subtle or occult, resulting in common misdiagnosis and mistreatment.
1) Understand the current practice and literature of Osteoid Osteoma ablation. 2) Discuss different techniques of Osteoid Osteoma ablation. 3) Review techniques of ablation of other benign Bone Tumors.

**SPSH30B**

**Cryoablation and Microwave Treatment of Metastatic Disease to Bone**

Damian E. Dupuy MD (Presenter): Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

**LEARNING OBJECTIVES**

1) Review the current microwave and cryoablation technology. 2) Understand the current clinical indications and how both thermal technologies are applied to patients with osseous metastatic disease. 3) Learn the pearls and pitfalls of implementation through clinical examples.

**SPSH30C**

**MR-guided Focused Ultrasound Treatment of Painful Bone Metastases**

David C. Gianfelice MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Introduce technology of MR Guided focused ultrasound ablation 2) Specific application of this technology for painful bone metastases 3) Review of the literature and definitive Phase 3 study 4) Possible future applications

**VSMK31**

**Musculoskeletal Series: Ultrasound**

**Series Courses**

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Tue, Dec 2 8:30 AM - 12:00 PM  Location: E450A

**Participants**

Moderator

Moderator
David Paul Fessell MD: Nothing to Disclose

**LEARNING OBJECTIVES**

The 'Ultrasound' Series Course will review musculoskeletal sonography through live instruction by expert refresher course instructors, interspersed with scientific presentations.

**Sub-Events**

**VSMK31-01**

**Shoulder Ultrasound (Demonstration)**

Jon A. Jacobson MD (Presenter): Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

**LEARNING OBJECTIVES**

1) Be familiar with ultrasound examination and anatomy of the shoulder and common pathology.

**ABSTRACT**

The goal of this live demonstration is to review shoulder ultrasound technique, which will be completed in 5 steps. The first step evaluates the long head of the biceps brachii tendon in short and long axis with the shoulder in neutral position. Step #2 with external rotation of the humerus evaluates the subscapularis in long and short axis, as well as the biceps brachii tendon for subluxation or dislocation. Step #3 evaluates the supraspinatus in long and short axis, as well as the distal infraspinatus tendon. Understanding the greater tuberosity facets is helpful in distinguishing between the supraspinatus and infraspinatus. Step #4 evaluates the acromioclavicular joint. With humerus abduction, the shoulder is also evaluated for subacromial impingement. Step #5 with the shoulder in neutral position evaluates the posterior glenohumeral joint recess, the posterior labrum, the spinoglenoid notch, and the infraspinatus muscle for fatty degeneration and atrophy. A comprehensive evaluation is essential to accurately diagnose shoulder pathology.

**VSMK31-02**

**Sonographic Median Nerve Cross Sectional Area Measurement in CTS Patients: Can Delta and Ratio Calculations Predict Severity Compared to Nerve Conduction Studies?**

Mohamed Mahmoud Hamdy Abd Ellah MD (Presenter): Nothing to Disclose, Thomas Auer MD: Nothing to Disclose, Eberle Gernot MD: Nothing to Disclose, Lenka Gerencerova MD: Nothing to Disclose, Sylvia
PURPOSE

To evaluate the role of high resolution US in prediction of carpal tunnel syndrome (CTS) severity compared to nerve conduction studies.

METHOD AND MATERIALS

643 wrists of 427 CTS patients (325 females and 102 males), age ranged between 17-90 years (57.9 +/- 14.7, mean +/- Std) were included in this study. CTS was diagnosed clinically and confirmed by nerve conduction studies (NCS). US was performed using a 14-8-MHz (LA424, 14-8 MPX; Esaote, Genoa-Firenze, Italy) or 18-6-MHz (LA435, MyLab90; Esaote) linear array transducer. CTS severity was classified according to NCS. Cross sectional measurements (CSA) of the median nerve was done at the level of the carpal tunnel (CSAc) and more proximally at the level of the pronator quadratus muscle (CSAp). Two parameters were calculated: Δ-CSA which is the difference between the proximal and distal measurements, and R-CSA which is the ratio calculated by dividing the distal over the proximal CSA.

RESULTS

Patients were classified into three groups (mild, moderate, and severe) according to severity by NCS. The mean CSA was (12.5, 14.7, and 18.8), mean Δ-CSA was (4.2, 6.95, and 10.7), and mean R-CSA was (1.5, 1.95, and 2.4) in all groups respectively with a significant difference between all groups (p<0.001). The cut off value was 5.5, and 8.5 between groups 1 and 2, and groups 3 and 4 respectively for Δ-CSA, while it was 1.7 and 2.2 between the same groups for R-CSA.

CONCLUSION

By implementing cut off values for the calculated parameters (Δ-CSA and R-CSA), high resolution US showed ability to predict CTS severity compared to NCS.

CLINICAL RELEVANCE/APPLICATION

1. The difference between cross-sectional areas of the median nerve measured at the level of the carpal tunnel (CSAc) and at the level of the pronator quadratus muscle (CSAp) - Δ-CSA - and the ratio between the two values - R-CSA - increases with the severity of Carpal tunnel syndrome (CTS). 2. Those parameters showed significant difference between different patient groups, which were classified according to nerve conduction study results (mild, moderate, and severe). 3. Better severity determination with Δ-CSA and R-CSA is obtained with better sensitivity and specificity values compared to measured CSAc alone especially for the differentiation between mild and moderate groups. 4. Cut off values were obtained for each parameter (Δ-CSA and R-CSA) between the different CTS severity groups.
For detection of rotator cuff tear in shoulders that have not undergone surgery, ultrasound (US), magnetic resonance imaging (MRI), and magnetic resonance arthrography (MRA) are all accurate methods with high sensitivity and specificity. However, imaging assessment of rotator cuff in postoperative shoulders can be challenging.

**VSMK31-04 Sonographic-guided Procedures (Demonstration)**


Kathy Quenneville BS, RT (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To demonstrate optimal techniques for performing sonographic-guided procedures.

**VSMK31-05 May Intratendinous US-guided Platelet Rich Plasma (PRP) Injection Modify the Natural History of Degenerative Tendinopathy of Rotator Cuff Tendons of the Shoulder? Results of 4 years of Clinical and MRI Follow-up**

Francesco Arrigoni (Presenter): Nothing to Disclose, Lorenzo Maria Gregori: Nothing to Disclose, Alice La Marra MD: Nothing to Disclose, Luigi Zugaro: Nothing to Disclose, Antonio Barile MD: Nothing to Disclose, Carlo Masciocchi MD: Nothing to Disclose

**PURPOSE**

There is currently no literature describing the diagnostic imaging of the long-term outcomes in case of US-guided PRP injection of the supraspinatus tendon. The aim of this study was to evaluate the evolution of the degenerative tendinopathy of the rotator cuff from the morphological (MRI images) and clinical point of view 4 years after treatment with US-guided PRP injection of the supraspinatus tendon, compared with patients submitted to medical and physical therapy alone.

**METHOD AND MATERIALS**

We retrospectively evaluated 240 patients (all patients with history of trauma or surgery during the follow-up were excluded), 120 treated 4 years before with US-guided PRP injection of the supraspinatus tendon (group 1, G1) and 120 submitted, over a 4 year period, to medical and physical therapy alone (group 2, G2). For each patient, 2 radiologists independently evaluated the MRI performed before and 4 years after the injection (G1) or, in the G2, 2 MRIs performed at the distance of 4 years from each other, dividing the results into 3 categories for each group: improvement, stationary findings or worsening. A clinical and functional evaluation was also performed (VAS and Constant scale).

**RESULTS**

We recorded an improvement in the MRI appearance of the supraspinatus tendon in 31.7% of the G1 and only in 3.3% of the G2; stationary findings were found in 48.3% in the G1 and in 34.2% in the G2, while worsening was of 20% in G1 and 62.5% in G2. Clinical evaluation: the mean VAS values showed improvement of 74.5% for the G1 and of 16.2% for G2; mean Constant values showed improvement of 56% (G1) and 9% (G2).

**CONCLUSION**

This study suggests that the US-guided PRP injection can be effectively used in the rotator cuff tendinopathy. Our results show the ability to regenerate and delay the degenerative processes: not only there is a higher percentage of patients with an improvement of the MRI appearance of the supraspinatus tendon 4 years after PRP injection, but also the number of patients that show a worsening of the MRI findings is lower in the G1 than in the G2. The clinical findings reflect positive outcomes in terms of pain relief and functional improvement.

**CLINICAL RELEVANCE/APPLICATION**

To evaluate, with a 4 year follow-up, clinical and functional effects and imaging findings of US-guided PRP injections of the supraspinatus tendon compared with natural history of tendinopathypath.

**VSMK31-06 Ultrasound-guided Perineural Injection of Upper Extremity and Sciatic Nerves: Does Single Needle Position Produce Circumferential Nerve Coverage?**

Ogonna Kenechi Nwawka MD (Presenter): Nothing to Disclose, Theodore T. Miller MD: Nothing to Disclose, Gregory Roy Saboeiro MD: Research funded, Terumo Corporation Speakers Bureau, Bioventus LLC, Shari Tamar Jawetz MD: Nothing to Disclose

**PURPOSE**

Our current clinical technique for ultrasound-guided perineural injection consists of placing the needle along both the superficial and deep surfaces of the nerve to obtain circumferential distribution of the injectate. This study aims to determine if a single needle position will produce circumferential coating of a nerve.

**METHOD AND MATERIALS**

For this IRB approved study, 6 upper extremity and 3 pelvic fresh cadaveric specimens were obtained. For the upper extremity, a 25 gauge hypodermic needle was positioned along the deep surface of the median nerve in the carpal tunnel, the radial nerve in the radial tunnel, and the ulnar nerve in the cubital tunnel, and 2 ml of dilute Omnimapue-300 contrast was injected for each nerve. In the pelvis, a 22 gauge spinal needle was positioned deep to the sciatic nerve, and 5 ml of contrast was injected. Thus, 18 upper extremity nerves (6
median, 6 radial, 6 ulnar) and 6 sciatic nerves were injected. All needle placements and injections were performed under ultrasound guidance by two experienced musculoskeletal radiologists. The specimens then underwent CT scanning, and the distribution of perineural contrast was assessed by a musculoskeletal radiologist not involved in the injections.

RESULTS

6/6 radial and 6/6 ulnar nerves demonstrated circumferential distribution of injectate on CT. Only 3/6 median nerves had circumferential coverage. 6/6 sciatic nerves demonstrated circumferential coverage on CT. The average length of spread for the upper extremity perineural injectate was 12.5 cm, with a range of 5.5 cm to 20 cm. For the sciatic nerves, the average length of spread was 10.3 cm, ranging from 6.4 cm to 15.5 cm.

CONCLUSION

Using the clinical volumes of injectate that we use for upper extremity nerves and the sciatic nerve, positioning adjacent to the deep surface of each nerve was sufficient to produce circumferential coating of the nerve, except in the tight fibroosseous space of the carpal tunnel.

CLINICAL RELEVANCE/APPLICATION

We no longer try to position the needle adjacent to two opposite sides of a nerve during ultrasound-guided perineural injections, except in the carpal tunnel.

Evaluating Bone Neoplasia: Ultrasound-guided Biopsy vs. Computed Tomography-guided Biopsy


PURPOSE

To compare the diagnostic accuracy of ultrasound (US)-guided biopsy with computed tomography (CT)-guided biopsy, regarding primary and metastatic bone lesions.

METHOD AND MATERIALS

A retrospective review was performed on 116 patients presenting with lesions of the appendicular skeleton and shoulder girdle that were suspicious for primary or metastatic bone malignancy. All patients underwent percutaneous needle core biopsy and/or fine needle aspiration (FNA) using CT (n = 83) or ultrasound (n = 33) guidance. Samples obtained by CT and ultrasound were then stratified by lesion characteristics (size, radiographic features, location), biopsy type (core vs FNA), and categorized as either Group A - Diagnostic or Group B - non-diagnostic. Diagnostic accuracy was based on comparison to surgical pathology and clinical outcome.

RESULTS

Overall accuracy of US-guided cases was 87.9% (29/33) whereas for CT-guided cases it was 87.9% (72/83). Biopsy results were further broken down by lesion size. For US, 88.9% of lesions 0-3cm were diagnostic, 85.7% of lesions 4-6cm were diagnostic, and 90% of lesions greater than 6cm were diagnostic. For CT, 80.0% of lesions 0-3cm were diagnostic, 92.9% of lesions 4-6cm were diagnostic and 81.3% of lesions greater than 6cm were diagnostic.

CONCLUSION

Ultrasound and CT have comparable diagnostic accuracy in the sampling of bone lesions, regardless of size.

CLINICAL RELEVANCE/APPLICATION

With comparable accuracy to CT and the benefits of lower cost, lack of radiation, and the ability to perform procedures at bedside, ultrasound is an ideal method for clinicians to investigate suspicious osseous lesions.

Sonography for Evaluation of Arthritis (Demonstration)

Etienne Cardinal MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To demonstrate comprehensive methods to evaluate joints for arthritis.

Ultrasound Findings in Hand Joints Involvement in Patients with Psoriatic Arthritis and Its Correlation with Clinical DAS28 Score

Priyanka Mahadeorao Naranje MBBS, MD (Presenter): Nothing to Disclose, Mahesh Prakash MBBS, MD: Nothing to Disclose, Aman Sharma: Nothing to Disclose, Sunil Dogra MBBS, MD: Nothing to Disclose, Niranjan Khandelwal MD: Nothing to Disclose

PURPOSE
To evaluate the ultrasound findings in hand joints in patients with psoriatic arthritis and correlate grayscale and power Doppler ultrasonography findings with Disease Activity Score 28.

**METHOD AND MATERIALS**

This prospective study was performed in 30 patients. Ultrasound evaluation of 28 joints of both hands was undertaken and various findings were recorded including synovial hypertrophy, power Doppler abnormality, soft tissue thickening, tendonitis, joint effusion, periosteal reaction and erosions. Composite ultrasound scores and Disease Activity Score 28 were calculated and compared.

**RESULTS**

Ultrasound detected more abnormalities in the hand joints than did clinical examination. The frequency of various ultrasound abnormalities were as follows: Synovial hypertrophy was seen in 100%, power Doppler abnormality suggesting hypervascularity in 36.7%, soft tissue thickening in 66.7%, periosteal reaction in 33.3%, erosions in 30% (mostly in DIP and PIP joints) and flexor tendonitis in 6.7% of patients. Significant correlation was found between Disease activity score 28 and gray-scale joint score (GSJS) (Spearman’s ρ: 0.499, P: 0.005), gray-scale joint count (GSJC) (ρ: 0.398, P: 0.029) and power Doppler joint score (PDJS) (ρ: 0.367, P: 0.046). There was a statistically significant difference between remission and low disease activity group, and moderate disease activity group in terms of GSJC, GSJS, PDJC and PDJS (P<0.05). These ultrasound measures were higher in moderate disease activity zone patients.

**CONCLUSION**

Ultrasound is a useful modality for the objective assessment of psoriatic arthritis, which can detect joint inflammation to a larger extent than clinically expected. Ultrasound including power Doppler can be used as a modality for assessment of severity of psoriatic arthritis as it correlates with the clinical scoring.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound including power Doppler is a very good modality for assessment of severity of psoriatic arthritis.

**Rhumatoid Arthritis: Correlations betwenn Ultrasound and Radiographic Images and betwewen Ultrasound and Clinical Findings**

Manel Limeme : Nothing to Disclose, Neila Benzina : Nothing to Disclose, Moncef Allegue MD : Nothing to Disclose, Houneida Zaghouani Ben Alaya : Nothing to Disclose, Senda Majdoub : Nothing to Disclose, habib amara : Nothing to Disclose, dejla bakir : Nothing to Disclose, Chakib Kraiem MD, DMD (Presenter): Nothing to Disclose

**PURPOSE**

To evaluate concordance between clinical examination and ultrasound of joints (hands) in an heterogeneous group of patients with rheumatoid arthritis (RA). To compare sonography with conventional radiography for the detection of erosions in the metacarpophalangeal (MCP) joints of patients with RA.

**METHOD AND MATERIALS**

Forty patients were included in a prospective, transversal, single-center study, whatever disease activity, duration or treatment. In each patient, both hands were evaluated for a total of 960 joints. Synovitis was scored using clinical examination, B-mode and power Doppler. Concordance between swelling joint by clinical examination, synovitis thickening by B-mode (grade 1 or higher) and inflammation by power Doppler (grade 1 or higher) was assessed by computing the kappa coefficient. Erosion sites were recorded using radiography and sonography and subsequently compared using each modality.

**RESULTS**

Clinical joint examination and ultrasound concordance was very low at the metacarpophalangeal joints (κ < 0.1) and was low at wrists (κ: 0.23 to 0.30). B-mode and power Doppler found 350 more synovitis than swollen joint count using clinical examination and up to 228 times more at metacarpophalangeal joints. Sonography detected 127 definite erosions in 56 of 100 RA patients, compared with radiographic detection of 32 erosions (26 % of which coincided with sonographic erosions) in 17 of 100 patients (P < 0.0001). The mean duration from the onset of symptoms was 3.46 months. Based on the clinical, biochemical and US scores the patients from our study presented early stages of RA. Also, statistically significant correlations were observed between the time elapsed from the onset, the changes highlighted by ultrasound and the stage of the disease.

**CONCLUSION**

Our study confirms that US evaluation of changes in the joints of the hand offers useful information for staging the diagnosis of RA as it determines the activity of the disease thanks to Doppler parameters. It is a reliable technique that detects more erosions than radiography, especially in early RA. This technology has potential in the management of patients with early RA and is likely to have major implications for the future practice of rheumatology.

**CLINICAL RELEVANCE/APPLICATION**

US evaluation of changes in the joints of the hand offers useful information for staging the diagnosis of RA as it determines the activity of the disease thanks to Doppler parameters.

**Supersonic Shear Imaging Identifies Potential Evidence of Localized Changes in Achilles Tendon**

VSMK31-10 VSMK31-11
Compliance in Middle-aged Adults

Laura Slane PhD (Presenter): Nothing to Disclose, Ryan J. DeWall PhD: Nothing to Disclose, Jack Martin: Nothing to Disclose, Kenneth S. Lee MD: Research Consultant, SuperSonic Imagine Speakers Bureau, Medical Technology Management Institute, Darryl Thelen: Nothing to Disclose

PURPOSE

Middle-aged adults exhibit increased incidence of Achilles tendon and calf muscle strain injuries. Age-related changes in tendon compliance are hypothesized to be a contributing factor, but assessing tissue compliance in vivo remains challenging. Supersonic Shear Imaging is an ultrasound elastography approach that noninvasively evaluates tissue compliance by measuring shear wave propagation speed (SWS). The purpose of this study was to compare spatial variations in SWS within the Achilles tendons of young and middle-aged adults.

METHOD AND MATERIALS

We recruited ten healthy young (27±4 yrs) and middle-aged adults (49±4 yrs). SWS images were collected from regions of the Achilles tendon, including the free tendon, the soleus aponeurosis and the medial gastrocnemius aponeurosis, at three ankle angles: resting (R), dorsiflexed (R-15 deg) and plantarflexed (R+15 deg). SWS data were evaluated post-hoc at regions of interest defined within tendon boundaries.

RESULTS

Achilles tendon SWS varied significantly with imaging location, with the greatest speeds measured in the free tendon. Ankle posture had a significant effect on SWS, with speed progressively increasing with ankle dorsiflexion along the entire tendon length. A significant, inverse relationship between resting gastrocnemius aponeurosis SWS and age (R²=0.34, p<0.01) was observed, but there were no age-effects in the free tendon or soleus aponeurosis. A similar relationship existed in the gastrocnemius aponeurosis in the dorsiflexed posture (R²=0.55, p<0.01).

CONCLUSION

We observed age-related changes in Achilles tendon SWS to be location dependent, with evidence of a significant increase in compliance in the gastrocnemius aponeurosis of middle-aged adults. Our results suggest that Achilles tendon compliance increases in a distal-to-proximal fashion, with greater compliance at the muscle-tendon junction. Middle-aged adults seem to exhibit greater tendon compliance near the muscle-tendon junction, which could give rise to localized tissue strain concentrations and hence injury risk.

CLINICAL RELEVANCE/APPLICATION

These results demonstrate the potential for Supersonic Shear Imaging to quantitatively characterize spatial variations in tendon elasticity that may be affected by aging, injury and disease processes.

Evaluation of the Median Nerve and Carpal Tunnel Tendons in Patients with Carpal Tunnel Syndrome using Transient Elastography

Renata La Rocca Vieira MD (Presenter): Nothing to Disclose, Ronald Steven Adler MD, PhD: Nothing to Disclose, Kiril Kiprovski: Nothing to Disclose, James S. Babb PhD: Nothing to Disclose

PURPOSE

Carpal tunnel syndrome (CTS) is caused by compression or irritation of the median nerve (MN) within the carpal tunnel (CT). The diagnosis of CTS might be challenging given the lack of typical clinical or EMG findings. We aim to prospectively determine whether shear wave analysis provides useful adjunctive and quantitative information regarding the diagnosis of CTS.

METHOD AND MATERIALS

This prospective work in progress included 5 patients-10 wrists (5 F, age range 41-70y, mean 55.6y) with clinically proven CTS and 4 healthy volunteer- 8 wrists (4 f, age range 32-45y, mean 39y). In both groups, the following measurements were performed: MN cross-sectional areas (CSA) in the CT and in the pronator quadratus (PQ); shear wave velocities in the longitudinal and axial planes (SWV) for MN and CT tendons. The differences between CTS patients and controls with regards to MN CSA and MN and tendon velocities were assessed with 9MHz linear transducer and S3000 scanner (Siemens, Mountainview, CA). A 2-dimension parametric SWV image was generated, from which selective SWV could be calculated.

RESULTS

The CSA in the patients with CTS was significantly higher than those in the volunteers (p<0.001). In the CTS group, the difference between MN CSA in CT and PQ was significant (p=0.006). The tendon velocity was significantly higher in the CTS group compared to controls, in both axial (P <0.017) and longitudinal (p< 0.001) planes. No significant difference was found between the velocities of the MN in any plane between CTS and volunteers. The mean velocities/SD of the MN in the axial and longitudinal planes in the CTS group and volunteers are respectively 6.13/2.55 and 7.97/2.12 and 7.21/1.67 and 7.59/0.83. The difference between the velocities of the MN in the longitudinal versus axial planes is significant (p=0.011) in the CTS group.

CONCLUSION

The stiffness of the CT tendons is significantly higher in patients with CTS. Preliminary data did not find significant difference between the velocities of the MN between CTS and volunteers, likely due to small sample size.
size. Interestingly, the difference between the velocities of the MN in the longitudinal versus axial planes is significant probably due to anisotropy.

**CLINICAL RELEVANCE/APPLICATION**

The pathophysiology of CTS is a combination of increased CT pressure and ischemic injury in the MN. Our results suggest the same theory can be applied to the tendons in the CT in patients with CTS.

**VSMK31-13**

**Superb Microvascular Imaging (SMI) and Detection of Low Grade Musculoskeletal Inflammation**

Adrian Kuok Pheng Lim MD, FRCR (Presenter): Luminary, Toshiba Corporation, Keshthra Satchithananda MBBS: Committee member, Johnson & Johnson, Sonya Abraham: Nothing to Disclose, Elizabeth Ann Dick MD, FRCR: Nothing to Disclose, David Owen Cosgrove MBCh, FRCR: Research Consultant, SuperSonic Imagine Research Consultant, Bracco Group Speakers Bureau, Toshiba Corporation

**PURPOSE**

To assess the efficacy of Superb Microvascular Imaging (SMI) in detecting low grade inflammation in joints and tendons compared with conventional Power Doppler ultrasound (PDUS).

**METHOD AND MATERIALS**

SMI is a new and sensitive Doppler technology designed to detect slow flowing microvasculature. We assessed it in patients who presented for routine MSK ultrasound (Aplio 500, Toshiba Medical Systems). The grey-scale, PDUS and SMI findings of each study were recorded on video clips. The joints and tendons which demonstrated an abnormality or vascular signal on either grey-scale appearance, PDUS or SMI were included in the analysis. Three radiologists with over 10 years experience individually in MSK ultrasound assessed the images and scored whether there were grey-scale changes, signal on PDUS and/or SMI within the joints or tendons examined. If signal was detected on PDUS and SMI, they also scored a four point scale comparing the two Doppler techniques (no difference, mildly, moderately or markedly better).

**RESULTS**

50 cases have been analyzed to date, comprising of 36 joints, 9 tendons, and 5 superficial lumps. In all cases, patients were symptomatic with joint pain or a palpable lump and 12 had a history of an inflammatory arthropathy. There was very good agreement between the readers (Kappa = 0.85). 29 cases demonstrated vascular flow with both PD and SMI while in 5 cases, no flow was detected with either technique. In 16 cases, vascularity was detected with SMI but not with PDUS (Fisher's exact test: p = 0.02). Out of the 29 patients with vascularity on SMI and PDUS, 3 showed no difference; while SMI scored moderately or markedly better in 20 cases (Chi²: p<0.02). In 12 patients, the SMI findings altered patient management where they either received an ultrasound guided steroid injection or started oral analgesia and/or disease modifying treatment.

**CONCLUSION**

SMI is a revolutionary Doppler technique which not only improves the visualisation of the microvasculature but allows detection of low grade inflammation not previously visualised with Power Doppler. This has significant clinical impact leading to a change in management in 25% of the patients in this study population.

**CLINICAL RELEVANCE/APPLICATION**

The improved sensitivity of SMI compared with the current 'gold standard' Power Doppler, allows the detection of low grade inflammation not possible with Power Doppler which would significantly influence patient treatment.

**VSMK31-14**

**Interesting Musculoskeletal Ultrasound Cases**

Benjamin David Levine MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be familiar with important topics in musculoskeletal ultrasound.

**ABSTRACT**

The goal of this presentation is to emphasize important teaching points through a series of interesting musculoskeletal ultrasound cases. Ultrasound imaging features of various musculoskeletal disease processes will be highlighted, along with review of case specific anatomy and technique.

**SSG09**

**ISP: Musculoskeletal (Muscle to Tendon - Sports and Clinical Practice)**

*Scientific Papers*  

**MR**  

AMA PRA Category 1 Credits™: 1.50  
ARRT Category A+ Credits: 1.50  

**Tue, Dec 2 10:30 AM - 12:00 PM** Location: E450B

**Participants**
**SSG09-01**

**Musculoskeletal Keynote Speaker: Muscle to Tendon—Structure and Mechanism Dictate Patterns of Injury**

David Alan Rubin MD (Presenter): Nothing to Disclose

**SSG09-03**

**Magnetic Resonance Imaging (MRI) of Muscle Strains of the Thigh in Professional Soccer players: Correlation of Imaging Findings with the Duration of Convalescence and Presentation at Return to Play**

Marc Regier (Presenter): Nothing to Disclose, Cyrus Behzadi: Nothing to Disclose, Frank Oliver Gerhard Hennes MD: Nothing to Disclose, Chressen Catharina Remus MD: Nothing to Disclose, Gerhard B. Adam MD: Nothing to Disclose, Philip Catala-Lehnen: Nothing to Disclose

**PURPOSE**

To determine the prognostic value of MRI for the estimation of the rehabilitation period after thigh muscle injury in professional soccer players and to evaluate imaging findings at return-to-play (RTP).

**METHOD AND MATERIALS**

During three consecutive seasons 87 thigh muscle injuries were examined at 3T MRI in 47 players of the highest professional level. The predefined imaging protocol included coronal and transversal T2w STIR, T2w TSE, DWI and T1w TSE sequences. Identical scans were performed the day after the injury occurred and on the day of RTP. All MRI data sets were independently read by two blinded radiologists and muscle injuries were graded applying Peetrons classification system (grade 0-3). Additionally, transversal area measurements of the muscle were performed and the percentage of the affected portion was recorded reading T2w and DWI images at the time of injury and RTP. The grade of muscle injury and the affected transversal muscle area were correlated to the duration of the rehabilitation period. Statistical analysis included Wilcoxon-matched-pairs and Chi-square test.

**RESULTS**

Muscle injuries were assigned grade 0 in 4.6% (4/87), grade 1 in 64.3% (56/87), grade 2 in 27.6% (24/87) and grade 3 in 3.4% (3/87). The mean duration of the rehabilitation correlated well with the severity of injury in all grades (grade 0, 6 days; grade 1, 12 days; grade 2, 20 days; grade 3, 46 days; p

**CONCLUSION**

In professional soccer players, MRI based grading and transversal area measurements of thigh muscle injury strongly correlate with the duration of convalescence and can be used to estimate players time of absence. Even at relief of symptoms and return to maximum physical exertion a decreasing though persistently elevated signal at fluid-sensitive T2w and DWI MRI can frequently be observed.

**CLINICAL RELEVANCE/APPLICATION**

MRI can be referred to as a valuable tool in the prognostication of thigh muscle injuries in professional soccer players, however, normalisation of imaging findings is not mandatory for return to play.

**SSG09-04**


Michel D. Crema MD (Presenter): Shareholder, Boston Imaging Core Lab, LLC, Ali Guermazi MD, PhD: President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgaA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc, Johannes Tol MD, PhD: Nothing to Disclose, Jingbo Niu: Nothing to Disclose, Bruce Hamilton: Nothing to Disclose, Frank W. Roemer MD: Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC

**PURPOSE**

To describe in detail the anatomic distribution of acute hamstring injuries in soccer players, including which muscles are affected and the locations of the injuries within each muscle, and to assess the relationship between location and extent of edema and tears (fiber disruption), all based on findings from MRI.

**METHOD AND MATERIALS**

We included 275 consecutive male soccer players who had sustained acute hamstring injuries and had positive findings on MRI. For each subject, lesions were recorded according to the presence of typical MRI features in specific locations (and groups of locations) of the hamstring muscles, which were divided into proximal or distal: Free tendon, myotendinous junction locations, muscle belly locations, and myofascial junction locations. For each lesion, we assessed the largest cross-sectional area of edema and/or tears (when present). We calculated the prevalence of injuries by location. The average value of edema and tears for each hamstring muscle was determined, considering the whole sample, and used as the reference standard. The relationships between locations and extent of edema and tears were assessed using a one-sample t-test, with significance set at p<0.05.

**RESULTS**

The sample included 393 lesions. The long head of biceps femoris (LHBF) was the most commonly affected muscle (56.5%). Overall, injuries were most common in the myotendinous junction and in proximal locations.
The proximal myotendinous junction was associated with a greater extent of edema in the LHBF and semitendinosus muscles (p<0.05). Proximal locations in the LHBF had larger edema than distal locations (p<0.05). Distal locations in the semitendinosus muscle had larger tears than proximal locations (p<0.05).

CONCLUSION

The proximal myotendinous junction and proximal locations in general are more commonly affected and are associated with a greater extent of edema in acute hamstring muscle injury. Distal locations, however, seem to be associated more with larger tears.

CLINICAL RELEVANCE/APPLICATION

Knowledge of the findings and relationships between hamstring muscle injury location and extent of edema and tears could potentially give useful prognostic information and guide physicians in the management of the injured athletes, since previous studies have shown that the extent of injury is associated with important clinical features such as time of recovery and risk of re-injury.

Prevalence of Sciatic Nerve Abnormalities in the Setting of Hamstring Injuries

Ryan Christian Barnett  Foster  MD (Presenter):  Nothing to Disclose , Theodore T.  Miller  MD :  Nothing to Disclose , Darius Paris  Melisaratos  MD :  Nothing to Disclose , Alissa Jo  Burge  MD :  Nothing to Disclose

PURPOSE

To determine the prevalence of sciatic nerve abnormalities on MRI in the setting of acute and chronic hamstring tears.

METHOD AND MATERIALS

IRB approval was obtained and informed consent was waived. We searched our PACS system for MRI of the hamstrings performed between January 2011 and November 2013, and identified 168 patients with either acute or chronic tears. We then reviewed the images of these patients and identified a cohort in which the sciatic nerve looked abnormal, and correlated these findings with clinical notes from the office visits of these patients. MRI was performed using either a 1.5 or 3T magnet (GE Healthcare) with a cardiac or body coil. The protocol included coronal and axial inversion recovery and proton density sequences. Initial image interpretation was performed by any 1 of 11 fellowship-trained musculoskeletal (MSK) radiologists. An MSK fellow then reviewed all of the MRI examinations to confirm the findings. The hamstring tears were characterized as partial or complete and acute/subacute or chronic. Partial tears were further subclassified as low, moderate or high grade. The sciatic nerve was evaluated for abnormalities in signal and morphology, and for extrinsic compression. Neither the original MSK radiologist reading the case nor the MSK fellow knew which patients had clinical findings of sciatica in all but 2 cases.

RESULTS

47 of the 168 cases of hamstring tear (28%) had MRI features of sciatic nerve abnormality/compression. 36/47 (77%) had acute/subacute hamstring tears and 11/47 (23%) had chronic tears. 29/47 (62%) were full thickness tears and 18/47 (38%) were partial thickness. Clinically, only 10/47 had symptoms referable to the sciatic nerve (21%), 6 of which were associated with an acute/subacute hamstring tear and the other 4 with a chronic tear. 7 of the 10 clinically symptomatic cases were associated with full thickness tears and 3 were associated with low to moderate grade partial thickness tears.

CONCLUSION

The sciatic nerve may look abnormal in almost a third of hamstring injury cases, and yet is clinically symptomatic in only one-fifth of those abnormal appearances.

CLINICAL RELEVANCE/APPLICATION

The sciatic nerve may look abnormal on MR imaging of hamstring tears, but is usually not clinically symptomatic.

Infraspinatus Tendon Tears with an Intact Footprint: Imaging Features and Anatomic and Clinical Relevance

Brady Kirk  Huang  MD (Presenter):  Nothing to Disclose , Eric Y.  Chang  MD :  Nothing to Disclose

PURPOSE

We aim to describe the imaging features of infraspinatus tendon tears that occur adjacent to an intact footprint. Isolated injuries of the infraspinatus tendon have been designated in the literature as a ‘novel lesion’ from a tendon versus myotendinous injury (Lunn JV, et al. J Shoulder Elbow Surg. 2008). Based on retrospective review of our own cases, we postulate that these injuries may be related to a layered anatomy of the infraspinatus tendon, with a superficial (transverse) tendon inserting onto a deeper (oblique) tendon, the latter of which inserts on the greater tuberosity (Kato A et al. Surg Radiol Anat. 2012).

METHOD AND MATERIALS

This retrospective chart review study was performed performed over a 3 year period from January 2010 to
December 2012. A key word search for the term "novel lesion" was applied to the search algorithm, as we began to document these cases in our reporting lexicon. MR images of all patient were retrospectively reviewed in addition to the clinical and surgical data, if available.

RESULTS

The average age at presentation was 50.8 years (range=24.2-69.3). 2 patients had a traumatic fall prior to presentation and 8 recalled a single event that lead to symptoms, such as lifting or throwing. The remaining 7 patients presented with pain without preceding injury. All patients showed myotendinous junction edema of the infraspinatus muscle and variable degrees of retraction of bursal-sided fibers, with an intact footprint. 8 patients eventually underwent arthroscopic surgery with an average time of 116 days from initial presentation. Average follow-up time after surgery was 141.8 days. Tendon repairs were performed in 6 patients and debridement in 2 patients. Only 2 patients shows bursal-sided tendon tearing potentially corresponding to the MRI. One repair failed. 3 patients underwent follow-up MRI, with 2 showing progression of infraspinatus muscle atrophy.

CONCLUSION

Partial tears of the infraspinatus tendon, especially when affecting the bursal surface fibers with an intact footprint, are likely the result of delamination of the superior (transverse) part from the inferior (oblique) part of the tendon, resulting in characteristic imaging appearances.

CLINICAL RELEVANCE/APPLICATION

Infraspinatus tendon injuries with an intact footprint are unusual injuries with a characteristic imaging appearance, and may be missed on arthroscopy, even when prospectively identified on pre-operative imaging.

SSG09-07

Biceps Femoris Tendon and Lateral Collateral Ligament: Analysis of Insertion Pattern Using MRI

Yunkyung Shin (Presenter): Nothing to Disclose, Kyung Nam Ryu MD, PhD: Nothing to Disclose, Ji Seon Park MD, PhD: Nothing to Disclose, Wook Jin: Nothing to Disclose, Han Na Lee MD: Nothing to Disclose, So Young Park: Nothing to Disclose

PURPOSE

Biceps femoris tendon (BFT) and lateral collateral ligament (LCL) in knee were formerly known to form a conjoined tendon at fibular attachment site. However, biceps femoris tendon lateral collateral ligament insert into the fibular head in a variety of patterns. Understanding of such anatomical variance would help to reduce misdiagnoses in the corresponding area. We classified insertion patterns of BFT and LCL using MR imaging, and analyzed whether LCL attaches to fibular head or not.

METHOD AND MATERIALS

A total of 494 consecutive knee MRIs of 470 patients taken between July 2012 and December 2012 were retrospectively reviewed. There were 224 males and 246 females, and the patient age varied from 10 to 88 (mean, 48.6). The exclusion criteria were previous surgery and poor image quality. Using 3T fat-suppressed proton density-weighted axial images, fibular insertion patterns of BFT and LCL were classified into the following types: type I (LCL passes between anterior arm and direct arm of long head of BFT), type II (LCL joins with anterior arm of long head of BFT), type III (BFT and LCL join to form a conjoined tendon), type IV (LCL passes laterally around the anterior margin of BFT), and type V (LCL passes posteriorly to the direct arm of long head of BFT).

RESULTS

Among the 494 cases of knee MRI, there were 433 (87.65%) type I cases, 21 (4.25%) type II cases, 2 (0.4%) type III cases, 16 (3.23%) type IV cases, and 22 (4.45%) type V cases. There were 26 cases (5.26%) in which LCL and BFT did not insert into fibular head.

CONCLUSION

Only a small fraction of subjects showed a conjoined tendon at fibular insertion of BFT and LCL. Fibular attachment pattern of BFT and LCL shows various types in MR imaging. Lateral collateral ligaments do not insert into the fibular head in some patients.

CLINICAL RELEVANCE/APPLICATION

An understanding of insertion pattern of BFT and LCL will be helpful to evaluate tendons in reading knee MRIs.

SSG09-08

Gastrocnemius Tendinosis- An Overlooked Finding on Knee MRI Examinations

Anugayathri Jawahar MBBS, MD (Presenter): Nothing to Disclose, Yanan Lu MD: Nothing to Disclose, Gokcan Okur MD: Nothing to Disclose, Laurie McAdams Lomasney MD: Consultant, Amirsys, Inc

PURPOSE

Gastrocnemius tendinosis (GT) is one potential cause for posterior knee pain, commonly overlooked on clinical examinations and imaging. Tendinosis/tendinopathy is frequently due to chronic repetitive micro trauma to
muscle/tendon complex. There is little mention about GT in literature. This study assesses the frequency of GT on MR imaging and potential associated articular pathologies or clinical association.

**METHOD AND MATERIALS**

With IRB approval, retrospective review was done on randomly selected 300 MR knee exams performed from February 2009 to June 2010. Following de-identification, axial T2 and sagittal PD images, with or without fat suppression were reviewed by 2 radiologists. The gastrocnemius tendon femoral attachments were graded as normal, mild (few cysts, thickening, intermediate signal) or severe GT (multiple cysts, marrow edema, tear). Select associated MR findings of internal derangement were documented. Clinical charts were reviewed for clinical presentation, physical exam findings, and select demographics including age, gender, BMI, occupation and recreational activities.

**RESULTS**

The inter-observer reliability for presence/ grading of GT very high (kappa statistic=0.97). Frequency of GT was 50.33%, most frequently medial head of gastrocnemius (63.6%). Grades of GT were 41.7% and 17.2% for mild and severe respectively. Univariate analysis showed statistically significant relationship between grade of GT with arthrosis (p=0.05) and clinical joint effusion (p=0.02). Multivariate analysis showed significant probability odds for medial plus lateral GT when effusion and posterior knee pain are present, and significant but decreased probability for isolated medial GT. Statistical significance was seen between GT and ACL tear (13.9%; p=0.02) but not for medial meniscal tear, popliteal cyst and chondrosis. Mean age for GT patients was 50.4 years, older than those without (p=<0.001). BMI and gender showed no statistically significant difference between with and without GT.

**CONCLUSION**

Gastrocnemius tendinosis is an under-reported finding on MR knee examinations. Increased understanding of frequency of GT allows more accurate reporting of MR knee exam and systematic search for associated abnormalities.

**CLINICAL RELEVANCE/APPLICATION**

Awareness of gastrocnemius tendinosis enhances knee MR interpretation, especially in setting of posterior knee pain, and can assist clinical management.

**SSG09-09 Edema between the Sartorius/Gracilis Tendons and Posteromedial Femoral Condyle: Description of a New Friction Syndrome in the Knee**

Frank J. Simeone MD (Presenter): Nothing to Disclose, Ambrose J. Huang MD : Nothing to Disclose, Maximilian Smith : Nothing to Disclose, Connie Y. Chang MD : Nothing to Disclose, Miriam Antoinette Bredella MD : Nothing to Disclose, Martin Torriani MD : Nothing to Disclose

**PURPOSE**

Medial joint line pain in the knee is often secondary to meniscal tears or osteoarthritis. The purpose of this study is to describe a new cause of medial knee pain, characterized by edema between the gracilis/sartorius tendons and medial femoral condyle (MFC).

**METHOD AND MATERIALS**

The study group comprised 31 patients with findings of edema between the sartorius/gracilis tendons and the posteromedial femoral condyle (mean age 36.6±8.5 years, 29 female, 1 male, BMI 22.9±3.3) and 27 age- and gender-matched controls. Cases were reviewed by two subspecialist radiologists with 2 and 17 years of experience for soft tissue findings, distance between gracilis tendon and medial femoral condyle, distance between sartorius tendon and MFC, knee flexion angle, position of gracilis tendon with respect to sartorius and presence or absence of related findings including Baker’s cyst and pes anserine bursitis. Clinical notes were reviewed and history and physical exam data were recorded.

**RESULTS**

Study patients with findings of edema demonstrated significantly lower BMI (P<0.05) and distance between the gracilis tendon and MFC (p<0.05) compared to controls. There was no significant difference between age, sartorius distance, knee flexion angle or other incidental findings in the knee. Study patients were often mistaken for medial meniscus tears clinically (70%). Ultrasound guided steroid and anesthetic injection of the MRI-identified area of edema between tendons and MFC resulted in immediate and up to 2 months of pain relief in 2 subjects.

**CONCLUSION**

MRI findings of focal soft tissue edema between the sartorius/gracilis tendons and medial femoral condyle represents a clinical syndrome of knee medial joint line pain. Subjects are more likely to be female, have lower BMI and closer position of the gracilis tendon relative to the MFC.

**CLINICAL RELEVANCE/APPLICATION**

This study describes a new cause of medial joint line pain with reproducible clinical and imaging findings which should be considered on the differential of medial sided pain.
**MKS-TUA**

**Musculoskeletal Tuesday Poster Discussions**

*Scientific Posters*

**MKS**

AMA PRA Category 1 Credits ™: .50

**Tue, Dec 2 12:15 PM - 12:45 PM  Location: MK Community, Learning Center**

**Participants**

**Moderator**

Hatice Tuba Sanal MD : Nothing to Disclose

**Sub-Events**

**MKS365**

**Diffusion Tensor Imaging with Quantitative Evaluation and Fiber Tractography of Lumber Nerve Roots in Sciatica (Station #1)**

Yin Shi (Presenter): Nothing to Disclose , Min Zong MD, PhD : Nothing to Disclose , Dehang Wang MD : Nothing to Disclose

**PURPOSE**

To quantitatively evaluate nerve roots by measuring fractional anisotropy (FA) values in healthy volunteers and sciatica patients, visualize nerve roots by tractography, and compare the diagnostic efficacy between conventional magnetic resonance imaging (MRI) and DTI.

**METHOD AND MATERIALS**

Seventy-five sciatica patients and thirty-six healthy volunteers underwent MR imaging using DTI. FA values for L5-S1 lumbar nerve roots were calculated at three levels from DTI images. Tractography was performed on L3-S1 nerve roots. ROC analysis was performed for Pfirrmann grade and FA values.

**RESULTS**

The lumbar nerve roots were visualized and FA values were calculated in all subjects. FA values decreased in compressed nerve roots and declined from proximal to distal along the compressed nerve tracts. Mean FA values were more sensitive and specific than MR imaging for differentiating compressed nerve roots, especially in the far lateral zone at distal nerves.

**CONCLUSION**

DTI can quantitatively evaluate compressed nerve roots, and DTT enables visualization of abnormal nerve tracts, providing vivid anatomic information and localization of probable nerve compression. DTI has great potential utility for evaluating lumbar nerve compression in sciatica.

**CLINICAL RELEVANCE/APPLICATION**

DTI is able to quantitatively evaluate compressed nerve roots and has a higher sensitivity and specificity for diagnosing sciatica than conventional MR imaging. Additionally, DTT enables visualization of abnormal nerve tracts, providing vivid anatomic information and probable localization of nerve compression.

**MKS366**

**Diffusion-weighted MR Neurography of Nerves in Wrist and Palm and the Initial Clinical Applications (Station #2)**

Shanshan Wang (Presenter): Nothing to Disclose , Guangbin Wang MD : Nothing to Disclose

**PURPOSE**

To demonstrate the feasibility of diffusion-weighted (DW) magnetic resonance (MR) neurography of nerves in wrist and palm and evaluate the potential clinical applications

**METHOD AND MATERIALS**

This study was approved by local institutional review board, and informed consent was obtained. Total forty-two healthy volunteers and seven patients underwent DW MR neurography of nerves in wrist and palm at a 3.0-T magnetic resonance system. DW MR neurography images were displayed using a three-dimensional (3D) maximum intensity projection and blindly evaluated by two radiologists in consensus using a four-point grading scale (1 = poor [the nerves were twist seriously, and recognized difficulty]; 2 = moderate [the nerves were twist but the branches can be recognized]; 3= good [the branches were displayed clearly, ill-defined margin]; 4=excellent [the branches were displayed clearly, well-defined margin]). In patients, the relation of the lesion to adjacent nerves were evaluated.

**RESULTS**
The trajectory of median and ulnar nerve in wrist, the branches of median nerve including the lateral and medial portion and three proper volar digital nerves, superficial and deep branches of ulnar nerve could be visualized on DW MR neurography images. In volunteers, image quality of nerves in wrist and palm was all graded as excellent. The mean score of all nerves and their branches were 3.45±0.74 and 3.43±0.67 for observers 1 and 2, respectively. Interobserver agreement was good(κ=0.793). In patients, there was no discrepancy in imaging quality scores between observers. Scores of all nerves were 2-4. The extent of lesions and the relationship with nerves were displayed clearly on DW-MRN images of 7 patients.

CONCLUSION

DW MR neurography is feasible for providing three-dimensional visualization of median and ulnar nerves and their main branches in wrist and palm. Our preliminary results suggest that the use of DW MR neurography, as complementary to conventional MR imaging, may enable nerve depiction and allow assessment of the anatomic relationship between lesions with diffusion restriction and adjacent nerves.

CLINICAL RELEVANCE/APPLICATION

DW MR neurography may enable nerve depiction in wrist and palm and allow assessment of the anatomic relationship between lesions and adjacent nerves

Efficacy of Diffusion-weighted MRI in Diagnosing Spinal Root Disorders in Lumbar Disc Herniation (Station #3)

Hiroyuki Takashima PhD (Presenter): Nothing to Disclose, Tsuneo Takebayashi MD, PhD: Nothing to Disclose, Mitsunori Yoshimoto MD, PhD: Nothing to Disclose, Yoshinori Terashima MD, PhD: Nothing to Disclose, Kazunari Ida MD, PhD: Nothing to Disclose, Rui Imamura: Nothing to Disclose, Yoshihiro Akatsuka RT: Nothing to Disclose, Hiroki Shishido RT: Nothing to Disclose, Motomichi Sakata PhD, RT: Nothing to Disclose, Toshihiko Yamashita MD, PhD: Nothing to Disclose

PURPOSE

In this study, we captured diffusion-weighted imaging (DWI) of dorsal root ganglion (DRG) of the affected nerve root in lumbar disc herniation and examined the relationship between apparent diffusion coeffi cient (ADC) and clinical symptoms to evaluate the effi cacy of DWI in the diagnosis of lumbar spinal disorders.

METHOD AND MATERIALS

The subjects were patients who underwent surgical management of unilateral radiculopathy caused by a single level lumbar disc herniation where the affected nerve root could be easily identified. The clinical symptoms of all the subjects (total 30; 19 males, 11 females; average age: 44.3 ± 15.5 years) were consistent with the imaging findings. We analyzed the relationship between morbidity duration, Visual analogue scale (VAS) score, and ADC. In addition, we investigated any correlation between the improvement rate of VAS before and after surgery with ADC.

RESULTS

When compared to the contralateral intact side, ADC of the affected nerve root was observed to increase in 18 subjects and decrease in 12 subjects and thus no definite trend were observed. In cases showing a decrease in ADC on the affected side, the VAS recovery ratio was low, suggesting that patients with decreased ADC tended to show poor improvement of leg symptoms.

CONCLUSION

This study showed that patients with decreased ADC tended to show poor improvement of leg symptoms, which may suggest the possibility that ADC of DRG is related to neuronal plasticity.

CLINICAL RELEVANCE/APPLICATION

The evaluation of DRG using ADC calculated from the DWI data may be available for a variety of spinal disorders such as lumbar spinal stenosis.

Increased Signal Intensity at the Proximal Patellar Tendon: MR Imaging-Histologic Correlation in Five Cadavers and MR Imaging Studies of 84 Patients (Station #4)

Seong Jong Yun (Presenter): Nothing to Disclose, Wook Jin: Nothing to Disclose, Gou Young Kim MD, PhD: Nothing to Disclose, Yong Koo Park MD, PhD: Nothing to Disclose, Woo Jin Yang: Nothing to Disclose, Kyung Jin Lee MD: Nothing to Disclose, Ji Su Kim: Nothing to Disclose, Sohee Yoon MD: Nothing to Disclose, So Young Park: Nothing to Disclose, Jung Eun Lee: Nothing to Disclose, Ji Seon Park MD, PhD: Nothing to Disclose, Kyung Nam Ryu MD, PhD: Nothing to Disclose

PURPOSE

During evaluation of the knee MR images, we can often observe increased signal intensity (SI) in the posterior portion of the proximal patellar tendon (PT) on T1-weighted images (T1WI), which shows no signal suppression on fat-suppressed sequences. Therefore, we correlated the MR findings with the histologic findings in 5 cadavers to investigate the cause of signal change, and also retrospectively evaluated SI of the PTs in 84
METHOD AND MATERIALS

MR imaging was performed in 5 cadavers followed by gross histologic correlation. To compare SI of the PTs, 84 patients (31 men, 53 women) without trauma history and anterior knee pain were included in this study. Length and thickness of increased SI portion in the proximal PT on T1WI were recorded and we divided these 84 patients into 3 groups as follows; between 20 and 39 years old (group 1, n = 21), between 40 and 59 years old (group 2, n = 37), and above 60 years old (group 3, n = 26). Demographic characteristics, length, and thickness of the PTs of the 84 patients were also recorded and compared in the 3 groups.

RESULTS

Histologic specimens of 5 cadavers showed the fat, vessels, and connective tissue invaginating into the posterior portion of the proximal PT, corresponding to signal change of the tendon on MR imaging. Linear increased SI of proximal PT was seen in all of 84 patients (100%) on T1WI. There were no differences in length and thickness of increased SI portion among the 3 groups (p > 0.05). No differences in demographic characteristics, length, and thickness of the PTs were also found among the 3 groups (p > 0.05).

CONCLUSION

On T1WI and fluid-sensitive MR images, a normal PT can present linear increased SI without any disease process, which results from invaginating intratendinous fat, vessels, and connective tissue. It was not related to the age, sex, and size of the PT. Therefore, this might be a normal finding without clinical significance.

CLINICAL RELEVANCE/APPLICATION

The linear increased SI of proximal PT on T1WI and fluid-sensitive MR images is not a pathologic or degenerative condition, but a common normal finding.

MKS370

Correlation between BMD Measurements on Unenhanced Routine CT Scans Using a Phantom-less Measurement Tool and the 10-year Fracture Probability Calculated by FRAX® (Station #6)

Andrea Toelly (Presenter): Nothing to Disclose, Constanze Bardach: Nothing to Disclose, Michael Weber: Nothing to Disclose, Rui Gong: Nothing to Disclose, Yanbo Lai: Nothing to Disclose, Pei Wang: Nothing to Disclose, Yanbo Lai: Nothing to Disclose, Pei Wang: Nothing to Disclose, Michael Gruber MD: Nothing to Disclose

PURPOSE

To evaluate the correlation between bone mineral density (BMD) measurements on unenhanced, routine CT scans using a phantom-less measurement tool and the 10-year fracture probability calculated by the FRAX® tool. In addition, the ability to identify a potentially aggravated fracture risk using this measurement tool was investigated.

METHOD AND MATERIALS

Seventy-seven postmenopausal women (mean age: 57.2 years), who underwent a routine, unenhanced CT scan, were included. The mean BMD value of each patient, including the Th12 - L4 vertebrae, was calculated retrospectively using a commercially available phantom-less measurement tool. Exclusion criteria were vertebral fractures, and sclerotic or osteolytic bone lesions. A minimum of two measurable vertebrae was required. In addition, the patient’s 10-year probability of a major osteoporotic fracture and of a hip fracture were calculated using the FRAX® tool without including DXA-BMD values.

RESULTS

Mean BMD values of patients with a 10-year probability of a major osteoporotic fracture ≥5% differed significantly compared to patients with a FRAX® score <5% (mean BMD value ≥5%: 59.13 mg/cm³; <5%: 83.32 mg/cm³; t=3.460, p=0.001). Phantom-less BMD measurements correlated significantly (p<0.001) with the fracture risk evaluated by FRAX® (Pearson correlation coefficient: major osteoporotic fracture risk R=-0.526, hip fracture risk R=-0.464). With a threshold of about 70 mg/cm³, the sensitivity was 75%, with a false-positive rate of 36.8%. However, with a threshold of about 80 mg/cm³ the sensitivity was 80% and the false-positive rate raised up to 50.9%. The intra-rater agreement of BMD measurements was calculated with an intraclass correlation (ICC) of 0.986, and the inter-observer reliability was calculated with an ICC of 0.987.

CONCLUSION

An increased fracture risk can be diagnosed as an additive finding on routine CT scans, without additional radiation exposure, by using a phantom-less tool. Patients with a decreased BMD value should be further evaluated using the FRAX® 10-year fracture probability calculation.

CLINICAL RELEVANCE/APPLICATION

Patients with a decreased BMD value, measured with a phantom-less tool on routine CT scans, may benefit from an additional calculation of the FRAX® score to predict osteoporotic bone conditions.

MKE251

Inferior Glenohumeral Ligamentous (IGHL) Complex - Anatomy, Injuries, and Adhesive Capsulitis (Station #8)

TEACHING POINTS

The purpose of this exhibit is to educate the radiologist about the clinical presentation, basic pathophysiology, imaging findings, differential diagnosis, and relevant clinical management for Inferior Glenohumeral Ligamentous (IGHL) complex injuries and related pathologies. The reader will be walked through an anatomic refresher followed by a series of imaging based cases demonstrating key findings in the variants of IGHL injury and adhesive capsulitis using various imaging modalities and illustrations.

TABLE OF CONTENTS/OUTLINE

- Pictorial and imaging anatomy of the glenohumeral joint and IGHL complex (anterior and posterior bands and interposed axillary pouch)
- Mechanism of injury and clinical presentation of specific IGHL pathology
- Pictorial presentation of variations of IGHL injuries (HAGL, BHAGL, GAGL, RHAGL, AIGHL, and axillary pouch tears)
- Radiological imaging cases of all of the discussed IGHL injury variants -Management of IGHL injuries
- Adhesive capsulitis: clinical presentation, etiology, imaging findings, staging, grading, case examples, and treatment options
- References

MKE284

Fly through the Joint - Virtual Arthroscopy of the Shoulder Using CT Arthrogram (Station #9)

Lulu Tenorio MD (Presenter): Nothing to Disclose, Shaun Michael Nordeck MS, RRA: Research Grant, Toshiba Corporation, Avneesh Chhabra MD: Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc

TEACHING POINTS

1. Similar to 3D simulated "fly through" in CT colonography and Virtual Bronchoscopy, learn the virtual arthroscopy protocol as applied to 3D CT arthrogram 2. Gain knowledge of normal anatomy of the shoulder on virtual arthroscopy 3. Learn surface rendered imaging appearances of synovial thickening, cartilage abrasions, bankart lesion and labral pathology

TABLE OF CONTENTS/OUTLINE

1. Introduction to 3D "fly through" and surface rendering technique on stand alone work station, TeraRecon 2. Normal anatomical appearances of the shoulder on virtual arthroscopy 3. Case examples of synovial, labral, cartilage and bankart lesions on virtual arthroscopy with relevant direct arthroscopy correlation 4. Advantages and disadvantages of virtual arthroscopy will be highlighted

MKE252

Secrets of the Periosteum: Clues to Underlying Osseous and Metabolic Diseases (Station #10)

Chuanxing Qu MD (Presenter): Nothing to Disclose, Cynthia Ann Britton MD: Nothing to Disclose

TEACHING POINTS

1. Review the anatomy, physiology and function of the periosteum. 2. Emphasize the importance of analysis of the periosteum on CR, as well as CT and MRI imaging, and its relationship to underlying osseous and metabolic disease processes which may impact clinical management.

TABLE OF CONTENTS/OUTLINE

1. Discuss the anatomy, physiology and function of the periosteum. 2. Present a method for systematic analysis of the periosteum, in particular in CR imaging, as well as CT and MR, with regards to appearance, location within a particular osseous structure and distribution within the skeleton. 3. Provide a differential based on the above analysis to permit identification of underlying osseous disease or identification of a more wide-spread metabolic process. Specifics examples of HPOA, SAPHO, thyroid acropachy, fluconazole-related periostitis, Ewings, osteosarcoma, metastatic disease and cortical-based osteoid osteoma will be demonstrated.

MKE224

Schematic Approach to MRI Diagnosis of Inherited Muscle Diseases Based on Clinical Signs and Categorization (Station #11)

Ahmed Wafaie (Presenter): Nothing to Disclose, Hassan Kassem MD: Nothing to Disclose, Ahmed Aboumousa: Nothing to Disclose

TEACHING POINTS

1- To learn how to approach a reliable MR diagnosis (or even a short list of differential diagnosis) of inherited muscle diseases based on clinical signs and categorization 2- Suggested MR grading system to describe muscle involvement will be displayed as the diagnosis depends on selective involvement of certain muscles and sparing of others 3- To gain an awareness of the clinical categorization of inherited muscle diseases and different clinical signs that will reinforce the confidence in MR diagnosis 4- To display a wide variety of original work cases

TABLE OF CONTENTS/OUTLINE

- Introduction about inherited muscle diseases
- The clinical categorization used as a frame for MR diagnosis (each has different group of diseases) which is:
  1- Limb girdle muscle dystrophy with calf hypertrophy
  2- Limb girdle muscle dystrophy with calf atrophy
3- Early onset myopathy
4- Myopathy with distinctive clinical manifestations
   - The MR examination protocol for thighs and legs
   - The MR grading system for muscle involvement to describe which muscles are affected more than others and which are spared
   - How to reach a reliable diagnosis based on the predescribed pattern of muscular involvement in literature for each disease under certain clinical category?

**MKE204**

**Bone Marrow Signal Changes on MRI: What Is Normal? (Station #12)**

Filippo Del Grande MD, MBA (Presenter): Nothing to Disclose, Laura Marie Fayad MD: Nothing to Disclose

**TEACHING POINTS**

1) There are a number of techniques available by MRI to differentiate normal red marrow interspersed with fatty marrow from bone marrow lesions. 2) Patterns in bone marrow signal changes by MRI are helpful for guiding the diagnosis towards marrow-replacing tumors, and differentiating stress reactions, osteomyelitis and arthropathy-related lesions. 3) Although T1 spin echo is vital to the characterization of bone marrow signal abnormalities, additional techniques, including chemical shift imaging, diffusion weighted imaging and perfusion imaging can be helpful for assessing bone marrow signal abnormalities.

**TABLE OF CONTENTS/OUTLINE**

Normal bone marrow
  Basic principles of normal bone marrow composition and physiological bone marrow reconversion. Review of MRI techniques and technical considerations for imaging the bone marrow
  Conventional noncontrast sequences: T1 weighted, T2 weighted, chemical shift imaging
  Functional sequences: diffusion weighted imaging, contrast enhanced dynamic and static sequences
  Differentiating features of bone marrow abnormalities
  Tumors, stress-related injuries, infection, arthropathy-related signal changes
  Important pitfalls in assessing bone marrow signal changes

**MKE198**

**"Oh!! Snap It ....." Dynamic Ultrasound of Snapping Syndromes (Station #13)**

Srinadh Boppana MD (Presenter): Nothing to Disclose, Eshwar Chandra Nandury MD: Nothing to Disclose, Krishna Subrahmanyam MS: Nothing to Disclose, Jyothi Reddy MD: Nothing to Disclose, Annapurna Srimambhatla MD: Nothing to Disclose, Balaji Varaprasad Mallula MD: Nothing to Disclose, Prashanth Kumar Karnati MD: Nothing to Disclose

**TEACHING POINTS**

Throw light on various snapping syndromes in the body
Usefulness of dynamic ultrasound in comprehensively evaluating these pathologies with emphasis on positioning and technique

**TABLE OF CONTENTS/OUTLINE**

Introduction
  Ultrasound positioning and technique at various anatomical levels
  Snapping syndromes
  Scapular snapping
  Snapping of biceps tendon
  Trigger finger
  Snapping of ulnar nerve
  Internal and external snapping of hip
  Medial collateral ligament snapping over surgical screws
  Peroneal tendon snapping

**MKE023-b**

**MR Artifacts in Musculoskeletal Imaging: Simple and Easy Method to Overcome (hardcopy backboard)**

Kyungjae Lim (Presenter): Nothing to Disclose, Dong-Ho Ha: Nothing to Disclose, Sunseob Choi MD, PhD: Nothing to Disclose, Jin Hwa Lee MD: Nothing to Disclose, Eun Ju Kang MD: Nothing to Disclose

**TEACHING POINTS**

The educational objectives of this article are to describe the common magnetic resonance imaging (MRI) artifacts in musculoskeletal imaging and to provide simple and easy solution with image-based explanation.

**TABLE OF CONTENTS/OUTLINE**

CONTENT ORGANIZATION
1. To illustrate the various MR artifacts that correlated with field inhomogeneity, the off center position, high resolution image for small joints, fat-suppression techniques, metal and flow, etc.
2. To describe simple and easy methods to overcome, including reposition into near iso-center, using insensitive sequences, swapping encoding directions and changing of voxel size, etc.

**MKS-TUB**

Musculoskeletal Tuesday Poster Discussions

Scientific Posters
Performing Lumbar Sympathetic Blocks: A New Technique (Station #1)

Humberto Gerardo Rosas MD (Presenter): Nothing to Disclose

PURPOSE

Injury to the genitofemoral nerve and unsuccessful blockade of the lumbar sympathetic chain are the most common complications following lumbar sympathetic blocks (LSB). Prior studies have shown that conventional techniques lead to either anterior or lateral placement of the needle in respect to the sympathetic ganglia, or placement within the psoas muscle itself leading to suboptimal flow of the injectate. A transdiscal approach was recently advocated to avoid these complications, however the potential for discitis, and accelerated disc degeneration must be considered. The purpose of the study was to evaluate a new paradiscal, extraforaminal technique to perform fluoroscopically directed lumbar sympathetic blocks that would avoid transgression of vital structures and allow appropriate needle placement along the anterolateral aspect of the vertebral body.

METHOD AND MATERIALS

IRB approval and a waiver of consent were obtained for this retrospective HIPAA compliant study. Fluoroscopic spot views and medical records from 73 (45 females, 28 males; mean age 46.3) consecutively performed lumbar sympathetic blocks dating back to March 13, 2008 were retrospectively reviewed. Patients meeting the diagnostic criteria for complex regional pain syndrome with symptoms lasting greater than 6 months refractory to conservative measures were included in the study. Utilizing the transverse process as a guide, the needle was advanced under fluoroscopic guidance to the anterolateral aspect of the vertebral body. Contrast was administered to confirm appropriate needle placement and skin surface temperatures monitored to document the sympathetic response. The response to the injection was determined utilizing a 10 point Visual Analog Score (VAS).

RESULTS

No major complications occurred defined as death, neurovascular injury, injury to the visceral organs, and infection. Minor complications included a single vasovagal response. All 73 injections resulted in a greater than 3°C increase in skin temperature indicating appropriate blockade of the sympathetic ganglia. VAS scores demonstrated a statistically significant reduction in symptoms from baseline to the postprocedure period.

CONCLUSION

This study describes a safe alternative method for performing LSB.

CLINICAL RELEVANCE/APPLICATION

The technique described allows placement of the needle subjacent to the sympathetic ganglia while avoiding transgression of vital structures.

US-guided Block of Suprascapular Nerve as a Treatment of Adhesive Capsulitis: Indications, Technique and Early Results (Station #2)

Francesca Lacelli MD : Nothing to Disclose, Chiara Martini MChir : Nothing to Disclose, Davide Orlandi MD (Presenter): Nothing to Disclose, Giovanni Serafini MD : Nothing to Disclose

PURPOSE

Adhesive capsulitis (AC) is characterized by pain and stiffness in external rotation and abduction of the upper limb; physiatric rehabilitation (PR) is often difficult. The suprascapular nerve (SN) supplies 70% of shoulder sensitive innervation. US visualizes the SN at the level of the spine of the scapula. The purpose of this work is to show that SN block makes a more lasting pain decrease than the intra-articular treatment of capsulitis and makes the PR easier.

METHOD AND MATERIALS

20 patients with clinical diagnosis of adhesive capsulitis were randomized in 2 groups (A=10F, y=45±3.2; B=10F, y=44±3.6). Group A was treated with US-guided intra-articular injection of 5cc of hydrochloride mepivacaine 2%, 40mg of methylprednisolone and 6ml(90mg) of hyaluronate. In group B the US-guided perineural (at the level of the spine of the scapula) injection of 5cc of hydrochloride mepivacaine 2% was added to the treatment. All patients began PR the day of treatment. All patients underwent clinical (VAS scale and ROM index) both before than immediately after the treatment, at 1 week and 1 month.

RESULTS

VAS before: 8.9 (A), 9.1 (B); immediately after: 5.0(A), 4.8(B); at 1 week: 6.2 (A), 4.5 (B); at 1 month: 6.1 (A), 4.0 (B) (p<0.01). ROM before: 100°(A), 95°(B); immediately after: 120°(A,B); at 1 week: 130°(A), 150°(B); at 1 month: 135°(A), 170°(B). We had not complications, in particular no deficit of motion. In all patients of group B
we visualized the SN by ultrasound.

CONCLUSION

The role of physiatry in rehabilitation and reduction of pain is fundamental. The SN block associated with intra-articular treatment allows an improvement of PR. The SN block has a more lasting effect than intra-articular treatment.

CLINICAL RELEVANCE/APPLICATION

Ultrasound guided SN block is recommended to improve efficiency of rehabilitation in patient with shoulder capsulitis.

Imiglucerase Shortage: Effects in Patients with Gaucher Disease (Station #3)

Jose Manuel Morales MD, PhD (Presenter): Nothing to Disclose, Antonio Cano-Rodriguez MD: Nothing to Disclose, Victor Manuel Encinas MD: Nothing to Disclose

PURPOSE

To study the reversibility of therapeutic effects upon interruption of enzymatic therapy after a prolonged shortage of human recombinant glucocerebrosidase treatment (Imiglucerase, Cerezyme® Sanofi), and to determine the posterior replacement by physiological lipids after the restart of it.

METHOD AND MATERIALS

Fourteen patients with Gaucher’s disease underwent long-term enzyme replacement therapy in our hospital. All of them had been clinically, biochemically and radiologically stable for at least four years before production of the enzyme was abruptly interrupted. Of these fourteen patients, six were excluded from the study for not having had a previous MRI scan, or for displaying results with artifacts. In the remaining eight, the last MRI scan prior to the beginning of the supply shortage (A: "baseline MRI" scan) was compared with the first of the scans performed when the shortage ended (B: “post-deprivation MRI” scan). To assess the reversibility of the pathological infiltration following the resumption of treatment, we compare this second study with a third MRI scan, performed after the restart of the therapy (C: “post-resumption” MRI).

RESULTS

In seven of these eight patients, a diffuse progression was confirmed in the infiltration of vertebral marrow by pathological Gaucher tissue when the post-deprivation images were compared with images corresponding to the baseline studies In all of these seven cases, the post-resumption MRI showed a tendency to recover the basal state, following the restoration of the usual enzyme dose.

CONCLUSION

The forced deprivation of enzyme treatment in the population of patients with Gaucher’s disease caused by the global enzyme supply shortage which followed the interruption of its production from September 2009 to October 2010, allowed us to confirm, in the majority of our patients, both the reversibility of the therapeutic effects of imiglucerase on bone marrow once its periodic administration is interrupted, and the tendency of this pathological infiltration to disappear following re-administration of this enzyme.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, the accidental world shortage of the enzyme replacement therapy, allows for the first time to prove the reversibility of the therapeutic effects of imiglucerase on bone marrow.

The Iliotibial Band in Acute Knee Trauma: Patterns of Injury on MR Imaging (Station #4)

David McKean BMBCh, FRCR (Presenter): Nothing to Disclose, Philip Yoong FRCR: Nothing to Disclose, James Teh MD: Nothing to Disclose, Ramy Mohamed Mansour MBBCh: Nothing to Disclose

PURPOSE

The appearance of the iliotibial band (ITB) is rarely described in MRI of acute knee trauma. The purpose of our study is to investigate the characteristic patterns of injury seen with injury of the ITB. We hypothesize that injury of the ITB on MRI is associated with internal derangement, in particular anterior cruciate ligament (ACL) tears and posterolateral corner disruption.

METHOD AND MATERIALS

A retrospective review was completed of 200 MRI scans performed for acute knee trauma. Patients were excluded if there was a history of injury over 4 weeks from the time of the scan, septic arthritis, inflammatory arthropathy, previous knee surgery or significant artefact. In each scan, the ITB was scored as normal, minor sprain (Grade 1), severe sprain (Grade 2) and torn (Grade 3). The menisci, ligaments and tendons of each knee were also assessed.

RESULTS

The mean age was 27.4 years (range 9-69). 71.5% (n = 143) patients were male. The ITB was injured in 115 cases (57.5%). The next most common soft tissue structure injured was the ACL in 53.5% (n=107). Grade 1 ITB injury was seen in 90 of these cases (45%), Grade 2 injury in 20 cases and Grade 3 injury in only 5 cases. There is a significant association between ITB injury and ACL rupture (P
CONCLUSION

ITB injury is strongly associated with significant internal derangement of the knee, especially cruciate ligament rupture, posterolateral corner injury and patellar dislocation.

CLINICAL RELEVANCE/APPLICATION

Injury of the iliotibial band on MRI is associated with internal derangement, in particular anterior cruciate ligament (ACL) tears and posterolateral corner disruption.

Pelvic Morphology in Ischiofemoral Impingement (Station #5)

Miriam Antoinette Bredella MD (Presenter): Nothing to Disclose, Debora Cristina Azevedo MD, Nothing to Disclose, Adriana Maria De Lima Oliveira MD, Nothing to Disclose, Frank J. Simeone MD, Nothing to Disclose, Connie Y. Chang MD, Nothing to Disclose, Ambrose J. Huang MD, Nothing to Disclose, Martin Torriani MD, Nothing to Disclose

PURPOSE

Ischiofemoral impingement (IFI) is associated with abnormalities of the quadratus femoris muscle and narrowing of the ischiofemoral (IF) and quadratus femoris (QF) spaces. Anatomic variations in pelvic morphology such as a wider inter-ischial distance and femoral neck anteversion may predispose patients to IFI.

The purpose of our study was to assess new MRI measures to quantify pelvic morphology which may predispose to IFI. We hypothesized that patients with IFI have a wider inter-ischial distance and increased femoral neck anteversion compared to normal controls.

METHOD AND MATERIALS

The study was IRB approved and complied with HIPAA guidelines. The study group comprised 78 patients with IFI (mean age: 52.2±15.6 y, 68 f, 10 m) and 51 age and gender matched controls. Control subjects underwent MRI of the hip for acute trauma but were otherwise asymptomatic. Two MSK radiologists independently measured IF and QF distance, femoral cross sectional area (CSA) at the level of the lesser trochanter, the ischial angle as a measure of inter-ischial distance, and femoral neck angle as a measure of femoral anteversion. The quadratus femoris was evaluated for edema and atrophy. Groups were compared with ANOVA.

RESULTS

All patients with IFI and none of the controls subjects had abnormalities of the quadratus femoris muscle (p<0.0001). Out of the 78 patients, 14 (18%) had bilateral MRI findings of IFI. Patients with IFI had decreased IF and QF distance (p<0.0001) compared to controls. Patients with IFI had increased ischial angle (p=0.04) and increased femoral neck angle (p=0.03) compared to controls. There was a trend toward decreased femoral CSA (p=0.08) in IFI compared to controls.

CONCLUSION

Patients with IFI have increased ischial and femoral neck angles compared to controls. These anatomic variations in pelvic morphology may predispose to IFI. MRI is a useful method to not only assess osseous and soft tissue abnormalities associated with IFI but also to quantify anatomic variations in pelvic morphology that can predispose to IFI.

CLINICAL RELEVANCE/APPLICATION

MRI can be used to assess osseous and soft tissue abnormalities associated with IFI and to quantify anatomic variations in pelvic morphology that can predispose to IFI.

Osteoporosis Screening with Computed Tomography: Contrast Media Significantly Affects Bone Signal (Station #6)

Esther Pompe MD (Presenter): Nothing to Disclose, Martin J. Willemink MD, Nothing to Disclose, Gawein Reinout Dijkhuis MD, Nothing to Disclose, Harald Verhaar: Nothing to Disclose, Firdaus Mohamed Hoessein MD, Nothing to Disclose, Pim A. De Jong MD, PhD: Nothing to Disclose

PURPOSE

Osteoporosis could be detected by determining the bone density (BD) in a region of interest (ROI) within a lumbar vertebra on CT. The effect of intravenous contrast media on CT examinations performed for other indications was evaluated.

METHOD AND MATERIALS

152 subjects (99 without and 53 with malignant renal neoplasm) who underwent both un-enhanced and two contrast-enhanced (arterial and portal venous phase) abdominal CT exams in a single session between June 2011 and July 2013 were included. BD was evaluated on the three exams as CT-attenuation values in Hounsfield Units (HU) in the first lumbar vertebra (L1).

RESULTS

Subjects were stratified based on the presence of malignancies, because BD measurements were significantly higher in the group without malignancies. Mean ± standard deviation (SD) differences in BD measurements were 27.5±56.4 HU (p<0.01) in the un-enhanced phase, 23.6±59.9 HU in the arterial phase (p<0.01) and 19.8±56.5 HU (p<0.01) in the portal phase. CT-attenuation values were significantly higher in contrast-enhanced phases, compared to the un-enhanced phase (p<0.01). In patients without malignancies, HU-values increased from 128.8±48.6 HU for the unenhanced phase to 142.3±47.2 HU for the arterial phase and 147.0±47.4 HU for the portal phase (p<0.01). In patients with malignancies, HU-values increased from 112.1±38.1 HU to 126.2±38.4 HU and 130.1±37.3 HU (p<0.02), respectively. With thresholds of ≤110 HU,
≤135 HU, ≤160 HU to define osteoporosis, measurements in the arterial phase and portal phase resulted in 7-25% false negatives.

CONCLUSION
Our study showed that intravenous contrast injection substantially affects BD-assessment on CT and taking this into account it may improve opportunistic screening for osteoporosis.

CLINICAL RELEVANCE/APPLICATION
An overestimation of bone density due to contrast injection in clinical CT scans could lead to false negative results if used in a screening setting for osteoporosis.

**Ultrasound of Morton’s Neuroma: What Are We Really Looking At? (Station #7)**

**MKS378**


**PURPOSE**
To correlate the appearance of preoperative ultrasounds of Morton's neuromas with the surgical specimens.

**METHOD AND MATERIALS**
Nine Morton's neuromas excised between July, 2013 and March, 2014 that had preoperative ultrasounds were evaluated with approval of the IRB. Preoperative ultrasounds were evaluated for neuroma size and appearance. The resected surgical specimens were sonographically evaluated for size and appearance immediately following excision. All pre- and postoperative scans were performed using Philips IU-22 scanners. Specimens were then evaluated pathologically. The appearance and size of the neuromas were compared between the preoperative and postoperative images, and were correlated to the surgical and pathologic appearances.

**RESULTS**
All specimens were pathologically proven as Morton's neuromas; they showed focal thickening of the nerve at gross examination, and sclerosis and mucoid degeneration of the nerve fascicles and fibrotic thickening of the perineurium histologically. Longitudinal sonography of the specimens demonstrated echogenic focal enlargement of the nerve at the site of the neuroma, measuring 6.9 mm average (range 4 mm to 11 mm). Preoperative images in the longitudinal plane showed a normal fibrillar echogenic nerve extending to a focal heterogeneous hypoechoic mass within the webspace which measured 14.3 mm average (range 9 mm to 24 mm). Surgically, all cases had thickened or scarred bursal tissue around the nerve, and interdigital vessels that had to be disentangled from the nerve.

**CONCLUSION**
The heterogeneous hypoechoic intermetatarsal mass that is sonographically considered a "Morton's neuroma" is actually a “neuroma-bursal complex” consisting of the thickened nerve, tangled vessels, and scarred/thickened bursa, that is much larger than the neuroma itself.

**CLINICAL RELEVANCE/APPLICATION**
Sonographically, Morton's neuromas are actually neuroma-bursal complexes, larger than the neuroma itself.

**Ultrasound Guided Lumbar Spine Facet Injections (Station #8)**

**MKE299**


**TEACHING POINTS**
After a short anatomic review of the posterior lumbar spine, introduce the idea that facet joints can be identified and ultrasound guided facet injections performed.

**TABLE OF CONTENTS/OUTLINE**
1. Sonographic and pictorial anatomic review of the lumbar spine II. Introduction of Ultrasound guided facet injections. A. Reasons why this procedure will be beneficial in the future: III. Research/ procedure confirming location in the facet joint. IV: Discussion

**Hand & Wrist Masses: MR Imaging with Pathologic Correlation (Station #9)**

**MKE114**

Cody Jackson Morris MD (Presenter): Nothing to Disclose, Gina Johnson : Nothing to Disclose, Adam Daniel Singer MD : Nothing to Disclose, Elie Harmouche : Nothing to Disclose, Abhijit Datir MD : Nothing to Disclose

**TEACHING POINTS**
1. To discuss a practical approach for MRI evaluation of hand and wrist masses, including optimal sequences and the use of intravenous contrast. 2. To present the characteristic MRI findings of hand and wrist masses, ranging from common to uncommon, and benign to malignant lesions. 3. To emphasize the understanding of MRI tissue characteristics of hand and wrist masses in correlation with underlying pathologic findings.

**TABLE OF CONTENTS/OUTLINE**
1. Introduction to MRI protocols in imaging of hand and wrist masses 2. Utility of contrast in the evaluation of hand and wrist masses 3. Characteristic MRI findings of hand and wrist masses 4. Discussion
1. Introduction to MRI protocols in imaging of hand and wrist masses 2. Utility of contrast in the evaluation of hand and wrist masses 3. Spectrum of common to uncommon, and benign to malignant lesions in hand and wrist 4. Understanding of MRI tissue characteristics in correlation with pathologic findings 5. Individual examples with explanation based on histopathology, including but not limited to - Ganglion cyst Abscess Lipoma Peripheral nerve sheath tumor Epidermal inclusion cyst Glomus tumor Adamantinoma Giant cell tumor of tendon sheath Synovial osteochondromatosis Lipofibrous hamartoma Soft tissue sarcoma, including undifferentiated pleomorphic sarcoma, liposarcoma, and spindle cell sarcoma 6. Conclusion

**MKE266 Imaging of Low Back Pain in Adult and Pediatric Populations: Red Flags, Educational Intervention, and Outcomes (Station #10)**

Dennis Parhar BSc (Presenter): Nothing to Disclose , Ismail Tawakol Ali MBChB, MD : Nothing to Disclose , Savvas Nicolaou MD : Nothing to Disclose

**TEACHING POINTS**

The purpose/aim of this exhibit is to:

1. Demonstrate when low back imaging should be ordered in adult and pediatric populations and to present guidelines with an underlying rationale
2. Review the benefits, drawbacks, and controversies of the various imaging modalities used in the investigation of low back pain
3. Identify the radiologic findings of red flags of low back pain in various imaging modalities along with their clinical correlations
4. Understand the utility of educational intervention as opposed to imaging in patient satisfaction and outcome

**TABLE OF CONTENTS/OUTLINE**

- Review the necessity of guidelines in determining the need for diagnostic imaging of low back pain
- Review of imaging modalities used in the investigation of low back pain (plain film, CT, MRI, myelography, bone scintigraphy) including their benefits and drawbacks
- Review of clinical red flags in the adult and pediatric populations
- Outline an algorithm to identify presentations meriting early diagnostic imaging
- Demonstrate image examples and clinical correlation of diagnoses meriting early diagnostic imaging
- Discuss the efficacy of educational intervention compared to imaging in patient satisfaction and outcome
- Summary points and future directions

**MKE112 Extrinsic Wrist Ligaments for Dummies: Detailed Anatomy on Dissection, Function, and MR Imaging (Station #11)**

Anнемиеke Milants (Presenter): Nothing to Disclose , Maryam Shahabpour MD : Nothing to Disclose , Michel De Maeseneer MD : Nothing to Disclose

**TEACHING POINTS**

To discuss detailed anatomy of the extrinsic wrist ligaments, illustrated by anatomical dissection. To discuss function and clinical relevance of the different ligaments. To present standard and 3D MR images with thin sections of the extrinsic ligaments.

**TABLE OF CONTENTS/OUTLINE**

1. The palmar extrinsic ligaments - radioscaphocapitate (RSC) - radiolunotriquetral (RLT) - short radiolunate (SRL) - radioscapholunate/ligament of Testut (RSL) - palmar ulnotriquetral (pUT) - ulnolunate (UL) - ulnocapitate (UC) 2. The dorsal extrinsic ligaments - dorsal radiotriquetral (dRT) - dorsal ulnotriquetral (dUT) 3. The midcarpal ligaments (combining extrinsic and intrinsic ligaments) - palmar scaphotriquetral/ligament of Sennwald (pST) - arcuate ligament: triquetrohamatocapitate (THC) and scaphocapitate (SC) - dorsal scaphotriquetral (dST) - triquetrotrapeziotrapezoidal (TTT) - distal part of RSC - scaphotrapeziotrapezoidal complex (STT) 4. Stabilizing function of the extrinsic ligaments 5. MR Imaging of the extrinsic ligaments (standard and thin section 3D DESS)

**MKE164 Current Concepts of Total Ankle Arthroplasty for Radiologists (Station #12)**

Hyojeong Mulcahy MD (Presenter): Nothing to Disclose , Felix Sze-Kway Chew MD : Nothing to Disclose , Jack Anthony Porrino MD : Nothing to Disclose

**TEACHING POINTS**

Total ankle arthroplasty is becoming the definitive treatment for end-stage, symptomatic arthritis of the tibiotalar joint. More sophisticated designs, stronger materials, improved surgical technique, and broader indications have led to an increased use. This educational exhibit will:

1. Review the current concepts of ankle replacement including various designs and modern surgical techniques.
2. Explain and illustrate the expected imaging appearances.
3. Demonstrate complications, and explain how such failures occur.

**TABLE OF CONTENTS/OUTLINE**


**MKE005-b Trapped in a Tunnel: Ultrasound Imaging of Peripheral Nerve Entrapment Neuropathies (hardcopy backboard)**
Srinadh Boppana MD (Presenter): Nothing to Disclose, Eshwar Chandra Nandury MD: Nothing to Disclose, Kamlesh M Chawda MD: Nothing to Disclose, Prashanth Kumar Karnati MD: Nothing to Disclose, Jyothi Reddy MD: Nothing to Disclose, Annapurna Srirambhatla MD: Nothing to Disclose, Balaji Varaprasad Mallula MD: Nothing to Disclose

TEACHING POINTS

Describe the anatomy and imaging of various osteofibrous tunnels in the body using ultrasound. Recognise the normal ultrasound appearances of peripheral nerves. Identification of peripheral nerve entrapments, their location and causes.

TABLE OF CONTENTS/OUTLINE

Introduction: Anatomy, imaging technique and normal appearances Various nerve entrapments (carpal tunnel, guyons canal, cubital tunnel, radial groove, suprascapular notch, inguinal ligament (meralgia paresthetica), fibular neck, popliteal fossa, tarsal tunnel). Causes including anatomical variants, retinaculae, ligaments, tenosynovitis, bone and joint abnormalities, masses and masslike lesions (neural and perineural). Conclusion

SSJ15

ISP: Musculoskeletal (Hip and Pelvis Evaluation)

Scientific Papers

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Tue, Dec 2 3:00 PM - 4:00 PM Location: E451A

Participants

Moderator
Christian W. A. Pfirrmann MD, MBA: Advisory Board, Siemens AG Consultant, Medtronic, Inc
Moderator
Jeffrey James Peterson MD: Nothing to Disclose

Sub-Events

SSJ15-01

Musculoskeletal Keynote Speaker: Femoroacetabular Impingement—Accuracy of Non-Arthrographic 3T MR Imaging in Evaluation of Intra-Articular Pathology of the Hip

Dorota Dominika Linda MD, FRCPC (Presenter): Nothing to Disclose

PURPOSE

To investigate the accuracy of non-arthrographic 3T MRI compared to hip arthroscopy, in assessment of labral and cartilaginous pathology in patients with suspected FAI.

METHOD AND MATERIALS

Following IRB approval and waived consent, 42 consecutive cases of suspected FAI with non-arthrographic 3T MRI and arthroscopy of the hip were reviewed. High-resolution TSE MR imaging including radial acquisitions were evaluated in consensus by 2 musculoskeletal radiologists, blinded to arthroscopic findings, for the presence of labral tears and articular cartilage lesions. Acetabular cartilage was categorized as normal, degeneration/fissuring, delamination, or denudation. MRI findings were compared to arthroscopy. Sensitivity, specificity, accuracy, and predictive values for MRI were calculated using arthroscopy as the standard of reference.

RESULTS

42 hips in 38 patients with a mean age of 29 (range 13-45 years) were assessed. Mean interval between MRI and arthroscopy was 154 days (range 27-472 days). MRI depicted 41 cases with labral tears (sensitivity 100%, specificity 50%, accuracy 98%, PPV 98%, NPV 100%), 11 cases with femoral cartilage abnormalities (sensitivity 85%, specificity 100%, accuracy 95%, PPV 100%, NPV 94%), and 36 cases with acetabular cartilage lesions (sensitivity 94% specificity 67%, accuracy 90%, PPV 94%, NPV 67%). Of the 36 cases with acetabular cartilage lesions on MRI, 7 were characterized as degeneration/fissuring, 26 as delamination, and 3 as denudation, with discordant results between MRI and arthroscopy for grading of articular cartilage in 10 cases.

CONCLUSION

Non-arthrographic 3T MR imaging is a highly accurate technique for evaluation of the labrum and cartilage in patients with clinically suspected FAI.

SSJ15-02

Diagnostic Performance of MR Arthrography of the Hip under Axial Leg Traction in the Detection and Grading of Labrum Lesions in FAI Patients: Preliminary Results

Florian Schmaranzer (Presenter): Nothing to Disclose, Michael Kogler MD: Nothing to Disclose, Markus
SSJ15-03

Radiographic Correlates of Arthroscopically Proven Partial Tears of the Ligamentum Teres in Patients with Femoroacetabular Impingement

Gavin Blair Gore MD (Presenter): Nothing to Disclose, Scott David Wuerzter MD, MS: Nothing to Disclose, Laura Raffield BS: Nothing to Disclose, Elizabeth A. Howse: Nothing to Disclose, Ailston J. Stubbs: Nothing to Disclose, Leon Lenchik MD: Nothing to Disclose

PURPOSE

In patients with femoroacetabular impingement (FAI), partial tears of the ligamentum teres are common and may contribute to the hip joint microinstability. The purpose of this study was to determine if the radiographic findings of acetabular over-coverage or early osteoarthritis are associated with arthroscopically proven partial tears of the ligamentum teres (LT).

METHOD AND MATERIALS

243 patients undergoing hip arthroscopy for FAI had radiographic evaluation with supine anteroposterior views of the pelvis as well as frog-lateral, cross-table lateral, and false-profile views of the symptomatic hips. Measurements of the lateral center-edge, anterior center-edge, and Sharp's angles were performed. Evaluation of acetabular overcoverage using the cross over sign, the posterior wall sign, coxa profunda, and acetabular protrusio was performed. Evaluation of osteoarthritis using the Tonnis grade, hammock sign (posteromedial sclerosis), saber-tooth sign (cotyloid osteophyte), and sea-gull sign (remodeling of superolateral acetabulum) was performed. Univariate and age-adjusted analyses were used to evaluate the association between radiographic findings and LT tears.

RESULTS

74 men and 169 women, ranging in age from 12 to 68 with a mean age of 34 years, were included in the study. 163 had partial LT tears and 80 had normal LTs. Partial LT tears were significantly more common in younger patients (p=0.008). In the partial tear group, mean lateral center-edge was 30, anterior center-edge was 32, and Sharp’s angle was 41. In the normal group, mean lateral center-edge was 33, anterior center-edge was 33, and Sharp’s angle was 39. In women with partial tears, there was a trend toward a decreased lateral center-edge angle (p=0.053) and a trend toward a decreased anterior center-edge (p=0.057). After age-adjustment in women, there was also a trend toward decreased profunda (p=0.064). The remaining radiographic signs showed no significant association with partial LT tears.

CONCLUSION

There is no significant association between radiographic findings of acetabular over-coverage or early osteoarthritis and arthroscopically proven partial tears of the ligamentum teres.
CLINICAL RELEVANCE/APPLICATION

Although ligamentum teres are common and contribute to hip pain, little is known about what radiographic or clinical findings predispose patients to them.

SSJ15-04

Normal Values of the Subspinal Interval and the Angle of AIIS - Acetabulum: A Multicentric CT Study


PURPOSE

The purpose of this study was to define the normal values of subspine interval (SI), and the angle of anterior inferior iliac spine (AIIS) - acetabulum (AAA) in normal individuals.

METHOD AND MATERIALS

We reviewed abdomen computed tomography scans of 157 patients who had been examined for reasons other than subspine impingement. For the measurements, sagittal-oblique reformatted images that parallel to midaxis line of AIIS were obtained. The SI was accepted as the distance between the most anterior-inferior edge of the AIIS and the acetabular rim. The AAA was defined as the angle between the line traversing through the long axis of AIIS and the line that connecting the points of conjunction of acetabular roof and deepest medial cortex of AISS in the axial images. Normal values and ranges of both SI and AAA were assessed. Age and gender differences were analyzed.

RESULTS

312 measurements of SI were made in 157 patients. 77 female (49%) and 80 male (51%) patients were included by the study. Mean age was 34.44 years with a range of 20-50 years. Overall, mean SI was found as 15.77±3.73 mm. SI was found to be significantly lower in females than that of males (17.22±3.34 mm in males, 13.61±2.85 mm in females, P=0.02). The mean AAA was calculated as 110.8°(with a range of 90°-129°). Patients with severe degeneration and developmental dysplasia of hip joint were not included by the study.

CONCLUSION

Subspine impingement is a recently described subtype of femoro-acetabular impingement. Its clinical diagnosis might be challenging and there are no objective radiological measurements to adequately describe this pathology. To the best of our knowledge, normal values of SI in asymptomatic individuals have not been reported in the English language literature. The range of normal values of SI might be helpful in the diagnosis of subspine impingement. Moreover, smaller values of AAA might indicate narrowing of the potential subspine space, causing pathological contact of the AIIS and femoral head during hip flexion. Further clinical studies are needed to investigate the relevance of our radiological findings.

CLINICAL RELEVANCE/APPLICATION

Subspine impingement has been reported to be a potential cause of femoroacetabular impingement. CT measurement of the subspine interval and the curve of AIIS may be helpful in diagnosis. Definition of normal values will form the base of further studies to describe pathological cut-off values.

SSJ15-05

Pubic Bone Stress Oedema as a Predictor of Return to Play in Athletes with Groin Pain

Joseph Coyle MBCh, MRCPI (Presenter): Nothing to Disclose, Eanna Falvey MD: Nothing to Disclose, Andrew Franklyn-Miller MBCh: Nothing to Disclose, Jenny Ward: Nothing to Disclose, Brian A. Hogan MBCh: Nothing to Disclose

PURPOSE

To correlate MRI imaging findings of Pubic Bone Stress Oedema (PBOS) with clinical examination standardized clinical performance models and return to play in a cohort of 300 patients presenting with exercise induced groin pain.

METHOD AND MATERIALS

MRI scans from 300 consecutive patients attending a dedicated groin injury clinic in a large specialist Sports Medicine and Orthopedic hospital were reviewed. A standard 3 tesla MRI groin imaging protocol was performed on all patients. Findings of pubic bone stress oedema were graded and then compared to standardized clinical assessment scores (Copenhagen Hip and Groin Outcome Score, HAGOS) and to time to return to play in all patients. Minimum patient follow up for study inclusion was 12 months.

RESULTS

Volume of pubic bone stress oedema (PBOS) correlated well with patient return to play times. There was poor correlation of volume and location of PBOS with HAGOS standardized clinical assessment scores. Laterality of PBOS (right versus left) did not correlate well with findings on clinical exam. There was no association between secondary cleft sign, common anterior plate rectus abdominus and adductor longus insertional tendonopathy or pubic symphysis joint effusion and return to play.
CONCLUSION
Volume of Pubic Bone Stress Oedema on MRI can be used to accurately predict return to play times in athletic patients presenting with groin pain.

CLINICAL RELEVANCE/APPLICATION
Groin pain is a common complaint amongst both recreational and elite athletes. Accurate diagnosis and treatment as well as prediction of return to play can be difficult. MRI findings of Pubic Bone Stress Oedema can be used as a useful predictor of return to play in this cohort.

SSJ15-06
Longitudinal MRI Follow-up of Patients with Large Head Metal on Metal Total Hip Arthroplasties
Nicola Jane Lyle MBBS (Presenter): Nothing to Disclose, Toby Briant-Evans: Institutional Research Grant, Biomet, Inc, Jennifer Teresa Hauptfleisch MBChB, FRCR: Nothing to Disclose, Richard Harker: Nothing to Disclose, Kevin Conn: Nothing to Disclose, John Britton: Nothing to Disclose, Geoff Stranks: Nothing to Disclose

PURPOSE
MRI is the gold standard imaging modality to assess soft tissue complications which occur around metal on metal (MoM) hip prostheses due to adverse reaction to metal debris (ARMD). The MR features of these ‘pseudotumours’ are well established but relatively little is known about the natural history of ARMD. This knowledge would be invaluable for appropriate patient management. The aim of this study was to investigate MRI changes over time in longitudinal follow up of our MoM total hip arthroplasties (THAs).

METHOD AND MATERIALS
155 large head MoM THAs underwent at least two separate MRI scans. The images were reviewed retrospectively by two musculoskeletal radiologists and 1 orthopedic surgeon. They were classified as 1. Normal 2. Trochanteric fluid only 3. Effusion 4. ARMD (extra-articular fluid/solid collections) The latter group was further classified according to the Oxford classification into Type I (thin-walled cystic), Type II (thick-walled cystic) and Type III (predominantly solid). Lesion volumes were also measured.

RESULTS
The mean time from primary surgery to first scan was 48 months. The median interval between scans was 15 months. 54 (35%) were classified as normal and 30% of these hips developed an abnormality by the time of the second scan. 19 (12%) had isolated trochanteric fluid of which 9 (47%) got larger or developed into Type I ARMD lesions. 12 (8%) had effusions and 6 (58%) progressed in volume with one becoming a Type I ARMD lesion. 70 (46%) had ARMD, 49 type I, 16 type II and 5 type III. There was a significant increase in size of the pseudotumours in type I and II categories (77% progression rate). New osteolysis was seen in 4 cases in the type II group (25%). Lesions most likely to progress had an irregular pseudocapsule and progression was associated with high cobalt levels.

CONCLUSION
Little has been published on the natural history of pseudotumours. In our series there was a high rate of ARMD (46%) and the majority (77%) showed a significant increase in size on serial MR. Pseudotumours with an irregular lining were more likely to progress. This progression rate is higher than in recently published smaller longitudinal series.

CLINICAL RELEVANCE/APPLICATION
In MR follow-up of patients with MoM THAs there was a 46% rate of ARMD and 77% progressed. The decision to revise is clinical but this high rate of progression may lower the threshold for revision.
CONCLUSION

regression analysis for the entire cohort, but not in the multivariable model. (1.01, 1.33), p = 0.04) were significant predictors of major surgical complications in univariable logistic regression analysis demonstrated that PD was a significant prognostic indicator of overall survival (HR = 0.97 (0.94, 0.99), p = 0.03). Visceral fat area (OR = 1.004 (1.0, 1.008), p < 0.05), and subcutaneous fat density SD (OR = 1.16 (1.01, 1.33), p = 0.04) were significant predictors of major surgical complications in univariable logistic regression analysis for the entire cohort, but not in the multivariable model.

RESULTS

Subjects with AN had higher marrow fat content (p<0.05), but similar marrow fat composition (p >0.05) compared to normal-weight controls. There was an inverse association between marrow methylene protons, an estimate of fatty acid (FA) saturated bonds, and lumbar spine BMD (r= -0.52, p=0.008) independent of %ideal body weight (%IBW) and total lipid content. Olefinic protons at 5.3 ppm, an estimate of FA unsaturated bonds, were inversely associated with body fat depots, independent of %IBW and total lipid content, and positively associated with soleus muscle unsaturation (p≤0.05).

CONCLUSION

Women with AN have higher total femoral marrow fat but similar composition compared to normal-weight controls. The degree of marrow FA saturation correlates inversely with BMD, suggesting that saturated lipids may have negative effects on BMD. The degree of marrow FA unsaturation correlates positively with soleus unsaturation, suggesting that marrow fat composition may be influenced by the same factors as ectopic lipid composition.

CLINICAL RELEVANCE/APPLICATION

Marrow fat composition assessed by 1H-MRS may serve as a biomarker for bone quality and metabolic risk.

SSJ16-02

Significance of Sarcopenia in Soft-tissue Sarcoma Patients: Do Skeletal Muscle and Fat Measures of Body Composition on Routine CT Exams Help Predict Clinical Outcomes?

Robert Downey Boutin MD (Presenter): Nothing to Disclose, Jeremy Richard Katz MD: Nothing to Disclose, Abhijit Jarawant Chaudhari PhD : Nothing to Disclose, Jonah Scott Hirschbein MD : Nothing to Disclose, Yves-Paul Nakache : Nothing to Disclose, Chin-Shang Li PhD : Nothing to Disclose, Ramit Lamba MD : Nothing to Disclose, Ghaneh Fanapazir MD : Nothing to Disclose, Robert Canter MD : Nothing to Disclose

PURPOSE

To assess muscle and fat metrics as prognostic indicators of outcomes in sarcoma patients.

METHOD AND MATERIALS

147 patients (81 M, 66F; mean age, 53 years; range, 1-85) diagnosed with a soft-tissue sarcoma between 2000 and 2013 with inclusion criteria (including availability of BMI, stage, grade, depth, abdominopelvic CT, follow-up) were retrospectively studied after IRB approval. Treatment included surgery (n=124), pre-op chemotherapy (n=13), or a combination. Using a routine CT exam, the L4 pedicle level was analyzed for 4 skeletal muscle metrics (total muscle area [TMA], average total muscle density [TMD], psoas area [PA], average psoas density [PD]) using manual segmentation by a musculoskeletal radiologist. Visceral and subcutaneous fat metrics (area, mean density, SD density) were quantitated at the same level using automated segmentation. Clinical outcome variables were evaluated, including overall survival and major post-surgical complications (within 30 days).

RESULTS

At presentation, stage distribution was as follows: stage 1 (n=51), 2 (n=27), 3 (n=55), 4 (n=14). Survival averaged 27.2 months (range, 0.2-156) from the date of diagnosis. Muscle and fat metrics varied widely among patients. TMA averaged 106 cm² (range, 7-194), with a TMD of 32 HU (range, -24 to 75). Univariable Cox PH regression analysis demonstrated that PD was a significant prognostic indicator of overall survival (HR = 0.97 (0.94, 0.99), p = 0.02) in the entire cohort, as well as when stage 4 patients were excluded (HR = 0.95 (0.93, 0.98), p = 0.001). TMD also was a significant predictor of overall survival when stage 4 patients were excluded (HR = 0.97 (0.94, 0.99), p = 0.03). TMD (OR = 0.97 (0.95, 0.99), p = 0.04), PD (OR = 0.96 (0.92, 0.99), p = 0.03), visceral fat area (OR = 1.004 (1.0, 1.008), p < 0.05), and subcutaneous fat density SD (OR = 1.16 (1.01, 1.33), p = 0.04) were significant predictors of major surgical complications in univariable logistic regression analysis for the entire cohort, but not in the multivariable model.

CONCLUSION
Routine CT can be used to quantify muscle and fat metrics; some body composition measures appear to have prognostic significance in soft-tissue sarcoma patients.

**CLINICAL RELEVANCE/APPLICATION**

Although muscle and fat metrics are not routinely analyzed on CT exams, both muscle and fat are routinely imaged, are easily measured, and are potential prognostic biomarkers for sarcoma patients.

### SSJ16-03

**Multimodality Imaging Shows Cytotoxic Cancer Therapy Causes Rapid Expansion of Marrow Fat (MF) and but Slower Decrease in BMD Causing Failure of Their Inverse Correlation Why We Should Think Differently about Cancer Survivors; Bone Health - Multi-modal**


**PURPOSE**

Cancer survivors have an increased risk of osteoporotic fractures. However the extent of bone and marrow damage is poorly understood. The purpose is to develop multimodality imaging to monitor BMD changes quantitatively with time.

**METHOD AND MATERIALS**

We used dual energy CT (DECT), water-fat MRI (WF-MRI), quantitative CT (QCT) and DXA to measure one-year changes in MF and BMD associated with three cancer treatments: oophorectomy, radiotherapy or chemotherapy. We also measured changes in circulating adiponectin levels. Twenty nine patients with gynecologic malignancies underwent DECT and DXA at 0, 6 and 12 months post-treatment; 15 were also imaged by WF-MRI.

**RESULTS**

We observed a high overall correlation ($r = 0.77$, 95% CI: 0.69, 0.83) between DECT and WF-MRI based MF quantification at L3, L4, and L5 for 15 subjects (Figure A). Likewise, changes in MF from 0 to 12 months were highly correlated by both imaging methods ($r = 0.91$, 95% CI: 0.84, 0.95). MF increased significantly from 0 to 12 months ($p<0.002$ at L3, L4, L5, and FN). All three treatments increased MF ($p<0.032$), but chemotherapy and radiation caused greater increases than oophorectomy (Figure B andC). L4 BMD measured by DECT decreased most after chemotherapy ($p = 0.01$), followed by radiation ($p = 0.09$) and oophorectomy ($p = 0.24$). L4 BMD decreased 14% by DECT, 20% by QCT, but only by 5% by DXA ($p<0.002$ for all) (Figure D). At baseline, we observed a statistically significant, inverse association between MF and BMD. By contrast, at 12 months the inverse association between MF and BMD was dramatically attenuated (Figure E andF). Adiponectin increased from 0 to 12 months without changes in total body fat.

**CONCLUSION**

Our study demonstrated rapid increases in MF following radiotherapy and chemotherapy. Additionally, DECT detected much greater changes in BMD than did conventional DXA. Our results suggest that contrary to the general population, MF and BMD cannot be used interchangeably to monitor skeletal health following cancer therapy. Longitudinal studies in larger population are needed to determine if increases in MF and adiponectin are associated with long-term sustained bone damage and ultimate ability to predict fracture risk.

**CLINICAL RELEVANCE/APPLICATION**

If MF is the key results of cytotoxic therapy, more effective preventive therapy must be to reverse or suppress adipogenesis in addition to common method of antiresorptive therapy that is common used for general population

### SSJ16-04

**Complications of Atypical Femoral Fractures: Does Fracture Morphology or Instrumentation Type Predict Hardware Failure?**


**PURPOSE**

Predict Hardware Failure?
Long-term bisphosphonate use has been associated with Atypical Femoral Fractures (AFFs). The purpose of this study is to evaluate the association of fracture morphology and hardware type with hardware failure in patients with AFFs.

**METHOD AND MATERIALS**

Imaging studies of 100 patients with 131 AFFs (4 male, 96 female, mean age 68.1 years) with hardware instrumentation from July 2004 to February 2014 were reviewed. Type of instrumentation, fracture morphology (overall fracture morphology (OFM), lateral cortical fracture angle (LCFA), lateral cortical thickness, femoral angle), and fracture location were compared in the hardware complication group and control group using the Wilcoxon rank sum test or Fisher's exact test.

**RESULTS**

131 AFFs had instrumentation (98 for complete and 33 for incomplete fractures). Instrumentation included intramedullary (IM) nailing (117), dynamic hip screw (7), lateral plate (2), short gamma nail (3), total hip arthroplasty (1), and compression plate (1). Hardware complications occurred in 15.3% (21/131) and were more common in complete (18/21) than incomplete (3/21) fractures. Complications included screw fractures in 19%(4/21), plate fractures in 14.3%(3/21), loosening of hardware in 28.6%(6/21), nonunion in 9.5%(2/21), and a combination of complications in 28.6%(6/21). Hardware failure was significantly less common after IM nailing (12.8%) compared to other hardware (35.7%) (p=0.04). Comparing failure to non-failure group, the mean OFM was 31.9° (vs 36.3°), the mean LCFA was 7.0° (vs 11.3°), the mean lateral cortical thickness was 12.1 mm (vs 12.1 mm), the mean medial cortical thickness was 8.9 mm (vs 7.8 mm), femoral angle 133° (vs 133°). Comparing the failure to the non-failure group, the location of fracture was 14.9 cm (vs 16.8 cm) from the greater trochanter. Of all measured parameters, only the LCFA was significantly associated with hardware failure (p= 0.03).

**CONCLUSION**

In patients with AFFs, hardware complications are not uncommon. Hardware failure is more common in AFFs with smaller LCFA and when fixation other than IM nailing is used.

**CLINICAL RELEVANCE/APPLICATION**

Patients who undergo hardware fixation for AFFs are at risk for hardware failure and should be followed for development of complications. Surgeons should consider IM nailing for treatment of AFFs.

**Bilateral Atypical Femoral Fractures: How Much Symmetry Is there on Imaging?**

**PURPOSE**

Atypical Femoral Fractures (AFFs) are commonly bilateral. The purpose of this study is to evaluate bilateral AFFs and to determine if the imaging features of both fractures are similar.

**METHOD AND MATERIALS**

Imaging studies of 76 patients with bilateral AFFs were retrospectively reviewed (3 male, 73 female, age range 31.1 to 91 years, mean age 67.3 years). The time interval between fracture diagnoses was determined. For each fracture, the following imaging features were evaluated: location of fracture, femoral angle, length of cortical thickening, comminution, medial spike (proximal or distal fragment), and fracture orientation (superior or inferior). Associations between imaging findings on pairs of bilateral fractures were assessed with Spearman's correlation ($r_s$) and the Kappa ($\kappa$) statistic.

**RESULTS**

Bilateral fractures (62 incomplete and 14 complete) occurred within 12 months of each other in 59/76 cases (77.6%). Average time between fracture diagnoses was 10.2 months. 90% of bilateral fractures occurred within 2.9 years of each other (range 0 to 120 months). There was a strong correlation between fracture location ($r_s=0.68$) with 58/76 cases (76.3%) of bilateral fractures occurring within a distance of less than 5 cm. 41/76 cases (53.9%) had a distance of less than 2.5 cm between bilateral fractures. There was moderate correlation between femoral angles ($r_s=0.4$) and weak correlation between length of cortical thickening ($r_s=0.28$). There was substantial agreement for medial spike location ($\kappa=0.67$) and fracture orientation ($\kappa=0.62$), and moderate agreement for lack of comminution ($\kappa=0.42$). These findings were independent of the time between fractures.

**CONCLUSION**
Patients with unilateral AFFs are likely to be diagnosed with a contralateral AFF within the first year of presentation. Bilateral fractures are likely to have similar imaging findings and location along the femur, regardless of the time interval between fractures.

**CLINICAL RELEVANCE/APPLICATION**

After diagnosing a unilateral AFF, surveillance of the contralateral femur is essential. Most contralateral fractures are similar in appearance and location to the index fracture.

**SSJ16-06**

Detection of Bone Marrow Edema for Diagnosis of Osteoporotic Thoracolumbar Vertebral Compression Fractures Using Dual-Energy CT in Correlation with MRI

Moritz Kaup (Presenter): Nothing to Disclose, Julian Lukas Wichmann MD: Nothing to Disclose, Jan-Erik Scholtz: Nothing to Disclose, Martin Beeres MD: Nothing to Disclose, Josef Matthias Kerl MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Thomas Lehner MD: Nothing to Disclose, Moritz Albrecht MD: Nothing to Disclose, Renate Maria Hammerstingl MD: Nothing to Disclose, Wolfgang Kromen: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose, Ralf W. Bauer MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG

**PURPOSE**

To evaluate whether virtual non-calcium (VNC) dual-energy computed tomography (DECT) can improve the detection rate of acute thoracolumbar vertebral compression fractures in osteoporotic patients on CT in correlation with magnetic resonance imaging (MRI).

**METHOD AND MATERIALS**

In this prospective IRB-approved study, 31 patients with known osteoporosis and suspected acute vertebral compression fractures underwent second-generation DECT (80/140 kV) and MRI. Standard grayscale CT (M_0.4; bone kernel) and corresponding VNC-DECT reconstructions were calculated. Five blinded radiologists (1-7 years of experience in skeletal radiology) first evaluated the grayscale CT scans to detect vertebral compression fractures (acute and old). After each case, VNC fusion maps were evaluated to detect bone marrow edema indicative of acute fractures. Findings were compared with MRI as gold standard. Sensitivity, specificity, predictive values, intra- and interobserver agreements were calculated.

**RESULTS**

Compared with grayscale CT images, supplemental VNC-DECT showed a significantly higher ($P<0.001$) global sensitivity (95.1% vs. 70.1%), negative predictive value (NPV, 91.8% vs. 65.5%), and accuracy (90.2% vs. 77.7%). Specificity (83.0% vs. 89.6%) and positive predictive value (PPV, 89.4% vs. 91.4%) decreased due to increased false positive findings (23 vs.11). Differences regarding the detection of bone marrow edema between VNC-DECT and MRI were non-significant ($P=0.417$). Further analysis with the Youden-index confirmed a higher diagnostic performance for CT + VNC-DECT (0.780) compared to grayscale CT scans only (0.597; $P<0.001$). Global interobserver agreement regarding the evaluation of VNC-DECT series was substantial (intraclass correlation coefficient [ICC]: 0.655; 95% confidence intervals [CI]: 0.488, 0.779) while global intraobserver agreement between both CT image series was fair (ICC: 0.267; 95% CI: 0.080, 0.414).

**CONCLUSION**

VNC-DECT can accurately depict bone marrow edema in acute thoracolumbar vertebral compression fractures in osteoporotic patients with good correlation to MRI and significantly improves the detection rate of such fractures compared with grayscale CT scans.

**CLINICAL RELEVANCE/APPLICATION**

DECT can significantly improve the detection rate of acute vertebral compression fractures on CT imaging and may be especially beneficial for patients with contraindications for MRI.

**RC404**

Hip Imaging: Challenges and Solutions

*Refresher/Informatics*

**Learning Objectives**

1) Multimodality imaging of the hip be reviewed, with an emphasis on MRI and MR arthrography.

**Sub-Events**
**Imaging and Treatment of the Snapping Hip**

Donna Genette Blankenbaker MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the causes of snapping hip. 2) Describe how to image snapping hip. 3) Discuss treatment options for the painful snapping hip.

**MoM Hip Complications**

Christian W. A. Pfirrmann MD, MBA (Presenter): Advisory Board, Siemens AG Consultant, Medtronic, Inc

**LEARNING OBJECTIVES**

1) To learn about the epidemiology and risk factors for complications after metal on metal hip implants. 2) To know the role of different imaging modalities for the diagnostic assessment of symptomatic metal on metal hip replacements. 3) To recognize the typical imaging findings symptomatic metal on metal total hip replacements.

**ABSTRACT**

In 2010 the Medicines and Healthcare products Regulatory Agency (UK) issued a Device Alert for certain metal on metal total (MoM) hip replacements: a small number of patients may develop progressive soft tissue reactions to metal wear. Data showed 5-year revision rate of approximately 12% on certain implants. Risk factors of MoM total hip arthroplasty (THA) are the use of large heads, hip resurfacings MoM THA with mal positioning (Cups with excessive anteversion/lateral inclination), high activity level of the patient, severe local / mechanical symptoms, change in gait (i.e. Limp), abductor weakness or swelling. Imaging workup of patients with MoM-THA should start with plain radiographs. Pseudotumors can be detected by US or MARS-MRI. A pseudotumor can be a solid or cystic mass, in continuity/communication with the hip joint. Pseudotumors are non-neoplastic and not infected. The majority of pseudotumors are associated with high wear. A minority of pseudotumors are associated with low wear and a prominent immune response. Two pathomechanism are discussed: Cytotoxic effect of phagocytosed metal particles on macrophages or a hypersensitivity response to metal wear particle. This leads to extensive necrosis and tissue destruction. Pseudotumors are not necessarily symptomatic. The presence of bone marrow edema and abductor tendon tears shows a higher correlation to symptoms than the presence or size of pseudotumors. Osteolysis is frequent, often undetected or underappreciated. Frequency of osteolysis in MoM hips similar to metal-on-polyethylene. However, early osteolysis is a concerning radiographic finding.

**Normal Anatomy, Variants and Pitfalls**

Ulrich Studler MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To discuss a practical approach to the fundamentals of normal cross-sectional anatomy of the hip with a special emphasis on cartilaginous structures, the acetabular fossa, the location of bursae and their association with adjacent structures. 2) To know osseous and cartilaginous variants about the hip simulating disease. 3) To present pitfalls and skills to avoid misinterpretation of variants.

**Cam and Pincer Impingement: Acquired vs Developmental**

Stephen J. Pomeranz MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To present anatomic indications and differentiating features of cam vs pincer type hip impingement. 2) To review primary and secondary causes of hip impingement and considerations for measurement and assessment. 3) To discuss examples of acute, traumatic and developmental hip impingement on MRI with appropriate classification. 4) To identify imaging cues governing therapy.

**Vertebral Augmentation (How-to Workshop)**

**Refresher/Informatics**

AMRA PRA Category 1 Credits: 1.50

ARRT Category A+ Credits: 1.50

**Tue, Dec 2 4:30 PM - 6:00 PM Location: E260**

**Participants**

A. Orlando Ortiz MD, MBA (Presenter): Nothing to Disclose

Bassem Adeeby Georgy MD, MSc (Presenter): Consultant, Johnson & Johnson Consultant, DFIN, Inc Medical Advisory Board, SpineAlign Medical, Inc Stockholder, DFIN, Inc Stockholder, SpineAlign Medical, Inc Stockholder, Spine Solutions, Inc
LEARNING OBJECTIVES

1) Discuss appropriate algorithms for patient selection.
2) Review anatomic and technical considerations for vertebral augmentation.
3) Present an update of the recent advances in vertebral augmentation including sacroplasty.
4) Emphasize safety issues and how to avoid complications.
5) Understand the applications of vertebral augmentation in osteoporotic and neoplastic spine pathology.
6) Update participants with respect to advances in equipment and biomaterials.

ABSTRACT

1. Patient selection for vertebral augmentation: Indications and contraindications.
2. New devices and techniques in vertebral augmentation.
3. Vertebral augmentation for osteoporotic and pathologic vertebral compression fractures.
4. Sacroplasty (sacral augmentation).
5. Complications avoidance.
6. Efficacy: Vertebral augmentation is an image-guided (fluoroscopy or CT) percutaneous procedure in which a bone needle is inserted into a painful osteoporotic or pathologic fracture within the spinal axis. Biopsy, cavity creation or lesion ablation may then be performed under imaging guidance depending on the nature of the pathology that is being treated. Subsequently a radiopaque implant, usually an acrylic bone cement, is carefully injected into the vertebra or sacral ala under imaging guidance. These procedures have been shown to provide pain relief by stabilizing the fractured vertebra or sacrum. As with any other invasive procedure, they carry a small risk (<1%) of complication including bleeding, infection, neurovascular injury, or cement embolism. Appropriate patient selection and a detailed understanding of the technical aspects of the procedure along with active clinical patient follow-up are paramount to a successful outcome. This workshop will utilize short lectures, case examples and interactive audience participation in order to further explore critical topics in vertebral augmentation.

URL's

www.winthropradioogy.com

RC452

Nerve Ultrasound Based on a Regional Approach: Shoulder and Neck (Hands-on Workshop)

Refresher/Informatics

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Tue, Dec 2 4:30 PM - 6:00 PM Location: E264

Participants

Carlo Martinoli MD (Presenter): Nothing to Disclose
J. Antonio Bouffard MD (Presenter): Nothing to Disclose
Catherine J. Brandon MD (Presenter): Stock options, VuCOMP, Inc
Etienne Cardinal MD (Presenter): Nothing to Disclose
Mary Margaret Chiavaras MD, PhD (Presenter): Nothing to Disclose
Joseph Gérard Craig MD (Presenter): Nothing to Disclose
Michael A. Dipietro MD (Presenter): Nothing to Disclose
David Paul Fessell MD (Presenter): Nothing to Disclose
Ghiyath Habra MD (Presenter): Nothing to Disclose
Andrea Klauser MD (Presenter): Nothing to Disclose
Rachel Beth Hulen MD (Presenter): Nothing to Disclose
Marina Kislyakova MD (Presenter): Nothing to Disclose
Joseph Hudson Introcado MD (Presenter): Consultant, BioClinica, Inc, Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc
Kenneth S. Lee MD (Presenter): Research Consultant, SuperSonic Imagine Speakers Bureau, Medical Technology Management Institute
Humberto Gerardo Rosas MD (Presenter): Nothing to Disclose
Matthew Rutter MD (Presenter): Nothing to Disclose
Alfredo Tagliafico MD (Presenter): Nothing to Disclose
Ximena Loreto Wortsman MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the ultrasound anatomy and scanning technique for examination of neck (i.e. brachial plexus, spinal accessory, long thoracic, phrenic, vagus) and shoulder (i.e. suprascapular, axillary, musculocutaneous) nerves.
2) Illustrate the main anatomic landmarks to identify these nerves.
3) Master technical approaches to nerve ultrasound including the recognition of pitfalls.

ABSTRACT

In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound and with a special focus on the examination of small (<1mm thick) and difficult-to-study nerves. The standardized techniques of performing an adequate ultrasound study of the axillary nerve in the shoulder, the musculocutaneous nerve in the arm and the anterior interosseous nerve in the proximal forearm will be illustrated. Similarly, the examination technique to image the lateral femoral cutaneous nerve in the inguinal area and the saphenous nerve throughout the lower extremity will be described. The hands-on workshops will provide the opportunity to interactively discuss the role of ultrasound in this field with expert instructors. Participants will be encouraged to directly scan model patients. A careful ultrasound approach with thorough understanding of soft-tissue planes and extensive familiarity with anatomy are prerequisites for obtaining reliable information regarding the affected structure and the site and nature of the disease process affecting it.

SPDL41

RSNA Diagnosis Live™: Body, Cardiac, MSK, Neuro, ENT Potpourri
MSCS41

Case-based Review of Musculoskeletal Radiology (An Interactive Session)

Participants

Adam Eugene Flanders MD (Presenter): Nothing to Disclose
Sandeep Prakash Deshmukh MD (Presenter): Nothing to Disclose
Christopher Geordie Roth MD (Presenter): Author, Reed Elsevier

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage “active” consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendees 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.

Sub-Events

MSCS41A

Shoulder

Michael John Tuite MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the anatomy of the shoulder, focusing on common sites of pathology and which cause symptoms. 2) Present examples of common pathologies of the shoulder, including rotator cuff tears, labral injuries, and biceps lesions, on multiple imaging modalities including MR and US. 3) Present common findings of symptomatic shoulder arthroplasties.

ABSTRACT

A systematic approach to evaluating the shoulder can help radiologists recognize and not overlook common important pathologies in the shoulder. We will review multiple cases of the shoulder using various imaging modalities, and discuss how to discriminate between pathology and normal variants, and how to recognize and describe common pathologies.

MSCS41B

Wrist

Laura W. Bancroft MD (Presenter): Royalties, Wolters Kluwer nv

LEARNING OBJECTIVES

1) Imaging features of wrist pathology will be reviewed in an interactive multimodality case-based format.

ABSTRACT

This interactive multimodality case-based session will demonstrate injuries of the fibrocartilage complex (TFCC), intrinsic and extrinsic ligaments, tendons and bones of the wrist. Imaging features of a variety of tendon overuse syndromes will be discussed, as well as the mechanisms of injury, complications and clinical implications of osseous injuries. Participants will be presented with various pearls and pitfalls to assist them in interpreting wrist studies.

MSCS41C

Muscle Injuries

Robert Downey Boutin MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
LEARNING OBJECTIVES

1) Review clinically relevant imaging findings in patients with muscle injuries, with an emphasis on how MRI can help establish the diagnosis, impact treatment, and predict prognosis. 2) Present practical examples of traumatic injuries, and how they differ from non-traumatic derangements, using an interactive case-based format.

RC504
Bone and Cartilage Injury: Traumatic and Stress-related Chondral, Osteochondral and Subchondral Failure with Emphasis on Pathophysiology and Routine and Advanced MR 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: S406B

Participants
Donald L. Resnick MD (Presenter): Nothing to Disclose
Yolanda Y. P. Lee MBChB (Presenter): Author, Amirsys, Inc
Christine B. Chung MD (Presenter): Nothing to Disclose
Mini Nutan Pathria MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the structural anatomy of a. articular cartilage with emphasis on its collagen framework and b. the trabecular architecture in the subchondral bone. 2) Emphasize the manner in which the collagen and trabeculae respond to compressive, shear, and tensile forces applied to the joint surface and the resultant injuries as they are displayed in MR images. 3) Emphasize the anatomy and biomechanical implications of the osteochondral unit through novel MRI applications. 4) Discuss structure and biomechanics of bone tissue with regard to the pathogenesis of fatigue and insufficiency forms of stress injury. 5) Use case-based teaching methods to illustrate the imaging spectrum of traumatic and stress-related chondral, osteochondral, and subchondral injuries.

RC552
Dynamic Musculoskeletal US: Clicks and Clunks of the Upper Extremity (Hands-on Workshop)

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: E264

Participants
Viviane Khoury MD (Presenter): Nothing to Disclose
Etienne Cardinal MD (Presenter): Nothing to Disclose
Jon A. Jacobson MD (Presenter): Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Arthrex, Inc
J. Antonio Bouffard MD (Presenter): Nothing to Disclose
Joseph Gerard Craig MD (Presenter): Nothing to Disclose
David Paul Fessell MD (Presenter): Nothing to Disclose
Ghiyath Habra MD (Presenter): Nothing to Disclose
Joseph Hudson Introcaso MD (Presenter): Nothing to Disclose
Kenneth S. Lee MD (Presenter): Research Consultant, SuperSonic Imagine Speakers Bureau, Medical Technology Management Institute
Humberto Gerardo Rosas MD (Presenter): Nothing to Disclose
Catherine J. Brandon MD (Presenter): Stock options, VuCOMP, Inc
Kambiz Motamedi MD (Presenter): Nothing to Disclose
Mary Margaret Chiavaras MD, PhD (Presenter): Nothing to Disclose
Andrea Krauser MD (Presenter): Nothing to Disclose
Mark Cresswell MB BCh (Presenter): Nothing to Disclose
Robert R. Lopez-Ben MD (Presenter): Nothing to Disclose
Colin Daniel Strickland MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify anatomic structures which can impinge or move abnormally in the upper extremity causing pain during normal range of motion. 2) Describe the ultrasound anatomy and scanning technique for a dynamic examination of these lesions. 3) Position patients optimally for the dynamic evaluation of the upper extremity respecting ergonomics.

ABSTRACT

This course will demonstrate standardized techniques of performing the dynamic examination of upper extremity conditions that are only or best demonstrated dynamically. These include shoulder impingement syndrome, acromioclavicular joint instability, long head of biceps dislocation, medial elbow joint instability, extensor carpi ulnaris dislocation, median nerve movement, and trigger finger.
In the first portion of the course, probe positioning will be demonstrated on a model patient with overhead projection during live scanning. In the second portion of the course, an international group of expert radiologists will assist participants in learning positioning and scanning of the shoulder, elbow, and wrist/finger lesions described. An emphasis on dynamic maneuvers and ergonomic documentation of tissue dynamics will be taught. Participants will be encouraged to directly scan model patients.

Active Handout

MSRT42

ASRT@RSNA 2014: Shoulder Imaging

Multisession Courses

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 1.00
Wed, Dec 3 9:20 AM - 10:20 AM Location: N230AB

Participants
Ken L. Schreibman PhD, MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Review the anatomy of the shoulder in 3-dimensions, with attention to the complex anatomy of the scapula.
2) Demonstrate the standard radiographic views of the shoulder, with attention to proper patient positioning.
3) Discuss techniques for optimizing CT of the shoulder, including anatomic reformatting planes.
4) Illustrate the radiographic appearance of shoulder dislocations, with emphasis on posterior dislocations.

MSCS42

Case-based Review of Musculoskeletal Radiology (An Interactive Session)

Multisession Courses

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Wed, Dec 3 10:30 AM - 12:00 PM Location: S406A

Participants
Director Lynne S. Steinbach MD Nothing to Disclose

Sub-Events

MSCS42A Hip
Michael Paul Recht MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes that affect the hip. 2) Illustrate by using case examples of imaging findings of several important disease processes that affect the hip. 3) Present the major teaching points and differential diagnostic considerations for each of the chosen cases.

ABSTRACT
ABSTRACT Hip pain is a common clinical problem and imaging is often critical for the accurate determination of the etiology of the pain. A series of cases will be used to illustrate common causes of hip pain, with attention to the most appropriate imaging protocol, the important imaging findings, the anatomic and pathophysiologic factors that explain the findings, and the differential diagnosis of the imaging findings.

MSCS42B Knee
Donald L. Resnick MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To outline anatomic and pathophysiologic principles that guide accurate analysis of imaging studies of the knee, with emphasis on internal derangements. 2) To illustrate several disease processes in which imaging techniques are essential to accurate diagnosis. 3) To summarize major teaching points and differential diagnostic considerations for the cases used to illustrate disease processes.

ABSTRACT
In the analysis of many disease processes that affect the knee, imaging techniques provide clues to accurate diagnosis. In this presentation, several representative cases will be used to illustrate this point, emphasizing both conventional and advanced methods. The importance of an understanding of the disease process itself and its pathogenesis, along with regional anatomy, will form the foundation for proper interpretation of the imaging findings.

LEARNING OBJECTIVES

1) Discuss common and uncommon aspects of foot/ankle pathology. 2) Review clinically important imaging findings in foot / ankle injury and disease. 3) Learn proper utilization of MR imaging techniques and sequences for evaluation of foot/ankle pathology. 4) Acquire practical knowledge of foot / ankle pathology on MRI that can be applied to improve patient outcomes.

SSK14
Musculoskeletal Imaging (Infection and Arthritis)

Scientific Papers

MR MK
AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50
Wed, Dec 3 10:30 AM - 12:00 PM Location: E450B

Sub-Events

SSK14-01
Percutaneous Image Guided Biopsy of Osteomyelitis Has Low Impact on Guiding Antibiotic Management: A Retrospective Analysis of 63 Bone Biopsies

Nicholas Said MD, MBA (Presenter): Nothing to Disclose, Nicholas Cole Nacey MD: Nothing to Disclose

PURPOSE

Managing osteomyelitis is a complex clinical challenge in patients who typically have many comorbid conditions. Image guided percutaneous biopsy is occasionally requested to guide antibiotic therapy. The purpose of the study is to determine the utility of bone biopsy in guiding the management of patients with osteomyelitis diagnosed by imaging and clinical evaluation.

METHOD AND MATERIALS

After IRB approval, a retrospective chart review was performed inclusive of patients with a diagnosis of osteomyelitis based on clinical evaluation and imaging findings who underwent image guided biopsy, with the exclusion of spinal osteomyelitis. Histologic and microbiologic lab analysis were reviewed to determine the number of culture positive bone biopsies. A management decision was considered significantly altered by the biopsy results if the patient subsequently received antibiotic therapy targeted towards the cultured bacteria and the grown bacteria had not previously been cultured from other sites.

RESULTS

A total of 63 attempted bone biopsies for osteomyelitis were reviewed. The majority of these cases were either of the foot (28 biopsies) or pelvis (31 biopsies). Positive cultures were obtained in 8/63 cases (12.7%), 4 of which were foot biopsies and 4 of which were pelvic biopsies. Management decisions were altered by the culture findings in 3/8 (37.5%) patients with positive cultures, or 3/63 (4.8%) of all reviewed patients. Two biopsy associated complications were recorded, one needle fracture and one incident of analgesia related respiratory suppression resulting in cardiac arrest.

CONCLUSION

There is limited utility for bone biopsy in guiding the management of patients with imaging evidence of osteomyelitis given the low yield of culture positive results and the finding that antibiotic management is often unaltered despite a culture positive bone biopsy. The results represent a positive culture rate that is similar but slightly lower to those quoted in prior published studies. While the management of osteomyelitis is a complex issue, the finding of a similar rate of management alterations and immediate complications suggests that the procedure should best be reserved for difficult cases after careful consideration.
There is limited utility for bone biopsy in patients with imaging evidence of osteomyelitis given a similar rate post procedure management alterations and immediate complications.

**SSK14-02**

**Infective Tenosynovitis: Usefulness of MRI and Ultrasonography**

Abhishek Jha (Presenter): Nothing to Disclose, Prakhar Gupta: Nothing to Disclose, Ajay Gupta: Nothing to Disclose, DEEPAK RAGHAV: Nothing to Disclose, Sanjog Tewari: Nothing to Disclose, Ibne Ahmad MBBS, MD: Nothing to Disclose

**PURPOSE**

(1) To describe the MRI findings in infective tenosynovitis of the upper extremity. (2) To compare the sensitivity of MRI with ultrasonography in the diagnosis of tenosynovitis.

**METHOD AND MATERIALS**

This prospective study consisted of 60 patients with clinical features suggestive of tenosynovitis presenting to OPD of Orthopedic surgery. Children under 4 years of age were excluded from the study owing to technical limitations associated with sedation. After clinical evaluation these patients underwent ultrasonography and MRI of the affected part. Ultrasonography and MRI were performed and interpreted by 2 separate radiologists. Thereafter, these patients underwent fine needle aspiration cytology from the affected part. The sensitivity of both the imaging modalities were then calculated and compared with the cytopathological findings.

**RESULTS**

Out of 60 patients included in study, 45 were found to have infective tenosynovitis on cytopathology. MRI was highly sensitive in the diagnosis of infective tenosynovitis. On MRI, infective tenosynovitis involved flexor digitorum superficialis in 17 cases, flexor digitorum profundus in 13 cases and extensor carpi ulnaris in 5 cases each and multiple flexor tendons were involved in 10 cases. The most consistent finding of infective tenosynovitis on MRI was altered signal intensity of the tendon sheaths, which was seen in 43 cases, followed by abnormal tendon enhancement and fluid around tendon sheaths which were seen in 33 cases. Ultrasound detected the condition in 29 cases, where 22 cases showed fluid around and tendon and 4 cases showed hypoechoic tendon thickening and 3 case showed both the findings. The overall sensitivity, specificity, positive predictive value and negative predictive value of MRI examination was found to be 95.5%, 93.3%, 97.7% and 87.5%, respectively, while the same parameters for ultrasound were 64.4%, 66.6%, 85.3% and 38.4%.

**CONCLUSION**

MRI is highly accurate in diagnosis of tenosynovitis and associated complications, while ultrasonography can be used as a preliminary investigation in emergency situations.

**CLINICAL RELEVANCE/APPLICATION**

In patients with suspected infective tenosynovitis, MRI is a highly useful non invasive tool with excellent accuracy which also provides collateral information about the management of these patients.

**SSK14-03**

**Synovial Fluid 1-H MRS as an Imaging Biomarker for the Diagnosis of Knee Joint Osteoarthritis and the Evaluation of Disease Progression**

Francesca Bolacchi (Presenter): Nothing to Disclose, Ettore Squillaci MD: Nothing to Disclose, Marco Antonicoli: Nothing to Disclose, Simone Altobelli: Nothing to Disclose, Alberto Bergamini: Nothing to Disclose, Giovanni Simonetti MD: Nothing to Disclose

**PURPOSE**

To investigate whether synovial fluid 1-H MRS could be appropriate as a diagnostic biomarker for detecting intra-articular inflammation and early cartilage degradation in knee joint Osteoarthritis (OA).

**METHOD AND MATERIALS**

At baseline, 63 subjects aged 26 to 83 with normal or OA-affected knees were recruited to provide a broad range of OA states. The synovial fluid 1H MRS spectrum was analysed and a lipid unsaturation index (UI) was calculated. Diagnostic ability of UI was evaluated by comparison with conventional OA markers, specifically cartilage volume from MRI, Joint space width (JSW) from radiographs, and pain scores.

**RESULTS**

A total of 43 subjects concluded the 13-months study. The UI performed at least similar to JSW and were superior to volume markers (AUC for UI of 0.82 was higher than the 0.53 for volume, P< 0.001, and marginally higher than 0.75 for JSW, P = 0.038). The UI allowed diagnostic detection of pain presence (P=0.03) and showed correlation with pain severity (e.g., r = -0.72). The longitudinal change in UI was correlated with cartilage loss (r=0.65).

**CONCLUSION**
Synovial fluid 1-H MRS could be appropriate as a diagnostic marker for knee joint osteoarthritis. Furthermore, correlations between UI and pain values and UI and cartilage loss supported a link to progression of OA. Thereby, UI as determined by 1-H MRS may allow detection and monitoring of knee OA.

CLINICAL RELEVANCE/APPLICATION

Synovial fluid 1-H MRS allows detection and monitoring of knee osteoarthritis by providing a novel biomarker of disease activity.

SSK14-04

Single Source Dual Energy Computed Tomography in Soft Tissue Crystal Depositions - First Experience in a Phantom Study

Torsten Diekhoff (Presenter): Nothing to Disclose, Kay-Geert A. Hermann MD: Nothing to Disclose

PURPOSE

Dual energy computed tomography (DE-CT) is an emerging imaging technique in musculoskeletal radiology. However, until now it is restricted to dual source scanners. We used phantom measurements to prove the feasibility of single source DE-CT of the extremities using a volume scan mode in single source dual energy technique. In addition, we for the first time wanted to determine which concentrations of monosodium urate (MSU) in gout and calcium pyrophosphate (CP) in pseudogout are needed to detect or distinguish these soft tissue depositions.

METHOD AND MATERIALS

We prepared a descending order of concentrations of MSU and CP in ultrasound gel to equip a hand shaped plastic phantom. Dual energy imaging was performed with a standard 320-row CT scanner (Aquilion ONE, Toshiba medical systems, Japan) in two volumes with 135 and 80 kV tube voltage, respectively. Scans were performed with 15 / 90 mA (lower dose) and 100 / 570 mA (higher dose). We calculated the dual energy gradient using linear regression analysis. 60 samples of MSU and CP in different concentrations were scored by three blinded readers with a proprietary dual energy software to determine specificity and sensitivity of this method. Receiver operating characteristics (ROC) analysis was done to determine the diagnostic power.

RESULTS

The DE gradient was calculated 1.020 ± 0.006 for MSU and 0.673 ± 0.001 for CP. The randomized phantom scans indicate a reliable detection of MSU at concentrations of 12.5 % or higher and of CP at 6.25 % or higher in a phantom scan. This corresponds to crystal depositions with 59.8 HU for MSU and 48.2 HU for CP, respectively. The sensitivity for MSU ranged from 83.3 to 97.3 at lower and from 86.7 to 97.3 at higher tube current. Specificity was 96.7% to 100% in lower and 100% in higher dose scans. In ROC analysis the area under the curve for MSU ranged from 0.867 to 0.947 at lower dose and from 0.867 to 0.919 at higher dose CT and for CP from 0.693 to 0.745 and 0.718 to 0.750, respectively.

CONCLUSION

This phantom study shows that single source DE-CT is capable to distinguish crystal depositions in soft tissues at relatively low concentrations.

CLINICAL RELEVANCE/APPLICATION

Single source DECT may develop to a reasonable alternative for dual source systems. Further investigations have to prove its applicability in patients and its benefits in diagnostic imaging and therapy monitoring.

SSK14-05

MR Imaging of Enthesitis in the Lumbar Spine in Suspected Spondyloarthropathy: Gadolinium vs. STIR

Christoph Amadeus Agten MD (Presenter): Nothing to Disclose, Veronika Zubler: Nothing to Disclose, Andrea Rosskopf MD: Nothing to Disclose, Christian W. A. Pfirrmann MD, MBA: Advisory Board, Siemens AG Consultant, Medtronic, Inc

PURPOSE

To compare detection of enthesitis in the lumbar spine between gadolinium-enhanced fat saturated T1 (T1+Gd) and STIR in patients with suspected Spondyloarthritis.

METHOD AND MATERIALS

Sixty-eight patients (37 males, 31 females, mean age 42 years) with suspected spondyloarthropathy and MRI of the sacroiliac joints (SIJ) were included. Sagittal T1+Gd and STIR sequences of the lumbar spine were assessed for enthesitis (defined as enhancement or edema) in the supraspinous ligaments, interspinous ligaments, and joint-capsules of the facet joints (capsulitis). Patients were grouped according to ASAS (Assessment of SpondyloArthritis international Society) criteria into having a positive SIJ (group A) or negative SIJ (group B). Enthesitis and bone marrow enhancement/edema in the lumbar spine were compared between the two groups. Descriptive statistics and Wilcoxon signed rank test were used for statistical analysis.
RESULTS

More patients with supraspinous enthesitis were found with T1+Gd (60.3%, 41/68) compared to STIR (19.1%, 13/68), also more areas per patient (T1+Gd 1.32±1.46, STIR 0.29±0.71, P<0.005). No statistically significant difference in detection of interspinous enthesitis was found between T1+Gd (64.7%, 44/68) and STIR (72.1%, 49/68), with P=0.455. More patients with capsulitis of the facet joints were found with T1+Gd (61.8%, 42/68) compared to STIR (30.9%, 21/68), also more facet joints per patient (T1+Gd 1.76±1.99, STIR 0.51±0.94, P<0.0005). 76.5% (52/68) of SIJ were positive (group A), 23.5% (16/68) of SIJ were negative (group B). In more patients of group A vs. group B supraspinous enthesitis (T1+Gd 65.4% vs. 43.8%, STIR 19.2% vs. 18.8%), interspinous enthesitis (T1+Gd 69.2% vs. 50%, STIR 75% vs. 62.5%), and capsulitis (T1+Gd 69.2% vs. 37.5%, STIR 34.6% vs. 18.8%) were detected. Bone marrow enhancement or edema in group A vs. group B was found in 36.5% vs. 37.5% (T1+Gd) and 46.2% vs. 50% (STIR).

CONCLUSION

In patients with clinically suspected spondyloarthritis, enthesitis and capsulitis in the lumbar spine are common findings. T1+Gd detects more enthesitis of the supraspinous ligaments and capsulitis of the facet joints compared to STIR.

CLINICAL RELEVANCE/APPLICATION

Gadolinium detects a higher number of enthesitis of the supraspinous ligaments and capsulitis of the facet joints compared to STIR in patients with suspected spondyloarthritis.

DEMRIQ: A Dynamic Contrast Enhanced MRI Quantification Method for Objective Assessment of Treatment Response in Patients with Inflammatory Arthritis

Olga A. Kubassova PhD, MSc (Presenter): Founder, Image Analysis Ltd Director, Image Analysis Ltd, Mikael Boesen PhD: Advisor, Image Analysis Ltd Speaker, Esaote SpA, Mikkel Ostergaard: Nothing to Disclose, Henning Bliddal MD, PhD: Nothing to Disclose, Marco Amedeo Cimmino MD: Nothing to Disclose, Mette Bjorndal Axelsen MD: Nothing to Disclose, Rasmus Bouert: Nothing to Disclose, Anshul Rastogi MBBS, FRCR: Consultant, Image Analysis Ltd, Nikolay Tzaribachev: Nothing to Disclose, Mark Hinton: Employee, Image Analysis Ltd, Peter C. Taylor BMBCh, FCR, MA, PhD: Advisor, Image Analysis, Inc

PURPOSE

Synovitis is an early indicator of inflammatory disease activity. It is visualised in Dynamic Contrast Enhanced MRI (DCE-MRI) and quantified by assessing the height and slope of time vs. intensity curves. This study investigates the robustness of DCE-MRI Quantification method (DEMRIQ) for assessment of early inflammatory changes in rheumatoid arthritis (RA) patients.

METHOD AND MATERIALS

Three independent studies were performed to quantify DCE-MRI of wrist and knee: 1) 3T DCE-MRIs of wrist acquired from 10 healthy patients 4 times over a year; 2) 1T DCE-MRIs of wrist acquired in 26 healthy controls and 14 early RA patients under treatment over a year; 3) 1.5T DCE-MRI of RA knee joints twice over 6 months. The protocols were standardised to use GRE sequences acquired every 10-12 seconds over 5-6 min. The Initial Rate of Enhancement (IRE), Maximum Enhancement (ME) and the total number of enhancing voxels were automatically calculated with Dynamika (Image Analysis, UK) from rough ROIs drawn by two independent readers around the anatomy. DEMRIQ-Inflammation, the mean of IRE inside the ROI multiplied by DEMRIQ-Volume, were calculated and compared with the state of the art scoring for RA MRI - RAMRIS. Spearman’s rank correlation (ρ) was calculated between the results of both scoring methods. Inter Class Correlation (ICC) coefficients were calculated between the scores of the observers.

RESULTS

Correlation between DEMRIQ and RAMRIS was ρ=0.865, p<0.05. Longitudinal changes of ME and IRE were stable in controls, under 0.04 compared to baseline values. Healthy controls values were lower than baseline RA values for all parameters (Mann-Whitney, p<0.005). IRE decreased during treatment (Wilcoxon signed rank test, p<0.005), showing sensitivity to change. ICC=0.95, p<0.005.

CONCLUSION

DEMRIQ is robust to different scan parameters, correlates well with RAMRIS and allows for continuous assessment and high degree of automation and reproducibility. The method has the potential to become a sensitive marker for detecting early and subtle changes.

CLINICAL RELEVANCE/APPLICATION

Automation of DCE-MRI quantification allows for objective and reproducible decision support in clinical research and diagnosis. DEMRIQ allows for continuous assessment as opposed to discrete scores of 0-3 with RAMRIS, leading to much more personalised approach to treatment management and earlier diagnosis.


Benedikt Michael Schaar  MD (Presenter): Nothing to Disclose, Xenofon Baraliakos MD: Nothing to Disclose
PURPOSE

Treatment of active ankylosing spondylitis (AS) has undergone a dramatic change with the introduction of new, innovative biologicals like TNFα-blockers. To monitor treatment, more advanced imaging techniques are warranted. Integrated PET/MRI-Scanners may improve diagnostics by combining the high sensitivity of MRI for fat depositions (FD) and bone marrow edema (BME) with the option to monitor osteoblastic activity at a molecular level. The aim of this study was to correlate inflammatory and structural changes depicted by MRI with osteoblastic activity depicted by 18F-Fluoride PET.

METHOD AND MATERIALS

Simultaneous PET/MRI (Magnetom Biograph mMR™, Siemens) was performed in 13 patients with AS in the mineralization phase 40 min after the injection of 18F-Fluoride (mean injected dose 157MBq). 18F-Fluoride uptake, sacroiliac joint (SIJ) sclerosis, ankylosis and erosions as well as BME and FD were reviewed by two independent readers and recorded according to their location in the sacroiliac joint quadrant (SQ) or vertebral quadrant (VQ).

RESULTS

In the spine, FD were observed in 18.2%, BME in 9.9% and fluoride-avid lesions in 5.4% of VQ. Most frequently, high fluoride uptake in the spine was associated with FD (63.1% of VQ), followed by BME (53.8% of VQ). In the SIJ, fluoride-avid lesions were observed in 46.2%, BME in 44.2%, FD in 42.3% and erosions in 32.7% of SQ, while sclerosis and ankylosis was only seen in 19.2% and 9.6% of SQ, respectively. Most frequently, a high fluoride uptake in the SIJ was associated with BME (72.9% of SQ) and erosions (43.8%).

CONCLUSION

In the SIJ and the spine, high osteoblastic activity was observed in correlation with acute inflammatory as well as post-inflammatory MRI changes revealing that a fraction of chronic lesions in AS is metabolically active. Thus, 18F-Fluoride PET/MRI may be able to identify lesions at risk for development of syndesmophytes.

CLINICAL RELEVANCE/APPLICATION

This study helps to understand and potentially predict structural changes in AS patients and provides important information for further trials concerning treatment response in AS.

SSK14-08

In vivo Diffusion-weighted MR Imaging of Joint Fluid with Low and High b-values: Potential for Differentiation between Underlying Arthritis

Sohee Yoon MD (Presenter): Nothing to Disclose, Wook Jin: Nothing to Disclose, Hyug-Gi Kim: Nothing to Disclose, Geo-Ho Jahng PhD: Nothing to Disclose, Seong Jong Yun: Nothing to Disclose, So Young Park: Nothing to Disclose, Jung Eun Lee: Nothing to Disclose, Ji Seon Park MD, PhD: Nothing to Disclose, Kyung Nam Ryu MD, PhD: Nothing to Disclose

PURPOSE

Previous studies have described higher apparent diffusion coefficient (ADC) values in inflammatory arthritis than degenerative arthritis which may be caused by decreased viscosity. We evaluated the role of diffusion-weighted imaging (DWI) with different b-values in differentiation between infectious, inflammatory and degenerative arthritis.

METHOD AND MATERIALS

DWI with b-values of 0, 400 and 1400 s/mm² were obtained in clinically proven 63 arthritis patients with joint effusion (group 1, n = 15 with infectious arthritis; group 2, n = 8 with inflammatory arthritis; group 3, n = 40 with degenerative arthritis). ADCs for each b-value were evaluated. Regions of interest were manually defined in joint fluid areas across several slices with the exception of the synovium to obtain mean ADC values of the joint fluid with two b-values (ADC_400 and ADC_1400, respectively). Statistical evaluations were performed to test any differences among subject groups and to do those between the two b-values using Kruskal-Wallis test and Wilcoxon signed rank test.

RESULTS

The mean ADCs for joint fluid of groups 1, 2, and 3 were 2.48±0.61x10⁻³ mm²/s, 2.82±0.60 x10⁻³ mm²/s and 2.85±0.59 x10⁻³ mm²/s, respectively, at ADC_400 and 1.97±0.58 x10⁻³ mm²/s, 2.17±0.48 x10⁻³ mm²/s and 2.46±0.60 x10⁻³ mm²/s, respectively, at ADC_1400. We found significant differences between ADC_400 and ADC_1400 values in all three groups (P<0.05). The ADC_1400 differed significantly between groups 1 and 3 (P<0.01) and between groups 2 and 3 (P=0.01), but not between groups 1 and 2. The ADC_400 showed significant difference only between groups 1 and 3 (P<0.05).

CONCLUSION

We could differentiate group 3 from group 1 or 2 using in vivo DWI with ADC_1400. ADC_1400 values in group 3 were significantly higher than those in group 1 or 2, presuming the diffusion alternation may be more influenced by cellularity rather than by viscosity. In addition, we found that a high diffusion-sensitizing b-value is important to distinguish between groups.
**Feasibility Study to Estimate the Performance of Single-source Dual Energy CT Scans and Non-rigid 3D Anatomic Registration for Identifying Monosodium Urate Crystals**

Katrina Nesta Glazebrook MBChB (Presenter): Nothing to Disclose
Maria Shiung: Nothing to Disclose
Shuai Leng PhD: Nothing to Disclose
Naveen Srinivasa Murthy MD: Nothing to Disclose
Rickey Carter PhD: Nothing to Disclose
Cynthia H. McCollough PhD: Research Grant, Siemens AG

**PURPOSE**

To demonstrate the feasibility of identifying monosodium urate (MSU) crystals using a conventional single source (SS) CT scanner with two consecutive scans and a non-rigid 3D registration algorithm using dual-source (DS) dual-energy (DE) CT as the reference standard.

**METHOD AND MATERIALS**

After IRB approval, patients undergoing clinically indicated DSDE-CT scans for identification of MSU crystals in or around joints of the upper and lower extremities were recruited on the same day to have SS CT scans with an 80 kV scan, immediately followed by a 140 kV scan. The 2 scans were co-registered with the 3D non-rigid anatomic registration software. DE material composition analysis was then performed on the serial acquired SS DECT scans and the simultaneously acquired DS DECT scan. Four musculoskeletal radiologists randomly evaluated the presence or absence of green pixilation representative of MSU crystal deposition. Kappa estimates were calculated for the 4 readers.

**RESULTS**

A total of 40 patients were evaluated (13 female and 27 male, age range 40 to 82). All 4 readers classified the DS DECT as positive for MSU crystals in 14 patients and negative in 25 patients with 3 of the 4 readers classifying one additional patient as negative. The Kappa statistics for each reader and for the pooled readers showed substantial agreement between the DS and SS techniques (pooled kappa = 0.90 (0.83-0.97 95% confidence interval).

**CONCLUSION**

The results of this study indicate that consecutively acquired SS DECT datasets plus 3D non-rigid motion registration can reliably identify MSU crystals with high agreement to the reference standard of DS DECT.

**CLINICAL RELEVANCE/APPLICATION**

The ability to utilize SS CT scanners to identify MSU crystals in and around joints will significantly increase the availability of this non-invasive diagnostic test for patients with suspected gout.
METHOD AND MATERIALS

For this IRB-approved, HIPAA-compliant, retrospective study, the study population consisted of all patients referred to the MSK Division for fluoroscopically guided tibiotalar joint steroid injections from 1/1/2010-12/31/2013. Images were reviewed on a PACS workstation to determine the injection approach (lateral mortise vs anterior) and to confirm intra-articular administration of injectate. Fluoroscopy time (minutes), radiation dose (mGy), and dose area product (μGy-m^2) were recorded. Their means and standard deviations were calculated and compared using student t-tests. P < 0.05 was considered statistically significant.

RESULTS

246 patients underwent the lateral mortise approach, and 252 underwent the anterior approach. 4 patients were excluded from the lateral mortise group because a) no contrast was administered due to the patient’s contrast allergy (n=2), b) injectate was mostly extra-articular (n=1), or the joint could not be accessed due to severe osteoarthritis (n=1). Mean fluoroscopy time was 0.7±0.5 minutes in the lateral mortise group and 1.2±0.8 minutes in the anterior group (P<0.0001). Mean radiation dose was 2.1±3.7 mGy in the lateral mortise group and 2.5±3.5 mGy in the anterior group (P=0.2400). Mean dose area product was 11.5±15.3 μGy-m^2 in the lateral mortise group and 13.5±17.3 μGy-m^2 in the anterior group (P=0.1739).

CONCLUSION

The lateral mortise approach for fluoroscopically guided tibiotalar joint injection requires statistically significantly less fluoroscopy time than the anterior approach (approximately 40% less). Radiation dose and dose area product were also on average less for the lateral mortise approach than the anterior approach, though these did not reach statistical significance.

CLINICAL RELEVANCE/APPLICATION

Both the lateral mortise and the anterior approaches are effective methods of performing fluoroscopically guided tibiotalar joint injections. Knowledge of both techniques increases the likelihood of success when performing these injections, since one approach or another may be superior for a particular patient. The lateral mortise approach requires approximately 40% less fluoroscopy time and is technically easier to perform and to teach compared to the anterior approach.
SSK15-03

Percutaneous Laser Disc Decompression: Clinical Outcome and MR Evaluation

Venkatesh Hosur Ananthashayana MD (Presenter): Nothing to Disclose, Deepnarayan Srivastava: Nothing to Disclose, Sanjay Sharma MD: Nothing to Disclose, Sanjay Thulkar: Nothing to Disclose, R Malhotra: Nothing to Disclose, Vijay Kumar: Nothing to Disclose

PURPOSE

1. To evaluate the role of image guided Percutaneous Laser Disc Decompression in patients with low back pain due to disc herniation.
2. Role of magnetic resonance imaging in the evaluation of pre and post procedural morphology of the intervertebral disc and to determine a possible mechanism of action of the procedure in relief of symptoms.

METHOD AND MATERIALS

We performed a prospective, single centre study of 32 patients who underwent Percutaneous Laser Disc Decompression for chronic discogenic low back pain. Patients with contained lumbar disc herniation on MRI who did not respond to 6 weeks of conservative treatment were included. All procedures were performed under fluoroscopic guidance using a Flat panel DSA unit with 3D rotational X-ray imaging facility along with 980nm Diode laser system and 360µm PLDD laser fibre. Follow-up clinical outcomes were assessed by modified MacNab criteria at 1, 3 and 6 month. We prospectively reviewed the pre and postoperative MR images of all the patients.

RESULTS

According to modified MacNab criteria, excellent to fair response was seen in 18 out of 32 patients with overall success rate of 56%. In a group of patients with disc herniation smaller than 1/3 of the spinal canal diameter (20/32), success rate was 65% and another group of patients with disc herniation more than 1/3 of the spinal canal diameter (12/32), success rate was 35%. Only 2 of the 18 patients who had a successful result had a reduction in the size of the herniated segment. Subchondral marrow changes were identified in 8 of 32 Percutaneous Laser Disc Decompression patients.

CONCLUSION

Preoperative imaging studies and selection of patients with disc herniation smaller than 1/3 of the spinal canal diameter predict the clinical outcome of Percutaneous Laser Disc Decompression.

Postprocedural subchondral marrow changes were not associated with inflammation of the adjacent disc space and did not affect surgical outcome. Lack of morphological changes in the disc indicates that a chemical or humoral change rather than a mechanical change accounts for the success of the Percutaneous Laser Disc Decompression.

CLINICAL RELEVANCE/APPLICATION

Percutaneous Laser Disc Decompression (PLDD), a valid alternative for those selected patients with contained lumbar disc herniation, who do not respond to conservative treatment, avoiding in many cases need for surgery.

SSK15-04

Balloon-assisted Osteoplasty of Periacetabular Tumors Following Percutaneous Cryoablation

Anil Nicholas Kurup MD (Presenter): Nothing to Disclose, Jonathan Michael Morris MD: Nothing to Disclose, Thomas Duncan Atwell MD: Nothing to Disclose, Grant D. Schmit MD: Nothing to Disclose, Peter Rose MD: Nothing to Disclose, Matthew Raymond Callstrom MD, PhD: Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Gall Medical Ltd

PURPOSE

Percutaneous osteoplasty has been described as a method to alleviate pain and to provide structural support for osteolytic tumors at risk of fracture. However, cement extravasation outside the bone may occur with severe bony erosion or destruction. We describe a new technique using kyphoplasty balloons to promote targeted delivery of cement into the pathologic lesion.

METHOD AND MATERIALS

After IRB approval, the radiology departmental ablation database was searched for cases of combined cryoablation and balloon-assisted osteoplasty performed to treat tumors in the periacetabular region between March 2013 and February 2014. Procedures were performed under general anesthesia with CT guidance and neurophysiologic monitoring. Balloon-assisted osteoplasty was performed in the same session as or the day following cryoablation. One or more 20-mm kyphoplasty balloons were inflated in the ablation defect prior to cement instillation. Cement was then injected in typical fashion under CT-fluoroscopic guidance. Images were reviewed for cement leakage outside of the tumor cavity.

RESULTS

14 combined procedures were performed in 14 patients (9M;5F) with median age of 66 years (range, 43-81). 7 cases were performed primarily for palliation of pain, while 7 were performed solely for risk of impending fracture. 10 (71%) patients had metastases treated, and 4 (39%) had primary bone tumors (myeloma, fibrous dysplasia). Periacetabular tumors were located superiorly in 5, posteriorsuperiorly in 3, posteriorly in 1, anterionerly in 3, and anteromedially in 2 patients. Median tumor size was 4.0 cm (range, 2.9-7.6), and median estimated
tumor volume was 24 mL (range, 9-148). Mean number of balloons used was 2 (range, 1-4). Median cement volume instilled in the ablation cavities was 14 mL (range, 8-35 mL). Median percentage tumor fill was 59% (range, 24-96%). Minimal extravasation (less than 1 mL) was identified in 4 cases.

CONCLUSION

Balloon-assisted periacetabular osteoplasty following percutaneous cryoablation is feasible, may minimize the risk of cement extravasation, and may improve the degree of filling of the osteolytic defect.

CLINICAL RELEVANCE/APPLICATION

Osteolytic tumors in the periacetabular region are frequently painful and at risk of fracture. Use of kyphoplasty balloons to create space for cement filling following cryoablation may minimize the risks of this procedure and allow safe consolidation of these challenging tumors.

SSK15-05

Palliative Treatment of Painful Bone Metastases with MR Imaging–guided Focused Ultrasound Surgery: A Two-centre Study

Alessandro Napoli MD (Presenter): Nothing to Disclose, Alberto Bazzocchi MD: Nothing to Disclose, Giulia Brachetti: Nothing to Disclose, Gaia Cartocci MD: Nothing to Disclose, Paolo Spinnato MD: Nothing to Disclose, Ugo Albisinni MD: Nothing to Disclose

PURPOSE

To evaluate the efficacy of non-invasive high intensity MR guided focused Ultrasound Surgery (MRgFUS) for pain palliation of bone metastasis in patients who had exhausted EBRT or refused other therapeutic options.

METHOD AND MATERIALS

this prospective, single arm, two-centre study received IRB approval. 72 patients (female: 24, male: 48, mean age: 61.6) with painful bone metastases were enrolled. 87 non-spinal lesions underwent MRgFUS treatment using ExAblate 2100 system (InSightec). European Organization for Research and Treatment of Cancer QLQ-BM22 was used for clinical assessment additionally to Visual Analog Scale (VAS), at baseline and 1, 3 and 6 months after treatment. All patients underwent CT and MRI before treatment and 3-6 months afterward.

RESULTS

No treatment-related adverse events were recorded. 34/72 (47.2%) patients reported complete response to treatment and discontinued medications. 29/72 (40.3%) experienced a pain score reduction >2 points, consistent with partial response. Remaining 9 (12.5%) patients had recurrence after treatment. Statistically significant differences between baseline (6, 95%CI 5-8) and follow-up (2, 95%CI 0-3) VAS values and medication intake were observed (p<0.05). Similarly a significant difference was found for QLQ-BM22 between baseline and follow-up (p<0.05).

CONCLUSION

MRgFUS can be safely and effectively be adopted for treatment of painful bone metastases.

CLINICAL RELEVANCE/APPLICATION

MRgFUS can be safely and effectively used as totally noninvasive treatment for pain palliation of bone metastasis in patients who had exhausted EBRT and also in patients not previously treated with EBRT.

SSK15-06

MRI, CT, Na18F-PET, and Histopathological Monitoring of Bone Remodeling Following MR-guided High-intensity Focused Ultrasound

Matthew Dwayne Bucknor MD (Presenter): Nothing to Disclose, Viola Rieke PhD: Nothing to Disclose, Youngho Seo PhD: Research Consultant, sanofi-aventis Group, Andrew Horvai: Nothing to Disclose, Loi Do: Nothing to Disclose, Randall A. Hawkins MD, PhD: Nothing to Disclose, Sharmila Majumdar PhD: Research Grant, Merck & Co, Inc, Thomas M. Link MD, PhD: Research funded, General Electric Company Research funded, InSightec Ltd, Maythem Saeed DVM, PhD: Nothing to Disclose

PURPOSE

To monitor bone remodeling following MR-guided high-intensity focused ultrasound (MRgHIFU) of the normal swine femur with MRI, CT, Na18F-PET and histopathology, as a function of sonication energy.

METHOD AND MATERIALS

Experimental procedures received approval from the local institutional animal care and use committee. MRgHIFU ablations were created in the distal and proximal right femur of eight pigs. Energy dosed distally was higher (419±19 J) than the proximal target (324±17 J). Imaging was obtained before and after ablation using MRI (3T) and CT (64-slice). Animals were evaluated again at 3 and 6 weeks on MRI (n=8), CT (n=8), Na18F-PET (n=4) and histopathology (n=4). Ablation dimensions were measured on contrast enhanced MRI and cortical bone remodeling was measured on CT images.

RESULTS
MRI bone ablation sizes at 3 and 6 weeks following MRgHIFU were similar between distal (high energy) and proximal (low energy) lesions (average 8.7 x 21.9 x 16.4 mm). However, distal (high energy) ablations (n=8/8) demonstrated evidence of subperiosteal new bone formation on CT, with a subtle focus of new bone at 3 weeks and a larger ossification at 6 weeks. These morphologic changes were associated with increased uptake on Na18F-PET in 3/4 animals and confirmed by histopathology in 4/4. In contrast, proximal (low energy) ablations (8/8) demonstrated endosteal fat necrosis and subcortical osteonecrosis, but did not show evidence of new bone formation.

CONCLUSION

MRgHIFU ablation of bone can result in progressive remodeling with both subcortical necrosis and subperiosteal new bone formation. The exact pattern may be related to the energy dose used. MRI, CT and PET are suitable noninvasive techniques to monitor bone remodeling following MRgHIFU.

CLINICAL RELEVANCE/APPLICATION

Specific parameter changes during MRgHIFU of bone could potentially be used to change the pattern of chronic remodeling after treatment. Higher energies might be preferable to stimulate new bone growth, for example, when treating a lytic bone metastasis, while relatively lower energies might be preferable for treatment of benign conditions.

SSK15-07

Manual Needle Versus Powered Drill for CT- Guided Bone Marrow Aspiration and Biopsy: A Comparison of Diagnostic Utility

Sonali Lala MD (Presenter): Nothing to Disclose, Netanel Berko MD: Nothing to Disclose, Karen Ellen Sperling MD: Nothing to Disclose, Alan H. Schoenfeld MS: Nothing to Disclose, Esperanza Villanueva-Siles MD: Nothing to Disclose, Nogah Haramati MD: Investor, Kryon Systems Ltd Investor, OrthoSpace Ltd Investor, BioProtect Ltd Board Member, Kryon Systems Ltd Board Member, OrthoSpace Ltd Board Member, BioProtect Ltd Consultant, AFC Industries, Inc Advisory Board, General Electric Company, Beverly A. Thorntill MD: Nothing to Disclose, Shlomit Goldberg-Stein MD: Research Consultant, Intrinsic Therapeutics Inc

PURPOSE

CT-guided bone marrow biopsy and aspiration is conventionally performed using a manual needle, requiring physical pressure and rotation. We report our experience using a novel battery-powered rotatory bone drill in comparison with our prior use of a manual needle.

METHOD AND MATERIALS

After IRB approval, 20 CT-guided bone marrow aspiration and biopsy procedures were retrospectively reviewed. Ten were performed with a 13 Gauge manual needle and ten were performed with an 11 Gauge battery-powered bone drill. Patient demographics, procedure time, number of CT scans, and core sample size were recorded. Estimated radiation dose was calculated for each procedure by a physicist blinded to needle type. A blinded pathologist reviewed pathology reports and rated core samples as diagnostic/optimal, diagnostic/suboptimal, or non-diagnostic in consideration of overall quality and crush artifact. Median values and interquartile ranges (25th and 75th percentile) were calculated. Statistical analysis was performed using Fisher’s Exact test and Mann-Whitney U Test.

RESULTS

No evidence for significant difference was found between the manual needle and drill groups with respect to patient age, gender, procedure time, number of scans, or estimated radiation dose. Estimated radiation dose (total DLP in mGy-cm) was 638.36 (430.18, 812.75) for the manual group and 529.56 (306.39, 754.74) for the drill group. Four of 10 manual group cores (40%) were of diagnostic/optimal quality, compared to 10/10 drill group cores (100%, p= 0.01). There were significantly more diagnostic/suboptimal (n=4) or non-diagnostic in consideration of overall quality and crush artifact. Median values and interquartile ranges (25th and 75th percentile) were calculated. Statistical analysis was performed using Fisher’s Exact test and Mann-Whitney U Test.

CONCLUSION

Use of a battery-powered drill for CT-guided bone marrow biopsy provided significantly longer core biopsy samples (p<0.03) and significantly more optimal quality core samples (p=0.01) when compared to use of a manual needle, without increasing procedure time or radiation dose.

CLINICAL RELEVANCE/APPLICATION

Bone marrow biopsy cores obtained using a powered drill are significantly longer and more often of optimal quality, when compared to cores obtained using a manual needle approach. This is the first report of outcomes using a drill for CT-guided bone marrow biopsy and aspiration.

SSK15-08

CT Guided Dual Site Nerve Infiltration for Chronic Refractory Pudendal Nerve Neuralgia: Results of a Single Center in 79 Patients and 129 Procedures

Adrian Imre Kastler MD, MSc : Nothing to Disclose, Bruno Alfred Kastler MD, PhD (Presenter): Nothing to Disclose

PURPOSE

To assess the outcome of patients with typical refractory pudendal neuralgia who underwent dual site CT guided pudendal nerve infiltration.
METHOD AND MATERIALS

Between 1995 and 2014, 302 pudendal infiltrations were performed in 167 patients in our Unit. Only patients suffering from typical clinical pudendal neuralgia were included and only the first infiltration in each patient was considered for analysis. Therefore, 79 patients who underwent 129 procedures were assessed. Pain was assessed using Visual Analogue Scale scores (0-10) and self reported estimated improvement, expressed as a percentage. Efficacy of procedure was assessed at 1 month follow up and was defined as a 50% decrease of VAS score. Minimum follow up period was 6 months. All procedures were performed under CT Guidance and on an outpatient basis. Dual site infiltration was performed in each case at both ischial spine and Alcock's canal sites using a mixture of fast and slow acting anesthetic (1 ml lidocaïne hydrochloride 1% and 2 ml ropivacaine chlorhydrate) along with a half dose of 1.5 mL of cortivazol (3.75 mg).

RESULTS

Our cohort consisted of 79 patients (53 females (67,1%) 26 males (32.9%)) with a mean age of 53 years old (range 24-86). Mean pain prior procedure was 7.25/10. Patients suffered from bilateral pain in 50 cases and unilateral pain in 29 cases. Technical success of procedure was 100%. Mean procedure time was 10-15 minutes in case of unilateral infiltration and 20-25 minutes in cases of bilateral infiltration. Clinical success as defined at 1 month was 63 % of all performed procedures. Mean efficacy following procedure in cases of positive response was 3.3 months (ranging from 1 to 48 months). Mean self reported 1 month estimated improvement was 70% in patients with a positive response.

CONCLUSION

CT guided dual site infiltration of the pudendal nerve is an effective treatment in patients suffering from chronic pudendal neuralgia.

CLINICAL RELEVANCE/APPLICATION

Pudendal neuralgia is a debilitating condition with a high socio-economic impact. Treatments for this condition are sparse and pudendal neuralgia may become refractory. CT guided dual site infiltration presents satisfactory mid term results alleviating pain in these patients suffering from intractable pain.

SSK15-09

Sacral Radiofrequency Neurolysis (RF) for the Management of Sacroiliac Joint-related Pain: A Comparison of 3 Techniques

Andrew Michael Pagano MS, BA : Nothing to Disclose , A. Orlando Ortiz MD, MBA (Presenter): Nothing to Disclose , Stanley Golovac MD : Nothing to Disclose

PURPOSE

To compare the utility, efficacy, and safety of 3 different sacral denervation techniques in the management of sacroiliac joint (SIJ) pain that is refractory to conservative medical management.

METHOD AND MATERIALS

94 patients underwent radiofrequency (RF) neurolysis for the treatment of SIJ pain over a 56-month period. 8 patients were treated with cooled RF. 20 patients underwent bipolar RF. And 70 patients underwent multi-lesion RF (47 were treated at a second institution).

Eligible patients suffered at least 7/10 SIJ pain, were on analgesic therapy, and had a favorable, but temporary response to SIJ injections. Clinical presentation, procedure time, fluoroscopy time, anesthesia, complications, pre- and post- pain scores, and analgesic requirements were recorded. Patients were followed up at 3 week, 3 month, and 1 year intervals.

RESULTS

In cooled RF patients, the mean pre-procedure pain score was 8.9, and all experienced complete long-term resolution of SIJ pain. The average procedure time was 2.5 hours and the average fluoroscopy time was 10 minutes. For patients who had received bipolar RF, The mean pre-procedure pain score was 9.1. Post-procedure, all but 1 patient experienced complete resolution of SIJ pain. The average procedure time was 1.5 hours and average fluoroscopy time was 6 minutes. In multi-lesion RF patients, the mean pre-procedure pain score was 8.9 at the primary institution. All patients experienced complete resolution of their SIJ pain. Patients at the second institution experienced similar, dramatic outcomes. The average procedure time was 30 minutes and the average fluoroscopy time was 1.5 minutes.

CONCLUSION

All sacral RF procedures were effective in providing pain relief with a reasonable safety profile in properly selected patients. The sacral multi-RF procedure, however, was more efficient with the shortest average procedure time and the shortest average fluoroscopy time.

CLINICAL RELEVANCE/APPLICATION

Among all causes of lower back pain for patients of any age, SIJ pain represents a major contributor. The goals of treatment for SIJ pain include long-term efficacy, safety, reproducibility, and efficiency. Radiofrequency neurolysis provides a procedure that is minimally invasive with excellent patient outcomes. The three RF techniques examined in this study represent different levels of technical complexity and analogous differences in
procedure time and fluoroscopy time.

MKS-WEA
Musculoskeletal Wednesday Poster Discussions
Scientific Posters

MKS

AMA PRA Category 1 Credits™: .50
Wed, Dec 3 12:15 PM - 12:45 PM   Location: MK Community, Learning Center

Participants
Moderator
Jenny T. Bencardino MD : Nothing to Disclose

Sub-Events
MKS379
Imaging and Clinical Features of Lesions Suspicious for Malignant Transformation in Neurofibromatosis Type 1 (NF1) Associated Plexiform Neurofibromas (PNs) (Station #1)


PURPOSE
Malignant Peripheral Nerve Sheath Tumors (MPNSTs) in NF1 often arise in preexisting PNs. Neurofibromas with histologic atypia (atypical neurofibromas or ANFs) have been described as potential precursors for MPNSTs. Our goal is to identify precursors for MPNSTs based on MRI and FDG-PET imaging and tumor growth characteristics.

METHOD AND MATERIALS
Patients with NF1 and PN were followed longitudinally with MRI using volumetric analysis of tumor burden (MEDx v3.44), and underwent FDG-PET when clinically indicated. Nodular lesions within or outside a PN defined as well-demarcated encapsulated lesions > 3 cm lacking a central dot sign on MRI and often associated with FDG avidity were considered suspicious for malignancy. Growth rate (% change in tumor volume per year) was calculated for nodular lesions and PNs. Histology from either biopsy or resection of nodular lesions was obtained in a subset of patients.

RESULTS
Of 140 patients followed, 56 had suspicious nodular lesions. Tumor growth rates based on ≥1 year of follow up (median follow-up 2.3 yrs; range 1-11.5) with no PN-directed treatment during this interval could be calculated for 73 PNs and 29 nodular lesions from a total of 68 patients (41 male). The median age at the start of growth rate analysis was 8.9 yrs (range 0.7 to 40.2) for PNs and 18.9 yrs (range 8.1 to 45.3) for nodular lesions. The median growth rate was 13% per year (range -14 to 247) for PNs and 22% per year (range -10 to 273) for nodular lesions. In PNs, the highest growth rates were observed in young patients but no age relationship was noted for nodular lesions. Histology was obtained in 20 nodular lesions from 15 patients. 9 were benign, 10 ANF and 1 MPNST. One patient with ANF developed a high grade MPNST after 10 years of observation.

CONCLUSION
ANFs and MPNSTs may be identified based on MRI findings and FDG-PET avidity. Nodular lesions appear to develop at a later age compared to PNs, and growth rates are independent of patient age. We are evaluating additional imaging modalities (MRI diffusion weighted imaging, MR perfusion and 18Fluoro-thymidine PET), which may have further utility in identifying malignant transformation in NF1 PNs.

CLINICAL RELEVANCE/APPLICATION
MPNSTs are highly malignant sarcomas that require complete surgical removal for cure. Identification of precursor lesions for MPNST on imaging will facilitate successful treatment.

MKS380
Histogram Analysis of Iodine Maps from Dual Energy CT: Evaluation of an Objective Response Criterion for Monitoring Targeted Therapy of Melanoma Patients (Station #2)

Monika Uhrig MD, DIPLPHYS (Presenter): Nothing to Disclose, David Simons MD : Nothing to Disclose, Marika Ganten MD : Nothing to Disclose, Jessica Hassel : Nothing to Disclose, Heinz-Peter Schlemmer MD : Nothing to Disclose

PURPOSE
Radiologic monitoring of molecular targeted therapy is essential. Routine CT-follow only focuses on the quantification of tumor size changes, a method which is known to be limited. Contrast-enhanced dual energy CT (DECT) enables additionally within one single examination quantitative assessment of contrast media uptake of tumors. Our purpose was to investigate patterns of contrast media enhancement under targeted therapy by using a novel approach of assessing perfusion changes in melanoma lesions.
performing histogram analyses (HA) of iodine maps based on DECT.

**METHOD AND MATERIALS**

11 stage IV-melanoma patients underwent DECT at baseline, follow up (FU) 1 and FU 2. Volume segmentation of 28 metastases was performed semi-automatically. Iodine uptake (IU) and HA including standard deviation (STD), maximum (max) and mean of 8 RECIST-responders (4 male, 4 female, mean age 63) to BRAF-inhibitor (BRAF-I) therapy was investigated. Furthermore one mixed responder to BRAF-inhibitor as well as two patients under ipilimumab (IPI)-therapy (1 responder, 1 non-responder) are presented.

**RESULTS**

In general, histograms of responder reveal a characteristic pattern including narrower shape and means moving towards origin. For BRAF-responder mean, max and STD of the iodine histograms decrease significantly ($p<0.001$).

**CONCLUSION**

HA of iodine maps based on DECT revealed a typical pattern of contrast media enhancement. It has potential to add an objective and functional criterion to traditional size measurements of standard CT examinations without additional radiation exposure to the patient. DECT can therefore contribute to accurate response assessment of targeted therapies in clinical routine.

**CLINICAL RELEVANCE/APPLICATION**

DECT enables quantification and histogram analysis of contrast media which allows for accurate response assessment of targeted therapy in order to avoid potential toxicity and escalating costs.

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**MKS383**

**National Trends in the Management of Outpatients with Non-traumatic Knee Symptoms Over a Decade (Station #3)**

Patricia Silveira MD (Presenter): Nothing to Disclose, Ivan Ip MD, MPH: Nothing to Disclose, Michael J. Healey MD: Nothing to Disclose, Elizabeth G. Matzkin MD: Nothing to Disclose, Stacy Elaine Smith MD: Nothing to Disclose, Ramin Khorasani MD: Consultant, Medicalis Corp

**PURPOSE**

To examine trends in the management of outpatients with nontraumatic knee symptoms from January 2001 to December 2010.

**METHOD AND MATERIALS**

*Design:* Retrospective study using nationally representative data from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey. 

*Setting and Participants:* All adult outpatients presenting with nontraumatic knee symptoms from January 2001 to December 2010. 

*Main Outcome Measures:* Number of clinic visits, radiographs, computed tomography (CT) and magnetic resonance imaging (MRI) utilization rates, pain medication prescription, and referral to other physician or physical therapy.

*Statistical analysis:* Linear and logistic regressions were performed. Multiple variable regression was conducted to control for confounders.

**RESULTS**

We identified 7847 patient-visits with nontraumatic knee symptoms, which are a representative sample of an estimated 172 million outpatient visits in the United States over the study period. The average age of patients was 57.5 years; 64.3% female. The proportion of pre- and post-operative visits did not change over time. Radiograph utilization remained stable at approximately 28%, while CT and MRI utilization increased from 5% in 2001 to 8.3% in 2010 ($p<0.001$). Non-steroidal anti-inflammatory drugs and acetaminophen use decreased from 35.3% in 2001 to 30.6% in 2010 ($p=0.001$), while narcotic use increased from 5.2% to 15.2% ($p<0.001$). Physical therapy and other physician referral rates increased from 5.7% in 2001 to 14.1% to 2010 ($p<0.001$) and from 9.7% in 2001 to 15.9% to 2010 ($p<0.001$), respectively.

**CONCLUSION**

While the proportion of pre- and post-operative visits and radiograph utilization remained stable, advanced imaging increased over 60%, and referral rates to physical therapy and other physicians increased 147% and 64%, respectively. The largest increase was in narcotic use - nearly 3-fold over the decade. These findings suggest an emerging need for evidence-based guidelines regarding the use of advanced imaging and narcotic prescription for patients presenting with knee symptoms, which could reduce costs, radiation exposure, and overdose rates, and improve quality of care.

**CLINICAL RELEVANCE/APPLICATION**

This is the first nationally representative study of ambulatory patients presenting with knee-related symptoms, the most common musculoskeletal reason for US ambulatory visits in 2009 and 2010.

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**MKS381**

**Reading of the Sacroiliac Joints on Plain Radiographs in Undifferentiated Spondyloarthropathies: Agreement between Local Reading and Trained Central Reading in a Cohort of 708 Patients (Station #4)**

Rosaline Van Den Berg MSc: Nothing to Disclose, Gregory Lenczner MD: Nothing to Disclose, Antoine A. Feydy MD (Presenter): Nothing to Disclose, Desiree M. F. M. Van Der Heijde MD, PhD: Nothing to Disclose, Alain Saraux: Nothing to Disclose, Pascal Claudepierre: Nothing to Disclose
Purpose

In daily practice, local radiologists/rheumatologist judge sacroiliac joints on X-rays (X-SI), while in cohorts the scoring is done by trained readers. Our aim was to compare the local scores to centralized scores.

Method and Materials

Patients with back pain from the 25 participating centers were included in the DESIR cohort (n=708). Baseline X-SIs were scored by the local reader, according to a scoring method derived from the modified New York (mNY) criteria (local score). Grade 2 and 3 from the original mNY were pooled together in one combined grade ‘DESIR-2’. Sacroiliitis was defined by at least unilateral grade ≥DESIR-2. In addition, two centralized readers independently scored all X-SIs according to the original mNY criteria. In case of disagreement, a radiologist experienced in SpA imaging served as adjudicator. An X-SI was marked positive for sacroiliitis if 2/3 readers agreed on bilateral ≥mNY-2 or unilateral ≥mNY-3.

Results

Inter-reader agreement between the two centralized readers was moderate (Kappa 0.54), while percentage agreement (84.3%) was good. However, the adjudicator needed to score 108/689 (15.7%) X-SIs because of disagreement among the two centralized readers. Overall, more radiographs were scored positive by the local readers (n=184) than by the centralised readers (n=145). In 77 patients, the X-SI was scored positive by the local reader but negative by the centralized readers.

Conclusion

Agreement between the centralized score and local score, also the inter-reader agreement between the two centralized readers, was moderate. The role of X-SI as diagnostic criterion for axial SpA should be re-evaluated.

Clinical Relevance/Application

The role of X-Ray of SI Joints as diagnostic criterion for radiographic axial SpA should be re-evaluated.

MKS382

Osteoarthritis of the Knee Treated with Intra-articular Hyaluronic Acid (HA) and Platelet-rich Plasma (PRP) Injection: Clinical, Functional and MRI Evaluation of 1 year Follow-up (Station #5)

Alice La Marra MD (Presenter); Nothing to Disclose, Silvia Mariani MD: Nothing to Disclose, Andrea Mancini MD: Nothing to Disclose, Luigi Zugaro: Nothing to Disclose, Antonio Barile MD: Nothing to Disclose, Carlo Masciocchi MD: Nothing to Disclose

Purpose

To compare long-term results of PRP and HA intra-articular therapy, in patients with osteoarthritis of the knee.

Method and Materials

On the basis of clinical and radiological diagnosis of OA of the knee we selected 223 patients treated in our department with intra-articular injection of HA (105 pts: Group A) and PRP (118 pts: Group B). Exclusion criteria were rheumatic and/or hematologic diseases. All patients were submitted to MRI before and 1 year after infiltrative treatment. To homogenize the results we divided the patients into 2 subgroups on the basis of the age and gender: group Aa (70 pts aged between 62/81; 36 males and 34 females) and Ab (35 pts aged between 36/61; 19 males and 16 females). Group Ba (38 pts aged between 62/81; 20 males and 18 females) and Bb (80 pts aged between 37/61; 42 males and 38 females ). In all patients clinical (VAS 0-10) and functional (WOMAC 0-240) evaluations were performed, before and 1 year after treatment. We created an imaging scale ranging from a minimum of 0 to a maximum score of 11, on the basis of the distribution of the joint effusion (articular recesses, periarticular bursae), the side of the chondral damage (medial and lateral compartments, patello-femoral compartment), and the presence or not of subchondral edema.

Results

Statistically significant age-related differences were observed in our study. Group Aa: MRI showed an improvement of about 60% (10 pre-treatment and 4 after treatment; P < 0.01), with VAS improvement of about 40% and Womac of about 65%; Group Ab: MRI showed an improvement of about 29% (7 pre-treatment and 5 after treatment; P< 0.01) with VAS improvement of about 52% and Womac of about 42%. Group Ba: MRI showed an improvement of about 30% (10 pre-treatment and 7 after treatment; P

Conclusion

Our result show improvements in symptomatology, function, and imaging in all patients, with better results in young pts treated with PRP (37-61 years) and in older pts treated with HA (62-82).

Clinical Relevance/Application

Our study shows that in cases of OA, MRI can be a valid technique both to document the improvement of the patients after infiltrative treatment and to plan their subsequent management.

MKE263

Disco Inferno: A Rapid Review of Lumbar Discography (Station #6)

Jordan Gold MD (Presenter); Nothing to Disclose, Kristen Elizabeth McClure MD: Nothing to Disclose, Adam C. Zoga MD: Nothing to Disclose, Christopher Geordie Roth MD: Author, Reed Elsevier
TEACHING POINTS
The purpose of this exhibit is: 1. Review the indications for lumbar discography, including using MRI-gadolinium based discography. 2. Review technique and interpretation of CT and MR discography, including potential pitfalls. 3. Review potential complications related to CT and MR discography. 4. Discuss potential benefit of MR Discography compared with conventional CT-discography.

TABLE OF CONTENTS/OUTLINE

Elbow Injuries in Adult and Pediatric Overhead Athletes (Station #7)
Dana Lin MD (Presenter): Nothing to Disclose, Jonathan Khedoori Kazam MD: Nothing to Disclose, Tony T. Wong MD: Nothing to Disclose

TEACHING POINTS
1. To review common injuries in the pediatric overhead athlete
2. To review common injuries in the adult overhead athlete
3. Use powerpoint based animations to explain mechanisms of all discussed injuries in both populations

TABLE OF CONTENTS/OUTLINE

Non-Neoplastic Masses of the Hand and Wrist (Station #8)
Maryann Ro MD (Presenter): Nothing to Disclose, Sarah Vanderlinde Mijangos MD: Nothing to Disclose, Carlos Luis Benitez MD: Nothing to Disclose, Robert Daniel Irish MD: Nothing to Disclose

TEACHING POINTS
1. Many palpable masses of the hand and wrist are of non-neoplastic origin.
2. The differential diagnosis of palpable masses of the hand and wrist can be narrowed by identifying their relationship to surrounding structures and defining the signal characteristics on MR imaging.
3. A more definitive diagnosis can be reached when the physical exam findings and previous medical conditions are known.

TABLE OF CONTENTS/OUTLINE
Exhibit Organization: I. Brief Overview of Hand Anatomy II. Acquired non-neoplastic masses of the hand and wrist 1. Arthropathies • Gout • Rheumatoid arthritis 2. Tendinopathy and Synovitis • Diffuse pigmented villonodular synovitis • Nodular tenosynovitis • DeQuervain’s tenosynovitis • Tenosynovial chondromatosis • Calciﬁc tendinitis 3. Post-traumatic Lesions • Flexor tendon bursitis • Hematoma 4. Cysts • Ganglion cyst 5. Other • Nora’s lesion III. Developmental non-neoplastic masses 1. Vascular • Arteriovenous malformations • Varic 2. Accessory Muscles • Extensor digitorum manus brevis 3. Bony excrescences • Carpal boss • Melorrheostosis 4. Other • Fibrolipomatous hamartoma

MR Imaging of BioCartilage Augmented Microfracture Surgery (Station #9)
Nicholas Mark Gutierrez MD (Presenter): Nothing to Disclose, Jean Jose MS, DO: Nothing to Disclose, Ty Kanyon Subhawong MD: Nothing to Disclose, James Banks MD: Nothing to Disclose, Bryson Lesniak MD: Nothing to Disclose, Michael Baraga: Nothing to Disclose, Thomas Temple MD: Nothing to Disclose

TEACHING POINTS
Focal full-thickness articular cartilage defects are prevalent in young active patients and often result in significant morbidity. The use of BioCartilage as an adjunct to standard microfracture surgery has emerged as a promising technique for cartilage restoration. A description of BioCartilage and its post-operative MR imaging appearance are provided in this exhibit. It is essential that the musculoskeletal radiologist becomes familiar with this surgical technique and its post-operative MR imaging findings including potential complications.

TABLE OF CONTENTS/OUTLINE
- Indications - Surgical technique - What is BioCartilage? • Dehydrated, micronized allogeneic cartilage extracellular matrix containing proteoglycans and type II collagen among other matrix elements. • What is the role of BioCartilage? • Primarily provides scaffolding over a microfracture defect and promotes regeneration of more hyaline-like cartilage in conjunction with platelet-rich plasma (PRP). • Post-operative MR imaging • Fast spin echo, gradient echo, and T2 mapping • Signs of incomplete incorporation and other complications with
**MKE320**

**Imaging of Soft tissue Tumors Clues and Tricks for Decision Making (SLAM Approach) (Station #10)**

Rammohan Vadapalli MD (Presenter): Nothing to Disclose, Harshavardhan KR MD: Nothing to Disclose, Lalitha Palle: Nothing to Disclose

**TEACHING POINTS**

To make an algorithmic diagnostic imaging approach for characterization of soft tissue masses (SLAM approach: S-Signal and Signs, L-Location A-Age group M-Multiplicity/Morphology)

**TABLE OF CONTENTS/OUTLINE**

SLAM approach: Signal morphology on T1 and T2, Location clues, Age group clues, Multiplicity are discussed with clinical examples. The Key Imaging Signs are illustrated with examples: Triple sign: Synovial sarcoma Lasagne sign: Liposarcoma Broccoli sign: Lipoma arborescence Fascicular sign: Neurogenic tumours Comet Tail sign: Neurogenic tumours Dots in circle sign: Myxoma Coaxial cable sign: Lipo fibromatosus Hamartoma Median nerve/Neural Fibrolipoma Location clues along a vein, along a nerve, along a tendon to name a few. Multiplicity and causes of multiple and symmetrical soft tissue mass lesions are illustrated: The M Rule or MI7 for the Morphology of the lesions is highlighted: Morphology (MI 7 Rule) Melanin - Clear cell Sarcoma Met haemoglobin: Haemorrhage in a tumour/Haematoma Mucin: Metastatic adenocarcinoma Mycelia (septal hyphae): Fungal pathology - Mycetoma MatrixMix: Calcium, Phleboliths, haemosiderin, Fat, Cellularity Makkan (Fat): Lipoma, Lipoblastoma Myxoid: Myxoma, Myxoid Liposarcoma

**MKE333**

**Sacrumology 101 - Benign and Malignant Primary Tumors (Station #11)**

Mital Kishor Patel MD (Presenter): Nothing to Disclose, Ricki Upendra Shah MD: Nothing to Disclose, Andrew Lee Chiang MD: Nothing to Disclose

**TEACHING POINTS**

- Multimodality imaging review of benign and malignant primary sacral tumors. - Brief review of the safety, efficacy, and technical aspects of CT guided biopsies of these tumors

**TABLE OF CONTENTS/OUTLINE**

- Purpose/Aim: The detection and imaging workup of sacral tumors often crosses multiple radiology subspecialties including musculoskeletal, neuroradiology, and body imagers. As each subspecialist may have a tendency to limit their differential based on their scope of practice, we hope to provide an electronic educational exhibit that broadens their perspectives and highlights the full spectrum of both benign and malignant primary sacral tumors. Table of Contents: Case based review (list below) - brief pertinent patient history and symptomatology - multimodality imaging review - discussion of role of CT guided biopsy in each case - treatment and management Benign Tumors - Myxopapillary Ependymoma - Schwannoma - Giant Cell Tumor - Large Tarlov Cyst Malignant Tumors - Plasmacytoma - Chondrosarcoma - Chordoma - Myeloid Sarcoma - Ewings - Non-Hodgkins Lymphoma

**MKE205**

**Brachial Plexus: MRI and Ultrasound Evaluation and the Clinical Impact. Demonstrating Imaging Technique, Anatomy & Pathology. Six Year Review of Both Ultrasound and MRI Findings of the Brachial Plexus in the Same Patients (Station #12)**

Mark Cresswell MBCh (Presenter): Nothing to Disclose, Mary Margaret Chiavaras MD, PhD: Nothing to Disclose, Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc, Darra Thomas Murphy MD, FRCP: Nothing to Disclose, Roberta Dionello MBBS, FRCR: Nothing to Disclose

**TEACHING POINTS**

- Imaging technique of the Brachial Plexus using both ultrasound and MRI
- Step by step approach to ultrasound technique to assess the Brachial Plexus.
- Understand the relative merits and pitfalls of both MRI and ultrasound
- Anatomic review of the brachial plexus
- Pathology of the Brachial Plexus reviewed by case examples

**TABLE OF CONTENTS/OUTLINE**

- A. Objectives
- B. Anatomy
- C. Ultrasound technique
- D. MRI evaluation
- E. Advantages: MRI vs US
- F. Advantages: US vs MRI
- G. Pathology: Roots
- H. Pathology: Trunks
- I. Pathology: Cords
Paraspinal Musculature Anatomy and Pathology: A Pictorial Essay (hardcopy backboard)

María Del Rocio Iniguez-Rodriguez MD (Presenter): Nothing to Disclose, Juan Eugenio Cosme MD: Nothing to Disclose, Jorge Vázquez-Lamadrid MD: Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit 1. Review the basic anatomical of the paraspinal musculature. 2. Describe and illustrate landmark that aid during the interpretation of MRI spine. 3. Describe and illustrate pathology in the paraspinal musculature.

TABLE OF CONTENTS/OUTLINE
Preliminary Results (Station #2)

Ty Kanyn Subhawong MD (Presenter): Nothing to Disclose, Mark D. Barton MBA, BS: Nothing to Disclose, Juan Abelardo Augusto Pretell MD: Nothing to Disclose, Juan Jose MS, DO: Nothing to Disclose, Sheila Conway MD: Nothing to Disclose, H. Thomas Temple: Consultant, Stryker Corporation

PURPOSE

Soft tissue sarcomas are often treated with neoadjuvant chemo- or radiation therapy; determining when treatment effect has plateaued has important treatment implications for timing of surgery. Such decisions are often based on radiologic imaging parameters but these remain suboptimally defined. We correlated quantitative measurements of tumor volume to quantitative and qualitative assessments of percent tumor necrosis.

METHOD AND MATERIALS

In this IRB-approved retrospective review, we identified 23 patients with both pre- and post-neoadjuvant therapy MRI available for volumetric tumor assessment. Tumor volume was calculated using OsiriX by drawing a region of interest, which outlined the tumor margins across multiple contiguous slices; a pixel-thresholding technique was used to identify solidly enhancing tumor, and the percentage of necrosis from the total tumor volume was calculated using the MATLAB programming language. Subjective assessment of percent tumor necrosis was performed on a randomly selected subset of 8 patients and compared to quantitative results.

RESULTS

Subject mean age was 53.6 years, range 15-88, 13 males). Relative change in tumor volume correlated poorly with change in percentage necrosis, as calculated quantitatively and subjectively (Pearson r = 0.15 and -0.21, respectively). There was good correlation in absolute assessments of percent necrosis between subjective and quantitative methods (Pearson r = 0.87). Correlation between subjective and quantitative assessments of change in tumor necrosis was fair (Pearson r = 0.48).

CONCLUSION

Changes in tumor volume show little correlation with changes in percent tumor enhancement assessed subjectively and quantitatively.

CLINICAL RELEVANCE/APPLICATION

Clinical decisions based on changes in soft tissue sarcoma tumor volume as a surrogate for treatment response should be made with caution; subjective assessments correlate well with more labor-intensive quantitative techniques.

Diagnostic Impact of Echo Planar Diffusion-weighted Magnetic Resonance Imaging (DWI) in Musculoskeletal Neoplastic Masses Using Apparent Diffusion Coefficient (ADC) Mapping as a Quantitative Assessment Tool (Station #3)

Sherif Abdelfattah MD, PhD (Presenter): Nothing to Disclose, Hassan Kassem MD: Nothing to Disclose

PURPOSE

To evaluate the diagnostic impact of echo planar DW imaging in distinguishing benign from malignant musculoskeletal soft-tissue masses using ADC mapping as a quantitative assessment tool.

METHOD AND MATERIALS

We evaluated 73 tumors (21 bone tumors and 52 soft-tissue tumors). MR examinations were performed with a 1.5-T system. Diffusion-weighted single-shot EPI images were obtained in all patients. Apparent diffusion coefficients (ADCs) were calculated by using b factors of 0 and 1000 s/mm2. ADC value measurements were compared with the histopathological findings.

RESULTS

The average ADC of benign tumors was 1.86 ±0.67 • 10^-3 mm2/s, and that of malignant soft-tissue tumors was 0.97 ±0.35 • 10^-3 mm2/s. ADC value of malignant tumors was significantly lower than that of the benign tumor group (p< 0.0001). The highest ADC value was seen in the case of ganglion cyst (2.8 ± 0.23 • 10^-3 mm2/s) and cystic neurofibroma (2.5 ± 0.04 • 10^-3 mm2/s), and juxta cortical enchondroma (2.65 ± 0.36 • 10^-3 mm2/s) while the lowest one was seen in aggressive fibromatosis (0.37± 0.05 • 10^-3 mm2/s). For malignant soft-tissue masses, the highest ADC value was seen in mesenchymal chondrosarcoma (2.1 ± 0.32) liposarcoma (intermediate grade) (1.4 ± 0.21) while the lowest ADC value was seen in fibrosarcoma (high grade) (0.78± 0.14).

CONCLUSION

MR diffusion provides additional information to the routine MRI sequences rendering it an effective non-invasive tool in differentiating between benign and malignant soft-tissue tumors.

CLINICAL RELEVANCE/APPLICATION

MR diffusion provides additional information to the routine MRI sequences rendering it an effective non-invasive...
MKS387

Prevalence of MRI Spinal Lesions Typical for Axial Spondyloarthritis in Patients with Inflammatory Back Pain (Station #4)

Manouk de Hooge: Nothing to Disclose, Jean-Baptiste Pialat MD: Nothing to Disclose, Antoine A. Feydy MD (Presenter): Nothing to Disclose, Monique Reijnierse MD: Nothing to Disclose, Maxime Dougdados: Nothing to Disclose, Desiree M. F. M. Van Der Heijde MD, PhD: Nothing to Disclose

PURPOSE

Background: Since 2012, a cut-off value of ≥3 inflammatory lesions was suggested by the ASAS/OMERACT group, as positive MRI of the spine (MRI-spine). Moreover, fatty lesions on MRI-spine are associated with axial Spondyloarthritis (axSpA). Objectives: To determine the prevalence of inflammatory (BME) and fatty lesions on MRI of the spine in patients with and without axSpA.

METHOD AND MATERIALS

Patients aged 18-50 with inflammatory back pain (≥3 months, ≤3 years) from 25 centres in France were included in the DESIR-cohort (n=708). All available baseline MRIs were independently scored by 2 well-calibrated readers, blinded to any other data. In case of disagreement, an experienced radiologist served as adjudicator. BME and fatty lesions typical for axSpA were scored when visible on ≥2 consecutive slices. Prevalence of MRI lesions was calculated based on several cut-offs and lesions were considered present if 2/3 readers agreed.

RESULTS

All patients with symptom onset <45 y with MRI-spine (n=549) were included in the analyses. Patients fulfilling the ASAS criteria could either fulfill both arms, only the imaging arm or only the clinical arm. The first 2 groups were subdivided; patients with radiographic sacroiliitis (mNY+) and sacroiliitis on MRI (MRI+), patients with mNY+ and no sacroiliitis on MRI (MRI−), patients without radiographic sacroiliitis (mNY−) and MRI+. BME lesions occur in all different subgroups of the ASAS criteria and in patients without axSpA. The prevalence in no SpA group (which can be seen as false positives) is only 6.1%. With a cut-off ≥2 BME lesions false positives drop below 5% while the prevalence in the ASAS axSpA groups is still reasonable. Especially prevalence in patients with mNY+ and MRI+ is very high; 61.9% (both arms positive) and 43.8% (imaging arm only positive). Fatty lesions are seen slightly less often seen in all patient groups.

CONCLUSION

In a low percentage of patients without axSpA BME and fatty lesions is found indicating that spinal BME and fatty lesions are specific for patients with axSpA. These lesions are especially prevalent in patients with sacroiliitis on imaging. In this cohort, a cut-off ≥2 or ≥3 BME lesions and similarly ≥2 or ≥3 fatty lesions discriminate best between patients with and without axSpA.

CLINICAL RELEVANCE/APPLICATION

Spinal BME and fatty lesions on MRI are especially prevalent in patients with sacroiliitis on imaging.

MKS388

Bastrup Disease (Kissing Spine Syndrome): Safety and Efficacy of Imaging- Guided Infiltrations (Station #5)

Maria Tsitskari MD (Presenter): Nothing to Disclose, Dimitrios Filippidis MD, PhD: Nothing to Disclose, Lazaros Reppas BS: Nothing to Disclose, Efthimia Alexopoulou: Nothing to Disclose, Nikolaos L. Kelekis MD: Nothing to Disclose, Alexios Kelekis MD, PhD: Consultant, Benvenue Medical, Inc

PURPOSE

Baastrup disease refers to pathology of adjacent spinous processes of degenerative origin resulting in back pain with central distribution. Purpose of this study is to assess safety and efficacy of percutaneous, fluoroscopy-guided infiltrations in a consecutive series of patients suffering from symptomatic Baastrup disease.

METHOD AND MATERIALS

During the last 4 years, 55 patients suffering from Baastrup disease (diagnosed clinically and by imaging findings) underwent percutaneous, fluoroscopy-guided infiltration. Diagnosis was performed both clinically and with imaging studies (x-ray or Computed Tomography or Magnetic Resonance Imaging). The position of the needle (22 Gauge spinal needle) was fluoroscopically verified at the level of interspinous-midspinous ligament. Once in proper position, a mixture of long acting glucocorticosteroid with local anesthetic (1.5/1 cc) was injected. A questionnaire with NVS scale helped assessing pain relief degree, life quality and mobility improvement.

RESULTS

A total of 67 sessions was performed in our patient sample (1.21 infiltration /patient). In 12/55 patients (21.8%) a second infiltration was performed within 7-10 days apart from the first one. Comparing the pain scores prior (mean value 8.18±1.44 NVS units) and after (mean value 0.62±0.93 NVS units) there was a mean decrease of 7.56±1.686 NVS units units (p<0.001) on terms of pain reduction, effect upon mobility and life quality. There were no clinically significant complications noted in our study.

CONCLUSION
Fluoroscopy-guided infiltrations seem to be a feasible, efficacious and safe approach for pain reduction and mobility improvement in patients with Baasstrup disease. Imaging guidance ensures proper needle positioning as well as enhances efficacy and safety.

**CLINICAL RELEVANCE/APPLICATION**

Corticosteroid infiltration for Baasstrup disease is a safe and efficient therapy for pain reduction and mobility improvement; imaging guidance ensures accurate needle placement and augments safety and efficacy.

**MKS389**  
Reliability of sterEOS 3D Scoliosis Measurements Using a 5 Fold Reduction in Radiation (Station #6)

**PURPOSE**

To evaluate the reliability of 3D spinal reconstructions from EOS x-rays utilizing a 5-fold reduction in radiation dosage compared to standard EOS images utilized for evaluating patients with adolescent idiopathic scoliosis (AIS).

**METHOD AND MATERIALS**

After IRB approval, 30 AIS patients (20 non-op, 10 post-op) who received “standard”, biplanar, anteroposterior and lateral spine x-rays in our EOS imaging unit (~ 0.31mGy) as part of their routine care, also underwent an additional set of “microdose” EOS x-rays (~ 0.06 mGy) using a new protocol. All subjects had a major Cobb angle greater than 20° (non-operative cohort) or a prior posterior spinal fusion with instrumentation (post-operative cohort). A single reviewer created full 3D reconstructions once of each set of images using sterEOS software. Coronal (Cobb angles), sagittal (T1-T12, T4-T12, L1-L5, L1-S1), and apical axial rotation measurements were obtained. Intraclass correlations (ICC) and the 95% confidence intervals for the differences between the standard and microdose EOS image measurements were compared.

**RESULTS**

The average ICC was 0.95 for both the non- and post-operative groups (range 0.89-0.99). The calculated differences for all coronal and sagittal measurements were statistically similar in the non-operative group (p>0.05). In the post-operative group, all measurements were statistically similar, with the exception of T1-T12 kyphosis, which measured greater in the microdose x-rays (45° vs 42°, p=0.001). The error in measurement between standard and microdose images can be found in the Table.

**CONCLUSION**

Good reliability was found between 3D measurements of the standard x-rays and the microdose x-rays in patients with idiopathic scoliosis. A small difference in measurements was observed for T1-T12 kyphosis in the post-operative group possibly suggesting slightly greater difficulty in visualizing the spine in patients after spinal fusion with instrumentation. Further study is underway with a goal of 30 subjects per group; however there is a strong suggestion that radiation exposure can be further reduced with EOS imaging in scoliosis patients.

**CLINICAL RELEVANCE/APPLICATION**

For scoliosis patients, standard EOS imaging offers reduced radiation exposure; it appears further reduction by another 5-fold is possible while maintaining reliability of 3D deformity measurements.

**MKE261**  
"Bending over Backwards": Dual-Energy CT Assessment of the Spine (Station #7)

**TEACHING POINTS**

Dual-energy computed tomography - how does it work Recognizing hardware or soft tissue complications such as fracture or loosening Optimize acquisition and reconstruction parameters to minimize artifact whilst maximizing soft tissue resolution Help problem solve by identifying vertebral marrow edema in trauma and perivertebral urate deposition in gout Tips and tricks for using the monoenergetic spectrum to your advantage

**TABLE OF CONTENTS/OUTLINE**

The advent of dual-energy technology is changing the way we utilize computed tomography. A variety of conditions affecting the spine may present themselves on CT such as traumatic or osteoporotic vertebral fracture, spondylo-lysis/listhesis or even gout. This exhibit demonstrates how to evaluate accurately and effectively using dedicated algorithms. However a big challenge for the Radiologist remains when evaluating the spine in the presence of high atomic number (high-Z) materials. Traditionally CT imaging has proved inadequate in these situations due to excessive spray and streak artifact resulting from a variety of factors including beam hardening, detector photon starvation and inherent quantum noise. With our ability to manipulate the parameters of the dataset acquired as well as apply specific reconstruction algorithms, comes more accurate evaluation of both the osseous and soft tissue structures.

**MKE184**  
The Forgotten Bone: An Overdue Review of Lesions Which May Arise In the Fibula (Station #8)
The purpose of this exhibit is: 1. To discuss the role of MRI in spinal marrow assessment with optimal use of sequences. 2. To discuss the role of MRI in spinal marrow assessment with emphasis on physiological changes and various patterns of denervation changes in musculature on MRI. 3. To illustrate the patterns of nerve entrapment of the upper extremity with high-resolution MRI. 4. To briefly review important lesion-specific “pearls” as well as options for clinical management. 5. To discuss how anatomy of the fibula influences the form of primary fibular lesions (e.g., benign lesions may be more likely to appear expansile and therefore aggressive than in other bones) 6. To simplify the differential diagnosis based on key imaging findings and clinical clues. 4. To briefly review important lesion-specific “pearls” as well as options for clinical management.

**TABLE OF CONTENTS/OUTLINE**

Introduction Discussion of how fibular anatomy influences lesion appearance. Review of fibular lesions and their imaging appearance, including benign and malignant intramedullary and surface tumors, tumor-like lesions, and tumor mimics. This review will include: --Clinical clues --Key imaging findings with pathology specimens --Multi-modality approach to imaging work-up --High yield "pearls" and management considerations. Summary

**MKE218**

**Nerve Entrapment of the Upper Extremity: A Closer Look with High-resolution MRI from the Nerve Roots to the Hand (Station #9)**

Niyata Chitrapat MD (Presenter): Nothing to Disclose, Karen Chi-Lynn Chen MD: Nothing to Disclose, Eric Y. Chang MD: Nothing to Disclose, Richard Znamierowski: Nothing to Disclose, Sheronda Statum: Nothing to Disclose, Christine B. Chung MD: Nothing to Disclose

**TEACHING POINTS**

Review the various types and severity of peripheral nerve injury. Review the MR appearance of peripheral nerves in health and disease. Review patterns of denervation changes in musculature on MRI. Detail potential sites of nerve entrapment of the upper extremity with high resolution MRI.

**TABLE OF CONTENTS/OUTLINE**


**MKE322**

**Imaging Signs of Nerve Sheath Tumours and Tumour Like Masses on Conventional MRI and MR Neurography Revisited (Station #10)**


**TEACHING POINTS**

-Elent the signs commonly used in characterization of neural sheath masses -Illustrate each Imaging sign with clinical examples -The Pathological correlates of Imaging signs used to identify neural sheath neoplasms and Tumour like masses

**TABLE OF CONTENTS/OUTLINE**


**MKE269**

**MR Imaging of Spinal Marrow: Normal and Abnormal Patterns (Station #11)**

Chandan Kakkar MBBS, MD (Presenter): Nothing to Disclose, Satwant Singh Khela MBBS: Nothing to Disclose, Kavita Saggar MD: Nothing to Disclose, RITU GALHOTRA MD: Nothing to Disclose, Prakashini Koteshwara MD: Nothing to Disclose, Rajagopal KV MD, FRCR: Nothing to Disclose

**TEACHING POINTS**

To discuss the role of MR imaging in spinal marrow with emphasis on physiological changes and various pathologies involving the spinal marrow.

**TABLE OF CONTENTS/OUTLINE**

1) To discuss the role of MRI in spinal marrow assessment with optimal use of sequences. 2) To illustrate the physiological changes in the marrow with advancing age. 3) To illustrate the patterns of marrow involvement in conversion process in haemolytic anemias and haemato logical malignancies. 4) Patterns of marrow infiltration and replacement in primary and secondary malignancies. 5) Considerations like marrow involvement in HIV, vertebral fractures, infectious and degenerative
Are New MRI Techniques Useful for Knee Evaluation? (Station #12)

Teodoro Martin MD (Presenter): Nothing to Disclose, Antonio Luna MD: Nothing to Disclose, Joan C. Vilanova MD, PhD: Nothing to Disclose, Maria Jose Romero Rivera: Nothing to Disclose, Fernando Caro Mateo: Nothing to Disclose, Jordi Broncano MD: Nothing to Disclose, Pilar Caro Mateo: Nothing to Disclose, Lidia Alcala Mata MD: Nothing to Disclose.

TEACHING POINTS
1. Review the technical adjustments necessary to perform, in the knee, functional sequences such as DWI, DCE-MRI, DWJ and DTI-based neurography, multiecho TSE T2-weighted sequence for T2 mapping of the cartilage, 3D and 4D angiography and MR lymphography.
2. Analyze the impact of all these new techniques in the evaluation of normal structures and pathological conditions.

TABLE OF CONTENTS/OUTLINE
CONTENT ORGANIZATION
1. Introduction
2. Technical basis and adjustments of advanced MRI sequences
   a. DWI
   b. DCE-MRI
   c. MR neurography: STIR, DWI and DTI
   d. MRI angiography: 3D, 4D
   e. MRI lymphography
3. Clinical applications
   a. Bone and soft tissue tumors
   b. Cartilage quantification
   c. Vascular disease (venous, arterial and lymphatic)
   d. Nerve pathology (tumoral and non-tumoral)

SUMMARY
Functional MRI permits to obtain quantifiable information in several clinical scenarios in the knee.

Musculoskeletal Imaging (Utilization, Dose Reduction and Technical Considerations)

Scientific Papers

SSM15

Utility of Pre and Post MR Arthrogram Imaging of the Shoulder: Effect on Patient Care

Thomas Henry Magee MD (Presenter): Nothing to Disclose

PURPOSE
MR arthrogram imaging of the shoulder is considered to be more accurate in assessing shoulder pathology than conventional MR imaging. Arthrography is a minimally invasive procedure. However, most patients prefer to have conventional MR imaging rather than MR arthrogram imaging. We report the benefit of assessing prearthrogram conventional MR imaging to determine whether an MR arthrogram is needed for further evaluation.

METHOD AND MATERIALS
One hundred consecutive conventional shoulder MR and MR arthrography exams performed on the same patients were reviewed retrospectively by consensus reading of two musculoskeletal radiologists. Both conventional MR and MR arthrogram exams were performed on each patient on the same day. Conventional MR and MR arthrogram exams were assessed for labral tears and supraspinatus tendon tears. All patients went on to arthroscopy.

RESULTS
Of these one hundred patients, forty-three had SLAP (superior labral anterior to posterior) tears, twenty-eight had posterior labral tears, twenty-three had anterior labral tears, and forty-seven had full thickness supraspinatus tendon tears. On MR arthrogram exam, fifty-one patients had SLAP tears, thirty-three had posterior labral tears, twenty-nine had anterior labral tears, and forty-nine had full thickness supraspinatus tendon tears. MR arthrogram detected eight SLAP tears, five posterior labral tears, six anterior labral tears, and two supraspinatus tendon tears not detected on conventional MR exam. All MR arthrogram findings were seen at arthroscopy. Eighteen of the twenty-one patients with additional findings on MR arthrogram exam had normal appearing conventional MR exams.

CONCLUSION
Use of pre and post MR arthrogram imaging may benefit patient care. When positive findings are demonstrated on MR exam, few additional findings are demonstrated on MR arthrogram exam. These patients may not need to proceed to MR arthrography. If the conventional MR exam is negative then additional information may be obtained by proceeding to MR arthography.

CLINICAL RELEVANCE/APPLICATION
Clinical relevance: Use of pre arthrogram imaging may allow for cancellation of a substantial number of MR arthrogram exams. If the conventional MR exam is negative then additional information may be obtained by proceeding to MR arthography.
Clinical relevance: Use of pre arthrogram imaging may allow for cancellation of a substantial number of MR arthrogram exams in patients with positive findings on conventional MR exam. If conventional MR imaging is negative proceeding to MR arthrography may demonstrate additional findings.

SSM15-02

Can a Single Isotropic 3D FSE Sequence Replace 3 Plane Standard PD FS Knee MRI Imaging at 1.5T?

Bill Pass MBBCh (Presenter): Nothing to Disclose , Andrew J. Grainger MRCP, FRCR : Speaker, General Electric Company Equipment support, Siemens AG , Philip Robinson MBBCh : Nothing to Disclose

PURPOSE

Our institution's standard 1.5T protocol for knee MRI comprises orthogonal 3 plane fat saturated (fs) proton density (PD), coronal T1 and sagittal T2 (fs) imaging. Our aim was to assess whether a single isotropic 3D fast spin-echo (FSE) PD(fs) sequence reconstructed in 3 planes could replace the 3 PD FS sequences in our standard protocol.

METHOD AND MATERIALS

MRI studies of 95 knees were independently and prospectively interpreted by two experienced musculoskeletal radiologists over two separate readings at least 3 weeks apart. A 3D FSE PD(fs) sequence was added to our routine MRI protocol for the recruited patients with the images reconstructed at 2.5 mm in axial, coronal and sagittal planes and presented as individual sequences. 2.5 mm was selected following a separate pilot study to determine the optimal slice thickness.

One observer read the conventional sequences first and for the second read replaced the 3 PD sequences with the reconstructed 3D sequences. The second reader performed the same two reads in opposite order. Following each read the observer was allowed to review the 3D data set and perform multi-planar reformats to see if this altered confidence. Menisci and ligaments were graded for the presence of a tear and articular cartilage for damage. Statistical analysis to calculate accuracy was performed comparing to our standard sequence as the reference standard.

RESULTS

We found that the accuracy for assessment of the menisci and cartilage surfaces was markedly reduced when using the reformatted 3D sequences. The reporting accuracy was as follows; medial meniscus (MM) = 90.9%, lateral meniscus (LM) = 93.7%, anterior cruciate ligament (ACL) = 98.9% and cartilage surfaces = 85.8%. Agreement between the two readers was also reduced using the 3D sequence (Standard protocol: MM kappa=0.91, LM =0.89, ACL= 0.98, cartilage= 0.84; 3D protocol: MM=0.86, LM=0.77, ACL=0.94, cartilage= 0.64).

CONCLUSION

Use of a 3D PD FSE sequence reconstructed in 3 planes gives reduced accuracy in comparison with conventional 3 plane PD FS sequences when evaluating menisci and cartilage surfaces with a 1.5T MRI scanner. The present study indicates a decreased level of concordance between readers for the reconstructed 3D (SPACE) sequence.

CLINICAL RELEVANCE/APPLICATION

At 1.5T a 3D PD FSE sequence reconstructed in 3 planes demonstrates reduced accuracy and confidence in reporting in comparison with conventional 3 plane PD FS sequences.

SSM15-03

Quality-controlled Dose-reduction of Full-leg Radiography in Patients with Knee Malalignment

Jost Kloth : Nothing to Disclose , Volker Ewerbeck : Nothing to Disclose , Wolfram Stiller PhD, DIPLPHYs : Nothing to Disclose , Iris Burkholder : Nothing to Disclose , Hans-Ulrich Kauczor MD : Research Grant, Boehringer Ingelheim GmbH Research Grant, Siemens AG Research Grant, Bayer AG Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Siemens AG Speakers Bureau, Novartis AG , Marc-Andre Weber MD (Presenter): Research Grant, Bayer AG Research Grant, Guerbet SA Research Grant, Bracco Group Research Grant, Siemens AG Speakers Bureau, Merck & Co, Inc

PURPOSE

Since digital plain radiographs of the full leg are frequently performed in children and young adults, the objective was to reduce the radiation exposure dependent on specific indications and to determine objective quality control criteria to ensure accurate assessment.

METHOD AND MATERIALS

Institutional review board approval and informed consent of all participants were obtained. In this prospective, randomized controlled, blinded, two-armed single-center study, 288 patients underwent plain-radiography of the full leg with standard (exposure class of SC 400) and reduced (SC 800) dose. The evaluation of the plain radiographs was conducted using the following criteria: mechanical axis, leg length, and maturation of the epiphyseal plate. Two blinded radiologists evaluated these criteria using scores ranging from 1 (definitely assessable) to 4 (not assessable). If a single criterion had been evaluated with a score of 3 or more points or more than 2 criteria with 2 points, the radiograph was scored as "not assessable". The study was designed as non-inferiority-trial with pre-specified non-inferiority margin of delta = 0.1, defining the maximum difference of clinically tolerated non-assessable radiographs with reduced dose for claiming non-inferiority. Both dose groups were randomized using a block randomization with the relation 1:1.

RESULTS

SSM15-02

Can a Single Isotropic 3D FSE Sequence Replace 3 Plane Standard PD FS Knee MRI Imaging at 1.5T?

Bill Pass MBBCh (Presenter): Nothing to Disclose , Andrew J. Grainger MRCP, FRCR : Speaker, General Electric Company Equipment support, Siemens AG , Philip Robinson MBBCh : Nothing to Disclose

PURPOSE

Our institution's standard 1.5T protocol for knee MRI comprises orthogonal 3 plane fat saturated (fs) proton density (PD), coronal T1 and sagittal T2 (fs) imaging. Our aim was to assess whether a single isotropic 3D fast spin-echo (FSE) PD(fs) sequence reconstructed in 3 planes could replace the 3 PD FS sequences in our standard protocol.

METHOD AND MATERIALS

MRI studies of 95 knees were independently and prospectively interpreted by two experienced musculoskeletal radiologists over two separate readings at least 3 weeks apart. A 3D FSE PD(fs) sequence was added to our routine MRI protocol for the recruited patients with the images reconstructed at 2.5 mm in axial, coronal and sagittal planes and presented as individual sequences. 2.5 mm was selected following a separate pilot study to determine the optimal slice thickness.

One observer read the conventional sequences first and for the second read replaced the 3 PD sequences with the reconstructed 3D sequences. The second reader performed the same two reads in opposite order. Following each read the observer was allowed to review the 3D data set and perform multi-planar reformats to see if this altered confidence. Menisci and ligaments were graded for the presence of a tear and articular cartilage for damage. Statistical analysis to calculate accuracy was performed comparing to our standard sequence as the reference standard.

RESULTS

We found that the accuracy for assessment of the menisci and cartilage surfaces was markedly reduced when using the reformatted 3D sequences. The reporting accuracy was as follows; medial meniscus (MM) = 90.9%, lateral meniscus (LM) = 93.7%, anterior cruciate ligament (ACL) = 98.9% and cartilage surfaces = 85.8%. Agreement between the two readers was also reduced using the 3D sequence (Standard protocol: MM kappa=0.91, LM =0.89, ACL= 0.98, cartilage= 0.84; 3D protocol: MM=0.86, LM=0.77, ACL=0.94, cartilage= 0.64).

CONCLUSION

Use of a 3D PD FSE sequence reconstructed in 3 planes gives reduced accuracy in comparison with conventional 3 plane PD FS sequences when evaluating menisci and cartilage surfaces with a 1.5T MRI scanner. The present study indicates a decreased level of concordance between readers for the reconstructed 3D (SPACE) sequence.

CLINICAL RELEVANCE/APPLICATION

At 1.5T a 3D PD FSE sequence reconstructed in 3 planes demonstrates reduced accuracy and confidence in reporting in comparison with conventional 3 plane PD FS sequences.
279 of 288 plain radiographs were rated similarly by both observers regarding the primary outcome measure (inter-observer agreement of 96.9%). Eleven (3.8%) plain radiographs were scored as not assessable. The rate of non-assessable radiographs with 33% reduced dose was not inferior to the rate of non-assessable radiographs with standard dose (p<0.0001). Also, the individual evaluation of the defined criteria was independent.

CONCLUSION

Full-leg plain radiography in patients with knee malalignment can be performed at 33% reduced dose without loss of relevant diagnostic information. Since all relevant parameters of orthopedic measurements could be assessed with SC 800 instead of 400, we recommend this setting as new reference parameter for standing full-leg radiography in patients with knee malalignment.

CLINICAL RELEVANCE/APPLICATION

Radiation dose reduction of up to 33% in full-leg radiography is possible without loss of diagnostic information. Thus, an exposure class of SC 800 is recommended in patients with knee malalignment.

SSM15-04

Reducing Artifacts from Metallic Implants Spectral CT Imaging after Pedicle Screw Internal Fixation

Jia Yongjun MMed (Presenter): Nothing to Disclose , Yu Yong MMed : Nothing to Disclose , Yang Chuangbo MMed : Nothing to Disclose , Chen Xiaoxia MMed : Nothing to Disclose , Zhang Xirong MMed : Nothing to Disclose

PURPOSE

To assess the value of spectral CT in reducing artifacts caused by metallic implants of lumbar pedicle.

METHOD AND MATERIALS

20 patients with metallic implants of lumbar pedicle were scanned using dual energy spectral CT protocol. 11 sets of monochromatic images from 40-140keV with the energy interval of 10keV and a set of polychromatic 140kVp image were generated. Two regions of interest (ROI) based on the most or the less pronounced artifact in the inferior vena cava were chosen and marked as ROIa and ROIB to measure CT numbers and calculate their difference CTA-CTB. The length of metallic artifacts along the pedicle screw was measured, and the subjective image quality assessed for the 12 image sets. The CT numbers of different ROIs for the 12 sets were compared with paired-samples t Test, and the CTA-CTB value, artifact length and image quality score (5 being the best) among the 12 sets were compared using LSD-t test.

RESULTS

The CT numbers between ROIa and ROIB of the 120 keV monochromatic images(figure 1)had no difference (42.50±3.64HU and 42.34±3.49HU), while those of other image(figure 2)sets were statistically different. Image at 120keV had the smallest CTA-CTB value (0.16±1.65HU) and was significantly different from those of other 11 groups (all P

CONCLUSION

Dual energy spectral CT imaging significantly reduced the artifacts caused by metallic implants of lumbar pedicle. The optimal monochromatic image was determined at 120keV.

CLINICAL RELEVANCE/APPLICATION

Spectral CT provides monochromatic images at high energy to reduce metal artifacts and is useful in assessing patients with metallic implants of lumbar pedicle.

SSM15-05

Which One is Better for Metal Artifact Reduction in Postoperative Spine Evaluation: Dual Energy CT Images with Metal Artifact Reduction Software or Not?

Nam Bo da (Presenter): Nothing to Disclose , Hyun-Joo Kim MD : Nothing to Disclose , Jang Gyu Cha MD : Nothing to Disclose , Seong Sook Hong MD : Nothing to Disclose , Jung Hwa Hwang MD : Nothing to Disclose

PURPOSE

To evaluate the effectiveness of gemstone spectral imaging (GSI) dual-energy CT (DECT) with or without application of metal artifact reduction software (MARS) and compare visualization in different keV values.

METHOD AND MATERIALS

This clinical study was performed in 25 patients who received spine surgery with metallic devices, between October 2013 and February 2014. All patients underwent GSI-DECT for postoperative evaluation. The CTs were performed using fast kV-switching between 80 and 140 keV. The CT data were reconstructed with monochromatic energy in the range 70-140 keV with or without MARS. All images were retrospectively reviewed according to the visibility of periprosthetic regions including bone and soft tissue by a six-point scale (0-5) and the severity of beam-hardening artifacts by using a four-point scale (0-3). Also the size differences of metal devices were measured with or without MARS in the range of 110keV.
RESULTS
There were twelve men and thirteen women. The mean age of patients was 58.2. The range of mean visibility scale of soft tissues is 1.36-3.16 in different keV values with or without MARs and that of bones is 1.44-3.8. Also the range of mean artifacts scale is 0-1.08 in same condition (p-values:<0.0001-1.000). Using 110 kev is the least affected by artifact (mean value of artifact scale : 1.08). The bone is most effectively visualized on 110 keV and the soft tissue on 120 keV without MARs. The sizes of devices were measured 1.5mm smaller with MARs and 1.7mm larger without MARs than real sizes.

CONCLUSION
Monochromatic energy images with 110-120 keV without MARs most effectively reduce artifacts and improve the delineation of the prosthesis and periprosthetic regions.

CLINICAL RELEVANCE/APPLICATION
Monochromatic energy images with 110-120 keV without MARs using DECT enables the radiologist to evaluate the periprosthetic lesions for the patient with previous spine surgery using metallic device.

Evaluation of a New Prototype Correction Algorithm to Reduce Metal Artifacts in Flat-detector Computed Tomography – An Ex-vivo Study
Lukas Filli MD (Presenter): Nothing to Disclose, Magda Marcon MD : Nothing to Disclose, Bernhard Georg Scholz PhD : Employee, Siemens AG, Maurizio Calcagni : Nothing to Disclose, Thomas Pfammatter MD : Nothing to Disclose, Gustav Andreisek MD : Grant, Holcim Ltd Grant, Siemens AG Speaker, Mepha Pharma AG Speaker, Guerbet SA Travel support, Guerbet SA Consultant, Otsuka Holdings Co, Ltd Travel support, Otsuka Holdings Co, Ltd Institutional Research Grant, Bayer AG Institutional Research Grant, Guerbet AG Institutional research collaboration, Siemens AG Institutional research collaboration, Koninklijke Philips NV Speaker, General Electric Company Speaker, Koninklijke Philips NV Speaker, Siemens AG , Roman Guggenberger : Nothing to Disclose

PURPOSE
In the past two years, flat-detector computed tomography (CT) has gained great interest for imaging small anatomic structures of the appendicular skeleton. However, flat-detector CT imaging can be significantly impaired by metal artifacts induced by orthopedic hardware. The aim of this study was to evaluate a new prototype metal artifact correction algorithm for flat-detector CT systems.

METHOD AND MATERIALS
IRB approval was waived. An experienced hand surgeon inserted commercially available scaphoid fixation screws into six cadaveric human specimens to fix artificially induced scaphoid fractures. Flat-detector CT was performed using an angiographic unit (Artis Zeego multiaxis system, Siemens Medical Solutions, Forchheim, Germany). From the raw data, images were reconstructed not using and using the prototype metal artifact correction algorithm. Two independent radiologists analyzed quantitatively the amount of artifacts and qualitatively the visibility of (anatomic) structures. For comparison, Wilcoxon signed-rank test were used. A p-value of < 0.05 was considered to indicate statistically significant differences. Intra-class-correlation was calculated for inter-observer agreement.

RESULTS
The overall intra-class-correlation was 0.85. The artifact-related noise around the scaphoid fixation screws was significantly lower on the images corrected with the prototype metal artifact reduction algorithm (p < 0.001). Qualitative analyses showed significantly fewer artifacts (p < 0.001), better visible screw contour (p < 0.001), and more clearly defined fracture lines (p < 0.01) on the corrected images.

CONCLUSION
The new algorithm for FDCT systems significantly reduces metal artifacts and improves visibility of relevant (anatomic) structures.

CLINICAL RELEVANCE/APPLICATION
The prototype metal artifact correction algorithm may facilitate intra- and postoperative follow-up imaging.
LEARNING OBJECTIVES

1) Review anatomy of the anterior cruciate ligament. 2) Address the pathomechanics for ACL injury. 3) Recognize the primary and findings for ACL tears and mucoid degeneration. 4) Understand reasons for surgery and surgical techniques and their complications.

ABSTRACT

The anterior cruciate ligament (ACL) is an important structure that stabilizes the knee. It runs from the lateral femoral notch to the tibia and resists anterior translation and knee rotation. Injuries of the ACL are caused by various different stresses on the knee and result in partial and full thickness tears. These tears are well seen with MRI. Secondary findings are also seen accompanying ACL tears, including characteristic contusions, impaction fractures, anterior tibial translation and meniscal and ligament tears. Surgery for ACL is often performed with either patellar tendon or hamstring graft. The normal postop appearance is defined by several parameters, and sometimes a normal MRI accompanies a lax ACL graft that needs to be surgerized. Complications of ACL surgery are many and this lecture will review some of them. Poor technique, failure to stabilize a posterolateral corner injury and reinjury of the ACL following trauma, a cyclops lesion, arthrofibrosis and loose hardware are some of the causes of graft failure.

LEARNING OBJECTIVES

This session will review the imaging features of common and sport-related shoulder pathology on conventional MRI through a case series approach.

ABSTRACT

This session will review common shoulder pathology demonstrated on conventional MRI, including rotator cuff tears, labral tears and sports-related injuries caused by overhead throwing. MRI features of posterior superior glenoid impingement, subcoracoid impingement and Little Leaguer’s shoulder will also be discussed.

LEARNING OBJECTIVES

1) Review indications for and technique of shoulder MR Arthrography (MRA). 2) Appreciate the normal anatomy and normal variants of the labro-ligamentous complex. 3) Develop an approach to interpreting shoulder MRA and understand Bankart and SLAP lesions, their variants, and mimics.

ABSTRACT

Shoulder MR arthrography (MRA) remains the most sensitive and specific imaging test for evaluating the shoulder labro-ligamentous complex. This presentation will focus on developing an simplified five step approach to evaluating the unstable shoulder, whilst reviewing normal anatomy (including variants such as sub-labral foramen and Buford complex) Bankart lesions, Bankart variants such as Perthes and ALPSA lesions, and indirect non-arthrographic signs of instability.
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.

**RC650**

**Image-guided Biopsy of the Spine (Hands-on Workshop)**

**Refresher/Informatics**

AMA PRA Category 1 Credits ™: 1.50  
ARRT Category A+ Credits: 1.50  
Thu, Dec 4 8:30 AM - 10:00 AM  Location: E260

**Participants**

Moderator  
John L. Go MD: Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss and demonstrate spine biopsy techniques including CT and fluoroscopic approaches, anatomic landmarks, needle selection, special technical considerations for dealing with soft tissue masses, and fluid accumulations, lytic and blastic lesions, and hypervascular conditions. 2) Hands on exposure will be provided in order to familiarize participants with the vast number of biopsy devices that are clinically available. 3) Training models will also be used in order to teach technical skills with respect to approach and technique. 4) Advantages and disadvantages of various biopsy devices and techniques, and improve their understanding of how to maximize the reliability and safety of these spine biopsy procedures.

**ABSTRACT**

**Sub-Events**

**RC650A**  
**Pre- and Postbiopsy Assessment**  
Richard Silberglet MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address to complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

RC650B Equipment Used for Image-guided Biopsies of the Spine
Michele Hackley Johnson MD (Presenter): Committee member, Boston Scientific Corporation

LEARNING OBJECTIVES

1) Demonstrate the types of needles used for spine biopsy. 2) Selecting the proper types of needles used for spine biopsy. 3) Case demonstration of the proper use of single or coaxial needle sets for spine biopsy and the advantages or disadvantages of each.

RC650C Thoracic and Lumbar Biopsies
John L. Go MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.

ABSTRACT

RC650D Cervical Spine Biopsies
A. Orlando Ortiz MD, MBA (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the various approaches used to biopsy lesions of the cervical spine. 2) Determine the selection of the proper needles to use to biopsy the spine. 3) Provide case examples of cervical biopsies and the thought process used to perform these procedures.

ABSTRACT

Cervical spine biopsies can be challenging procedures to perform, hence they tend to be performed by a limited number of proceduralists. C-spine biopsy is often performed to evaluate potential neoplastic or infectious processes of the cervical spine. The key to performing these procedures effectively and safely is in appropriate patient selection, careful image analysis in order to properly position the patient and choose an approach, identification of critical structures (such as the carotid artery) and neck spaces that should be avoided, and use of coaxial biopsy techniques. The procedure can be safely performed with CT and/or CT fluoroscopy. Specimen sampling principles and specimen handling are also discussed they can help to optimize this procedure.

RC650E Disc Biopsy and Aspiration
Amish H. Doshi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
LEARNING OBJECTIVES

The 'Knee Imaging' Series Course will review the multimodality imaging features of knee pathology through 5 expert refresher courses interspersed among multiple scientific presentations.

Sub-Events

VSMK51-01  MRI of Meniscal Tears
Mark W. Anderson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) describe the normal anatomy of the medial and lateral menisci, including their tibial and capsular attachments, as well as key differences in their morphology. 2) list the three primary types of meniscal tears and the most important features of each for the surgeon. 3) discuss the most common types of displaced meniscal tears and where to look for them on MR images.

VSMK51-02  MR Imaging Characteristics and Clinical Symptoms Related to Displaced Meniscal Flap Tears
Valentin Lance MD (Presenter): Nothing to Disclose, Ursula Renate Heilmeier MD : Nothing to Disclose, Gabby B. Joseph : Nothing to Disclose, Benjamin Ma MD : Nothing to Disclose, Lynne S. Steinbach MD : Nothing to Disclose, Thomas M. Link MD, PhD : Research funded, General Electric Company Research funded, InSightec Ltd

PURPOSE

(1) To describe MR characteristics of meniscal flap tears (2) To investigate associated imaging findings such as the presence of bone marrow edema pattern, degree of cartilage loss, synovitis and capsular ligamentous injury and (3) To correlate these MR findings to clinical presentation in groups stratified by surgical versus non-operative management.

METHOD AND MATERIALS

307 patients with MR diagnosis of flap tear were identified through a retrospective query of the hospital radiologic database and chart review from 2010 to 2013. Clinical history and flap tear related treatment were recorded for each subject. Subjects were excluded if MR imaging included signs of traumatic injury such as fracture, ACL or PCL tear, severe osteoarthritis or if the size of the flap tear was not measurable in the sagittal or coronal images. 58 subjects (35 men and 25 women, mean age 49.6±14.5 yrs) were included. MR studies of the knee were reviewed and graded for flap tear location, size and presence of additional knee abnormalities by two radiologists. Statistical analysis employed t-tests, Spearman correlations, linear regression and logistic regression models.

RESULTS

The medial meniscus was the most common site of flap tears (87%, 52/60), with inferior displacement in 78% (47/60). Average flap area was 18.3±18.1mm2. Bone marrow edema pattern was present in 36.2% and cartilage defects in 25.9%. Synovitis was present in 48.3%, and complete medial meniscofemoral and menisocotibial ligament tears in 8.6% and 3.4%, respectively. Comparing MR characteristics to clinical pain scores, we found that the degree of tibial cartilage loss was positively correlated with the visual analog pain scale (p=0.03). Comparing operative to non-operative groups, patients who underwent arthroscopic surgery were younger than those who did not (45.6±12.3 years vs 55.3±15.7 years, p=0.01), and more likely to present with a positive clinical McMurray test (79.4% vs 41.7%, p=0.01).

CONCLUSION

Medial meniscal and inferiorly displaced flap tears are the most common tear pattern. A greater degree of cartilage loss involving the tibia was associated with increasing pain scores. Those undergoing arthroscopy are younger and more likely to have positive meniscal signs on clinical exam.

CLINICAL RELEVANCE/APPLICATION

Knowledge of common flap tear locations, MRI appearance and related injury, and associated clinical findings is important for radiologists as it may affect surgical planning.

VSMK51-03  Meniscal Surgery Markedly Increases Risk for Incident Osteoarthritis and Cartilage Loss in the Following Year
Frank W. Roemer MD (Presenter): Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC, Kent Chian Kwoh MD : Advisory Panel, Pfizer Inc Data Safety Monitoring Board, Novartis AG, Michael Hannon : Nothing to Disclose, Jason Grago : Nothing to Disclose, David J. Hunter MD, PhD : Royalties, DJO Global, Inc, Ali Guermazi MD, PhD : President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgaA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc

PURPOSE

To assess whether meniscal surgery increases risk for incident radiographic osteoarthritis (ROA) and cartilage loss in the following year.

METHOD AND MATERIALS
Participants were drawn from the Osteoarthritis Initiative (OAI) including 4796 participants with, or at risk of knee OA. We studied 355 knees that developed incident ROA before the 60 month visit that were matched with a control knee that did not develop incident ROA. Matching was done by gender, age within 5 years, and baseline Kellgren-Lawrence grading (KLG) of both, the index and collateral knees. MRIs were read for medial and lateral meniscal damage (including maceration) and for cartilage morphology using the MOAKS system at one year prior and at the case defining visit (KLG≥2). Conditional logistic regression adjusted for BMI was applied to assess risk of incident ROA for knees that had surgery in the year prior to developing incident ROA, and for knees with prevalent meniscal damage. Logistic regression adjusted for BMI and the matching criteria was used to assess risk of cartilage loss.

RESULTS

Subjects were on average 60.2 years old (SD ± 8.6), predominantly female (66.5%) and overweight (mean BMI 28.3 SD ± 4.5). 31 (4.4%) knees underwent meniscal surgery during the year prior to the case defining visit. 238 (34.9%) knees had prevalent meniscal tears and 42 (6.2%) knees showed any meniscal maceration one year prior to the case-defining visit. All (n = 31, 100%) knees that had meniscal surgery and 58.9% (n = 165) of the knees with prevalent meniscal damage developed incident ROA (OR = 2.66, 95% CI [1.81, 3.89]), 39.5% (n=107) of knees with meniscal damage and 80.8% (n = 21) of knees with surgery showed cartilage loss. Risk of cartilage loss was significantly increased for knees exhibiting any prevalent meniscal damage without surgery (OR=1.5 95% confidence interval [CI] [1.1,2.2]), and markedly further increased for knees that had surgery (OR=13.1 95% CI [4.7,36.3]).

CONCLUSION

In a cohort with risk factors for ROA, all knees undergoing meniscal surgery developed incident ROA. Furthermore, risk for cartilage loss is much higher for knees undergoing surgery compared to knees with prevalent meniscal damage.

CLINICAL RELEVANCE/APPLICATION

Meniscal surgery has deleterious effects on joint structure in knees without ROA, but at risk of developing ROA. The decision for meniscal surgery needs to be carefully considered in order to avoid accelerated disease onset.

VSMK51-04  ACL Injuries

Thomas M. Link MD, PhD (Presenter): Research funded, General Electric Company Research funded, InSightec Ltd

LEARNING OBJECTIVES

1) Understand anatomy, function and physiology of the ACL and the mechanism of ACL injury. 2) Demonstrate direct and indirect radiographic and MRI signs of acute ACL tears and associated injuries. 3) Analyze imaging findings related to chronic tears and other abnormalities of the ACL. 4) Identify imaging signs of intact ACL repair, complications and failure.

VSMK51-05  In Search of a Soft Tissue Segond: Anterolateral Ligament and Its Neighbors

Brian Scott Martell MD (Presenter): Nothing to Disclose , Leon Lenchik MD : Nothing to Disclose , Scott David Wuertzer MD, MS : Nothing to Disclose , Maha Torabi MD : Nothing to Disclose

PURPOSE

Anterolateral ligament (ALL) is a controversial term recently introduced into the orthopedic literature as a potential source for Segond fractures. ALL injuries that do not result in Segond fractures may still contribute to knee instability. The purpose of our study was to determine if anterolateral knee injuries are more common in patients with arthroscopically proven ACL tears compared to controls.

METHOD AND MATERIALS

Retrospective review of 122 consecutive knee MRIs in patients under age 50 who had arthroscopies performed by the same orthopedic surgeon. Patients with revision ACL surgery and those with Segond fractures were excluded. 29 patients with first-time ACL reconstruction were compared to 29 age-matched controls with normal ACL at arthroscopy. Preoperative MR images in both groups were reviewed by consensus of two expert readers, blinded to surgical intervention. The anterior lateral corner of the knee was evaluated on axial and coronal images, from the iliotibial band anteriorly to the fibular collateral ligament posteriorly. In particular, the tibial attachment of the ALL (and other meniscotibial structures) was carefully scrutinized. The ALL was categorized as present or absent. When the ALL was present, it was categorized as torn or intact. In all cases, the presence of soft tissue edema in the anterolateral corner was recorded.

RESULTS

Meniscotibial portion of ALL was visualized in 24 of 29 (83%) patients without ACL tears and 23 of 29 (79%) patients with ACL tears. ALL was torn in 1 of 29 (3%) patients without ACL tears and 1 of 29 (3%) patients with ACL tears. Soft tissue edema in the anterolateral corner was present in 4 of 29 (14%) patients without ACL tears and 19 of 29 (66%) patients with ACL tears. The combination of soft tissue edema and nonvisualized ALL was more common in patients with ACL tears (17%) compared to controls (0%).

CONCLUSION

Meniscotibial portion of ALL is commonly visualized but rarely torn. The presence of edema in the expected
Meniscotibial portion of ALL is commonly visualized but rarely torn. The presence of edema in the expected location of ALL is common in patients with ACL tears.

**CLINICAL RELEVANCE/APPLICATION**

Whether ALL is a new structure or a new name for the mid-third capsular ligament; some authors suggest that it contributes to knee instability even in the absence of a Segond fracture. Further work is needed to determine if anterolateral edema on MR imaging contributes to knee instability and if such signal is associated with ALL tears (soft-tissue Segonds).

**VSMK51-06** Mucoid Degeneration of the Anterior Cruciate Ligament: Prevalence and Association with Cartilage and Meniscal Integrity at MR Imaging


**PURPOSE**

To assess the prevalence of mucoid degeneration of the anterior cruciate ligament (ACL) and its association with cartilage and meniscal abnormalities using magnetic resonance imaging (MRI) of the knee.

**METHOD AND MATERIALS**

Institutional review board approval was obtained and patient consent was waived for this HIPAA-compliant, retrospective study. Four hundred and seventy-one consecutive knee MRIs were identified. Fifty-three consecutive knee MRIs with mucoid degeneration of the ACL (M/F=0.71; median age of 53.6 years, range 26-81) were identified and matched with age and sex to 106 consecutive control knee MRIs without mucoid degeneration or tear of the ACL using frequency matching (case-control ratio of 1:2). Abnormalities of the cartilage of the medial (MTC) and lateral (LTC) tibiofemoral compartments and menisci were semiquantitatively assessed by using the Whole-Organ MR Imaging Score (WORMS) system. Differences in cartilage and meniscal abnormalities between patients with mucoid ACL degeneration and controls were assessed by performing chi-square and Mann-Whitney U tests.

**RESULTS**

Prevalence of mucoid degeneration of the ACL was 12.8%. Patients with mucoid ACL degeneration were older than all other patients (mean age of 53.6 vs. 43.7 years, P<0.001) but there was no gender predilection (P=0.319). The frequency of severe cartilage damage (WORMS ≥5) in the MTC was significantly higher in knees with mucoid ACL degeneration than in the control group (49.1% vs. 18.9%, P<0.001), but there was no significant difference in the LTC (13.2% vs. 8.5% P=0.351). Knees with mucoid ACL degeneration had significantly more meniscal damage compared to controls (mean WORMS of medial meniscus of 2.7 vs. 2.1, P=0.033; and mean WORMS of lateral meniscus of 1.1 vs 0.6, P=0.012).

**CONCLUSION**

Prevalence of mucoid degeneration of the ACL in patients referred for knee MR imaging is 12.8%. The presence of mucoid degeneration of the ACL is strongly associated with severe MTC osteoarthritis (OA) as well as more meniscal damage.

**CLINICAL RELEVANCE/APPLICATION**

Given the known association between ACL insufficiency and development of MTC OA, our results suggest that patients with mucoid ACL degeneration should also be carefully examined for ACL instability.

**VSMK51-07** Patellofemoral Disease

Mario P. Padron MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSMK51-08** Realtime Dynamic CT of the Patellofemoral Joint: A New Approach to the Old Problem of Patellar Maltracking

Daniel Fascia (Presenter): Nothing to Disclose, Dimitri Amiras: Nothing to Disclose, Andrew Hohnen MD: Nothing to Disclose, Nicholas Dominic Karl Wambeek MBBS: Nothing to Disclose

**PURPOSE**

Patellar maltracking is a significant problem affecting a young and active population which often results in premature osteoarthritis. It is said to be related to a combination of anatomical and biomechanical factors. So far radiological assessments with CT and MR have focussed on static anatomical assessment. Utilising fast multi-slice cinematic CT, we have designed a method to assess the patellofemoral joint during realtime dynamic patient initiated active motion, allowing both conventional anatomical assessment and biomechanical analysis during the same study.
METHOD AND MATERIALS

Symptomatic patients were selected by Orthopaedic surgeons using the Lysholm knee score. Using a 256-slice Phillips Brilliance CT, patients were scanned whilst actively extending their knee joints from 90 to zero degrees. Axial volume rendered images of the patellofemoral joint were generated from the animated sequence to recreate the patellar skyline view. Standard anatomical patellofemoral measurements as well as dynamic measurements to assess extent of patellar lateralisation and tilt were taken.

RESULTS

Our new dynamic CT method was effective in demonstrating patellar maltracking in patients with abnormal patellofemoral anatomy. It additionally had the advantage of demonstrating occult maltracking in a number of patients whose standard anatomical assessment was within normal ranges. Average radiation doses were acceptably low with a calculated body effective dose delivered.

CONCLUSION

Dynamic CT of the patellofemoral joint during active patient motion is highly effective at quantifying the degree of patellar lateralisation and tilt during maltracking. It also has the unexpected advantage of revealing maltracking in a number of anatomically normal but symptomatic patients.

CLINICAL RELEVANCE/APPLICATION

Our novel method of imaging the patellofemoral joint is a sensitive way of detecting maltracking in symptomatic patients and quantifying it. It has the advantage of being both more sensitive to maltracking and adding useful biomechanical information compared with current static anatomical cross sectional methods. The technique uses an acceptably low radiation dose for use in the target young-active population.

PURPOSE

Proximal patellar tendinopathy (PPT) is one of the most common overuse injuries of the knee. Knee morphology and alignment may play a role in the pathogenesis of PPT. The aim of this study was to assess the differences in morphology and alignment of the knee using MRI, focusing on the patellofemoral (PF) joint, between patients with PPT and controls.

METHOD AND MATERIALS

We retrospectively included 35 patients with clinically diagnosed and unequivocal findings of PPT on knee MRI (case group). For the control group, we retrospectively included 70 patients who underwent knee MRI for other reasons, without clinical or MRI findings of PPT. Patients and controls were matched for age and gender, with all subjects reporting frequent physical activity. Knee MRIs were evaluated by two musculoskeletal radiologists, who assessed parameters regarding patellar morphology (subchondral Wiberg index and subchondral Wiberg angle - sWA), trochlear morphology (medial/lateral trochlea length ratio, trochlear sulcus, and lateral trochlear inclination angles), PF alignment (lateral patellar displacement, patellar inclination angle, Insall-Salvati (IS) and Caton-Deschamps ratios, tibial tuberosity-trochlear groove distance), and tibiofemoral (TF) alignment (angle). The differences in parameters between cases and controls were assessed using Student’s t-test. Logistic regression was applied to assess the associations between the parameters measured on MRI and PPT.

RESULTS

The patellar height IS ratio was significantly different between cases and controls (1.37 ± 0.21 and 1.24 ± 0.19 respectively; p=0.003). The sWA was significantly higher in cases vs. controls (136.8 ± 7.4 and 131.7 ± 8.8 respectively, p=0.004). The TF angle was also different between cases and controls (+4.7 ± 2.5 and +2.5 ± 3.7 respectively, p=0.002). After applying logistic regression, patellar morphology (sWA), patellar height (IS ratio), and the TF angle were significantly associated with PPT (odds ratios (95%CI) of 1.1 (1.0, 1.2); 1.3 (1.0, 1.7); and 1.2 (1.1, 1.5); respectively).

CONCLUSION

Some MRI-based measures of patellar morphology (sWA) and alignment (patellar height and TF angle) were shown to be useful in discriminating between controls and those with PPT.

CLINICAL RELEVANCE/APPLICATION

Assessment of patellar morphology and height, as well as TF angle should be considered in athletes at risk for PPT, as it may help planning their training and potentially avoid PPT development.

VSMK51-10

Pre- and Postoperative Cartilage Imaging

Carl Scherman Winalski MD (Presenter): Institutional service agreement, sanofi-aventis Group Institutional service agreement, Bioclinica, Inc Institutional service Agreement, CartiHeal Institutional Research Grant, The Procter & Gamble Company Shareholder, Pfizer Inc Shareholder, General Electric Company

LEARNING OBJECTIVES

1) Gain knowledge of the basic mechanisms of cartilage injury. 2) Learn to recognize and describe the MR appearances of cartilage abnormalities. 3) Become familiar with the types of cartilage lesions that are
commonly missed, the technical limitations of MR imaging and methods to optimize lesion evaluation. 4) Understand the goals of articular cartilage repair and the basic surgical techniques. 5) Be able to analyze postoperative MR studies following surgical cartilage repair to report the clinically important features and common complications.

**VSMK51-11 Quantitative CT Arthrography of the Human Knee to Measure Cartilage Biochemical Composition: Results of an In-Vivo Validation Study Against Ex-Vivo Reference Standards**


**PURPOSE**

Recently, the ability of CT arthrography (CTa) to quantitatively measure knee cartilage composition in terms of its sulphated glycosaminoglycan (sGAG) content has been demonstrated in an ex-vivo study using human cadaveric knee joints. Since validation study comparing in-vivo acquired CTa outcomes against ex-vivo reference standards for cartilage composition has not yet been performed, the aim of the present study was to perform such a validation in humans with knee OA.

**METHOD AND MATERIALS**

We included 12 knee OA patients (Kellgren and Lawrence grade 2-4) who underwent CTa one month before total knee replacement (TKR). Mean X-ray attenuation values were calculated in 6 regions of interest (ROI) of the articular cartilage (medial and lateral weight-bearing femoral condyles and tibial plateaus and non-weight-bearing cartilage of the condyles). All cartilage ROIs were harvested during TKR and rescanned with contrast-enhanced microCT (CE-μCT). Mean CE-μCT X-ray attenuation values served as surrogate reference standard for cartilage sGAG content since it has been shown to accurately measure sGAG. We analyzed the correlation between mean CTa X-ray attenuation and mean CE-μCT X-ray attenuation with linear regression.

**RESULTS**

Mean X-ray attenuation values of the different ROIs ranged from 115 to 455 Hounsfield Units. Outcomes of CTa had a strong correlation with reference CE-μCT X-ray attenuation, representing sGAG content of articular cartilage, in the femoral (r= 0.76; p< 0.0001; r^2= 0.58), in the tibial (r= 0.77; p< 0.0001; r^2= 0.59) and in the tibiofemoral cartilage (r= 0.76; p= 0.0001; r^2= 0.57) (figure 1).

**CONCLUSION**

Our results suggest that CTa can accurately measure sGAG content of articular cartilage in human knee joints in-vivo. The coefficient of determination, however, is only moderate and therefore CTa outcomes are likely to be also influenced by other composites of cartilage, e.g. collagen. Despite the use of intra-articular contrast agent and ionizing radiation, CTa might become a relatively cheap and quick alternative to MRI based techniques to quantitatively measure cartilage composition in patients with contra-indications for MRI.

**CLINICAL RELEVANCE/APPLICATION**

CT arthrography can accurately measure cartilage sulphated glycosaminoglycan content in human knee joints in-vivo and might become a cheap and fast alternative to similar MRI based techniques.

**VSMK51-12 Diameters of Femoral and Tibial Tunnels on CT after ACL Reconstruction with Double Bundle Technique Using Auto-hamstring Graft: Correlation with Functional and Clinical Scores**

Young Cheol Yoon MD: Nothing to Disclose, Soo Jeong Yoon MD (Presenter): Nothing to Disclose

**PURPOSE**

Bone tunnel enlargement after anterior cruciate ligament (ACL) reconstruction represents a well-established phenomenon. Clinically, bone tunnel enlargement in the revision ACL reconstruction represents a great challenge to surgeons, may require staged reconstruction and additional operative procedures. To our knowledge, clinical significance of bone tunnel enlargement is not well established and does not known how affect clinical outcome. This study aimed to evaluate correlations between diameter of bone tunnel using computed tomography (CT) with respect to functional and clinical scores.

**METHOD AND MATERIALS**

Forty-seven patient (41 males and 6 females, mean age of 34 years old) who underwent ACL reconstruction with double bundle technique using auto-hamstring graft and had immediate postoperative (range: 1-4 days, mean of 2.5 days) and follow-up CT scans (range: 297-644 days, mean of 410.4 days) entered this study. Diameter of each tunnel (two femoral and two tibial) of both immediate postoperative (D1) and follow-up CT (D2) scans were independently measured by two MSK fellowship trained radiologists. They obtained diameters of each tunnel at 5 levels (proximal end, midportion, distal end, one-quarter and three-quarter portion) from longitudinal plane of each tunnel was regarded as diameter of it. Evaluation of graft stability and clinical performance was performed with functional (KT-2000) and clinical scores (IKDC objective, Lysholm). Correlation analysis was performed between D2 and functional and clinical scores, and D2/D1 and functional and clinical scores.

**RESULTS**

Correlation analysis showed no significant relationship between D2 and functional and clinical scores nor
CONCLUSION

Bone tunnel enlargement after anterior cruciate ligament (ACL) reconstruction by double bundle technique using auto-hamstring graft may not be correlated with graft stability or clinical outcome.

CLINICAL RELEVANCE/APPLICATION

Enlargement of bone tunnel after ACL reconstruction may not need to be emphasized.

VSMK1-13  Unicompartmental Knee Arthroplasty MRI: Impact of Slice-Encoding for Metal Artifact Correction MRI on Image Quality, Findings, and Therapy Decision

Christoph Amadeus Agten MD (Presenter):  Nothing to Disclose, Filippo Del Grande MD, MBA :  Nothing to Disclose, Sandro F. Fucentese MD :  Nothing to Disclose, Samuel Blatter :  Nothing to Disclose, Christian W. A. Pfirrmann MD, MBA :  Advisory Board, Siemens AG Consultant, Medtronic, Inc , Reto Sutter MD :  Nothing to Disclose

PURPOSE

To evaluate the impact of slice-encoding for metal artifact correction (SEMAC) on image quality, findings, and therapy decision in patients with unicompartmental knee arthroplasty (UKA).

METHOD AND MATERIALS

Forty-five painful UKAs were examined (1.5T-MRI, coronal STIR, sagittal proton-density (PD)-weighted sequence, each with SEMAC and high-bandwidth). Artifact size on each sequence was measured (1 reader). Image quality, anatomic depiction, and clinically relevant findings were compared between SEMAC and high-bandwidth sequences (2 readers). In 30 patients therapy decision and confidence (0=unsure, 10=sure) were retrospectively assessed by two orthopedic surgeons without MRI, with MRI using high-bandwidth, and with MRI using SEMAC. Wilcoxon test, McNemar test, Cochran's Q, and Friedman Test were employed for statistics.

RESULTS

SEMAC reduced mean artifact size for STIR (11.8cm² vs. 37.7cm²; \(P<.0005\)) and PD (16.8cm² vs. 18.9cm²; \(P<.0005\)). SEMAC showed more blurring than high-bandwidth (\(P<.0005\)). STIR-SEMAC was better in depiction of anatomic structures around the UKA (\(P<=.003\) and \(P<=.034\) for reader 1 and 2, respectively), except for the anterior meniscal root for reader 2 (\(P=.987\)). PD-SEMAC was inferior in depiction of meniscal roots and cartilage (\(P<.0005\)). STIR-SEMAC revealed significantly more bone marrow edema (29 vs. 18 patients, \(P=.001\) for reader 1 / 30 vs. 13 patients, \(P<.0005\) for reader 2). PD-SEMAC was substantially worse in detecting meniscal lesions (6 missed, \(P=.031\) / 9 missed, \(P=.004\), by reader 1 and 2, respectively). Revision-surgery was the chosen therapy in 12 and 11 patients for orthopedic surgeon 1 and 2 without MRI, with MRI using high-bandwidth, and with MRI using SEMAC. Wilcoxon test, McNemar test, Cochran's Q, and Friedman Test were employed for statistics.

CONCLUSION

STIR-SEMAC was useful for detection of bone marrow edema and influenced the orthopedic surgeons' decisions and confidence towards surgery. PD-SEMAC was of inferior image quality and led to missed meniscal lesions in some cases.

CLINICAL RELEVANCE/APPLICATION

In patients with unexplained painful unicompartmental knee arthroplasty, STIR-SEMAC may reveal bone marrow edema as a potential source of pain and is therefore useful in a knee MRI protocol.

VSMK1-14  Postoperative Imaging of the Knee

Bethany Uphold Casagranda DO (Presenter):  Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss surgical criteria for common knee pathology. 2) Discuss surgical options for meniscal, tendon and ligamentous injury. 3) Review imaging appearance of post operative changes as well as complications.
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.

ABSTRACT

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.

SSQ13

Musculoskeletal (Advanced Imaging Bone Structure and Tumor Characterization)

Scientific Papers
**SSQ13-02**

**Trabecular Bone Microstructure Assessed by Low-dose MDCT and Iterative Reconstruction Predicts Vertebral Bone Strength**

**PURPOSE**

High-resolution multi-detector computed tomography (MDCT) based trabecular bone microstructure analysis has improved the prediction of bone strength beyond bone mineral density (BMD) measurements in the context of osteoporosis. However, the clinical application of this method is currently limited due to the relatively high radiation exposure. Therefore, the purpose of our study was to investigate the effects of low-dose MDCT and iterative reconstruction algorithms on trabecular bone microstructure parameters.

**METHOD AND MATERIALS**

Twelve thoracic vertebrae were harvested from three fresh human cadavers. MDCT imaging of each vertebra was performed in a water bath to simulate the soft tissue environment. Images were obtained by using a clinical 64-row MDCT scanner with a tube load and current of 120kV and 220mAs (full-dose protocol, FD) and 120kV and 70mAs (low-dose protocol, LD), respectively. Voxel size and slice thickness amounted to 300x300µm² and 600µm in both protocols. Images were reconstructed by using standard filtered back-projection (FBP) and in-house developed fully iterative reconstruction (IR) algorithms. BMD and trabecular bone microstructure parameters (histomorphometric parameters and fractal dimension) were determined in the MDCT images and correlated with failure load (FL) as assessed by destructive biomechanical testing of the vertebrae.

**RESULTS**

BMD significantly correlated with FL (r=0.92; p<0.05). Trabecular bone microstructure parameters showed correlations with FL in the range of r=0.84-0.94 (FD-FBP), r=0.80-0.94 (FD-IR), r=0.84-0.89 (LD-FBP), and...
The correlation coefficients were not significantly different (p>0.05). However, the absolute values of the trabecular bone microstructure parameters as assessed in FD-FBP, FD-IR, LD-FBP, and LD-IR were significantly different (p<0.05).

**CONCLUSION**

Trabecular bone microstructure parameters as assessed by low-dose MDCT and iterative reconstruction algorithms adequately predicted vertebral bone strength. However, absolute values of the microstructure parameters were dependent on the used protocol and reconstruction algorithm.

**CLINICAL RELEVANCE/APPLICATION**

Low-dose protocols and iterative reconstruction algorithms may allow the clinical use of MDCT based trabecular bone microstructure analysis at the spine with an acceptable radiation exposure to improve fracture risk prediction and therapy monitoring in the context of osteoporosis.

**SSQ13-03**

**Predicting Pathologic Spine Fracture in Multiple Myeloma Patients Using Trabecular Microarchitecture and CT-based Finite Element Analysis: A Longitudinal Study**

Miyuki Takasu MD (Presenter): Nothing to Disclose, Yoko Kaichi: Nothing to Disclose, Chihiro Tani 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; Yoshiaki Kuroda: Nothing to Disclose, Akira Sakai: Nothing to Disclose

**PURPOSE**

Sixty percent of myeloma patients develop pathologic fractures, with the majority occurring in the spine or ribs. Determining the nature of a spine fracture in myeloma patients may be difficult due to the presence of concomitant osteoporosis. The purpose of this study was to determine whether trabecular microstructural analysis can be used to predict new pathologic spine fractures in myeloma patients.

**METHOD AND MATERIALS**

A total of 22 vertebral bodies from 14 patients with multiple myeloma (4 males; mean age, 64.3±4.1 years; 10 females; mean age, 61.2±7.9 years) were examined by 64-detector row computed tomography prior to follow-up CT (mean period: 10.9 months) which showed new pathologic spine fractures. Using a bone mineral calibration phantom and a 3-dimensional image analysis system, bone mineral density (BMD), trabecular parameters, and mechanical properties were calculated for three vertebrae comprising a vertebra that would become fractured and the two adjacent vertebrae. Areas of lytic lesions were also obtained using manually drawn regions of interest in the axial images containing the largest lytic lesions. Trabecular microstructural indices were expressed as ratios to mean values from the three vertebrae. For data analysis, univariate analysis was used to compare indices between vertebrae that would develop fracture and those that would not. Multivariate logistic regression analyses and receiver operating characteristic curves were also used. Values of P < .05 were considered significant.

**RESULTS**

Univariate analysis demonstrated that area of lytic lesion, trabecular spacing, structure model index, volumetric BMD (vBMD), failure load, and stiffness were significantly associated with occurrence of pathologic fracture. Multivariate analysis identified area of lytic lesion, vBMD, and failure load as significant predictors of pathologic fracture. Area under the curve was 0.779 for failure load, 0.741 for vBMD, and 0.632 for area of lytic lesion.

**CONCLUSION**

Trabecular microstructural analysis and finite element modeling can be used to predict new pathologic fractures in myeloma patients. Failure load and vBMD predict pathologic fracture better than existence of a lytic lesion in a vertebra.

**CLINICAL RELEVANCE/APPLICATION**

Factors predicting pathologic fracture in myeloma include BMD and bone strength estimated by CT-based FEM. Trabecular structural analysis can be used to predict pathologic fracture in vertebrae.

**SSQ13-04**

**Improving Bone Strength Prediction in Proximal Femur Specimens through Quantitative Characterization of Trabecular Micro-architecture with Minkowski Functionals and Support Vector Regression**

Chien-Chun Yang (Presenter): Nothing to Disclose, Mahesh Nagarajan: Nothing to Disclose, Markus B. Huber PhD: Nothing to Disclose, Jan Stefan Bauer MD: Nothing to Disclose, Felix Eckstein MD: Co-owner, Chondrometrics GmbH Co-founder, Chondrometrics GmbH CEO, Chondrometrics GmbH Consultant, Novartis AG Consultant, Merck KGaA Consultant, sanofi-aventis Group, Axel Wismueller MD, PhD: Nothing to Disclose, Thomas Baum MD: Nothing to Disclose, Julio Carballo-Gamio PhD: Nothing to Disclose, Thomas M. Link MD, PhD: Research funded, General Electric Company Research funded, InSightec Ltd

**PURPOSE**
Biomechanical bone strength prediction in the proximal femur is a key component of osteoporosis diagnosis and associated fracture risk estimation. Our study proposes to use advanced integral geometry texture features derived from Minkowski Functionals for purposes of characterizing trabecular bone structure on multi-detector computed tomography (MDCT) images of femur specimens. Such novel topological feature vectors are subsequently compared with conventional measures of bone mineral density (BMD) in their ability to predict bone strength, which is achieved through support vector regression (SVR).

METHOD AND MATERIALS

Axial MDCT images were acquired from 146 proximal femur specimens using a 16-row scanner and a calibration phantom. Spherical volumes of interest (VOI) were annotated in the femoral head (Huber et al., Radiology 2008) for BMD conversion and image analysis. VOIs of these BMD images were characterized through statistical moments as well as topological texture features derived from Minkowski Functionals. The specimens were then biomechanically tested by simulating a lateral fall on the greater trochanter, and failure load was recorded. All features were analyzed with multi-regression and SVR for predicting bone strength. The performance of different feature sets was compared using root-mean-square error (RMSE) and coefficient of determination ($R^2$). A Wilcoxon signed-rank test was used to compare two RMSE distributions and test for statistically significant differences in performance.

RESULTS

The best prediction performance was observed with Minkowski Functional surface (RMSE = 0.939 ± 0.345, $R^2$ = 0.544 ± 0.265) when analyzed with SVR, which was significantly lower than using mean BMD in conjunction with standard multi-regression analysis (RMSE = 1.075 ± 0.279, $R^2$ = 0.417 ± 0.228) ($p < 0.005$).

CONCLUSION

Our results suggest that biomechanical strength prediction in the proximal femur can be significantly improved through topological characterization of trabecular bone micro-architecture, when used in conjunction with advanced machine learning techniques, such as support vector regression.

CLINICAL RELEVANCE/APPLICATION

Complementing BMD characterization on MDCT images with advanced topological features and machine learning can contribute to improved diagnosis and disease progression monitoring in patients with osteoporosis.

SSQ13-05


PURPOSE

To predict the strength of the proximal femur with three imaging modalities: plain radiographs (XR), dual X-ray absorptiometry (DXA), quantitative computed tomography (QCT) with a dedicated three-dimensional image analysis tool (MIAF-Femur) and finite element model (FEM).

METHOD AND MATERIALS

The proximal ends of forty pairs of excised femurs (82 +/-12 years) were studied. Each femur was analyzed using (1) radiographs to measure geometric parameters: lengths, angles, cortical thicknesses; (2) DXA (gold standard) to measure bone mineral densities (aBMD); (3) QCT with a three-dimensional (3D) analysis tool (medical image analysis framework (MIAF-Femur)) to determine bone mineral densities (vBMD) and geometric variables (hip axis length, cortical thicknesses, volumes, moments of inertia) of cortical and trabecular bone; (4) CT-based FEM to calculate a numerical value of failure load. The eighty femurs were also studied using mechanical tests to failure either in stance or lateral configuration (random assignment of the two femurs from each pair to one mechanical configuration). The variables were described with mean, standard deviation, and range. Univariate correlations and multivariate models were computed for each imaging modalities, and FEM, to predict failure load in both configurations.

RESULTS

In multivariate analysis, models explained 66% (XR), 73% (DXA), 76% (QCT) and 87% (FEM) of the variance of the fracture load and 63% (XR), 79% (DXA), 83% (QCT) and 84% (FEM) in stance and lateral configurations respectively.

CONCLUSION

Simple measurements of geometric variables using radiographs, or simple measurements of densitometric variables using DXA, explains a large part of femoral failure load. However femoral failure load is best explained by a combination of geometric and densitometric variables as provided by QCT-MIAF or CT-based FEM.

CLINICAL RELEVANCE/APPLICATION
Validation of a Mechanical Competence Parameter for the Trabecular Bone Characterization from 3T-MR

SSQ13-06

Angel Alberich Bayarri (Presenter):
Nothing to Disclose
Waldir L Roque:
Nothing to Disclose
Maria Angeles Perez:
Nothing to Disclose
Luis Marti-Bonmati MD, PhD:
Nothing to Disclose

PURPOSE

High resolution 3T MR imaging can be used in the postprocessing and quantification of trabecular bone imaging biomarkers. However, its interpretation is intricate due to intrinsic heterogeneity. The aim of this work was to validate a bone mechanical competence parameter (MCP) for in vivo MR by combining morphology, connectivity, tortuosity and mechanical characteristics measured by comparison against microcomputed tomography (μCT).

METHOD AND MATERIALS

A total of 103 subjects (75 healthy, 28 osteoporosis) were included in the MR study. For the μCT evaluation, a different dataset of 15 in vitro cadaveric samples from human radius was considered. The MR images from distal radius metaphysis were acquired in a 3T system (Philips, The Netherlands) with an isotropic resolution of 180μm. μCT spatial resolution was 34μm (Scanco, Switzerland). The MR sequence was a 3D T1 gradient echo (TE/TR/α=5ms/16ms/25). Images were properly processed and finally binarized to obtain 3D reconstructions. Morphology algorithms were applied to calculate bone-volume/total-volume (BV/TV) ratio, trabecular thickness (Tb.Th) and trabecular separation (Tb.Sp). The Euler-Poincaré Characteristic (EPC) to assess structure connectivity and trabeculae tortuosity (τ) were also analyzed. The 3D volumes were converted to Finite Element meshes to simulate uniaxial compression and calculate the elastic modulus (Eapp[X,Y,Z]). The correlations and variance of the biomarkers calculated for MR and μCT were analyzed by principal components analysis (PCA) in order to extract the relevant parameters in each modality and define the MCP.

RESULTS

A first principal component was found explaining 95% of the variance, both in MR and μCT data. The first component had the same parameters and almost the same weights for MR (MCPμCT=0.53-BV/TV-0.50-EPC+0.51-EappZ-0.45-τ) than for μCT (MCPμCT=0.52-BV/TV-0.49-EPC+0.51-EappZ-0.48-τ), which was considered as the reference.

CONCLUSION

The results of this study validate the importance of the bone percentage, the connectivity, tortuosity and Z elastic modulus in explaining bone properties, showing almost the same weighting in MR-derived measurements than in the reference μCT using different samples. This justifies the use of MR for a complete quantitative bone characterization in Osteoporosis.

CLINICAL RELEVANCE/APPLICATION

Quantification of trabecular bone properties from MR can be used for the early evaluation of microstructural alterations in osteoporosis.

Differentiation of Skeletal Multiple Myeloma and Metastases Using Additive Axial Diffusion-weighted MR Imaging to Standard MR Imaging: Use of ADCmean, ADCminimum, and ADCvolume at 3.0 T

SSQ13-07

Ga-Eun Park MD (Presenter):
Nothing to Disclose
Won-Hee Jee MD:
Nothing to Disclose
So-Yeon Lee MD:
Nothing to Disclose
Jin-Kyeong Sung MD:
Nothing to Disclose
Robert Grimm:
Employee
Siemens AG:
Kee-Yong Ha:
Nothing to Disclose
Joon-Yong Jung MD:
Nothing to Disclose

PURPOSE

To retrospectively determine the value of adding axial diffusion-weighted imaging (DWI) to standard magnetic resonance imaging (MRI) to differentiate between skeletal multiple myeloma from metastases at 3.0 T, using mean ADC (ADCmean), minimum ADC (ADCmin), and volume ADC (ADCvolume).

METHOD AND MATERIALS

The institutional review board approved this HIPAA-compliant study, and informed consent was waived. The authors retrospectively analyzed 3.0 T MRI including DWI with high b value in 43 patients with treatment-naive bone metastases or multiple myeloma. Two radiologists independently interpreted MR images for the presence of multiple myeloma by using standard MRI alone and standard MRI and axial DWI combined. ADCmean, ADCmin, and ADCvolume from ADC histograms on volume of interests were measured by two independent reviewers. Mann-Whitney U test was performed. Area under the Receiver operating characteristic curve (AUC) was obtained for the differentiation of multiple myeloma from metastases.

RESULTS

There were 25 patients with bone metastases and 18 patients with multiple myeloma: 38 metastases and 36 multiple myeloma lesions. ADCmean, ADCmin and ADCvolume of multiple myeloma were significantly lower than those of metastases; 752 μm2/sec (interquartile range, 619, 849), 704 (587, 773) and 747 (636, 860) for multiple myeloma; 1081 μm2/sec (813, 1248), 835 (709, 1089) and 933 (718, 1322) for metastases (P < .05). With standard MRI alone, the sensitivity, specificity and accuracy were 61%, 86%, and 77%, respectively for reader 1, and 61%, 96%, and 81% for reader 2. With standard MRI and DWI combined, the sensitivity, specificity and accuracy were 100%, 92%, and 95% for reader 1, and 94%, 96%, and 95% for reader 2. Diagnostic performance of both readers improved significantly after additional review of DWI: AUCs improved from 0.762 to 0.953 and from 0.706 to 0.950 (P < .005) for two readers. AUC of ADCvolume (0.668) was
significantly lower than those of ADCmean and ADCmin (P < .005). Interobserver agreements were fair to good for ADCmean (ICC = 0.741) and excellent for ADCmin (ICC = 0.821).

CONCLUSION

The addition of axial DWI to a standard MRI improved the diagnostic accuracy in the differentiation of skeletal multiple myeloma from metastases, particularly using ADCmean and ADCmin.

CLINICAL RELEVANCE/APPLICATION

DWI should be added to standard MRI in clinical routine to help differentiate between skeletal multiple myeloma and metastases.

Evaluation of Vertebrae Marrow Health Based on MR Findings: IDEAL IQ Superior to MRS

Huiying Chen (Presenter): Nothing to Disclose, Ziheng Zhang : Nothing to Disclose, Huishu Yuan MD : Nothing to Disclose

PURPOSE

To evaluate the practicability of IDEAL IQ and magnetic resonance spectroscopy (MRS) for the quantification of vertebrae marrow fat, a significant indicator of vertebrae marrow health.

METHOD AND MATERIALS

19 healthy volunteers (F:M=6:13, age range: 23 - 66 years old) were recruited in this study with written informal consent obtained. All the attendees were performed MRI exams on a 3.0T MR scanner (GE MR750, Waukesha, WI) including routine T1WI, T2WI and single-voxel point resolved spectral selection (PRESS) MRS and IDEAL IQ. The L3 vertebrae of all the objects were scanned with the key parameters set as, for PRESS: TR/TE=2000/36ms, spectral width = 5000 Hz, NEX = 16, voxel size =20×20×18 mm3, with scan time = 2 min 24s, and for IDEAL IQ: TR/TE=8.4/1.2ms,echo train length=3, slice thickness=3mm FOV=35×35cm2, matrix=288×256, with scan time=61s. The original images from both acquisitions were post-processed automatically on GE host with the resultant spectrum and maps of fat fraction, R2*, fat and water obtained. The average fat fraction (FF) of the vertebrae marrow from IDEAL IQ was obtained by drawing a 20×20mm2 region of interest (ROI) on each of 6 successive slices, well corresponding to the voxel size of MRS. The relevance of the FFs from IDEAL IQ and MRS was evaluated through Pearson correlation analysis.

RESULTS

Due to the potential T2 and T2* effect of MRS, a certain bias of accuracy on MRS was expected. IDEAL IQ, however, was more accurate than MRS because of the application of the T2*-correction and fatty spectral modeling. As a result, IDEAL IQ FF exhibited a relatively high positive correlation with MRS FF (R2=0.88, P<0.01). In addition, the general distribution of vertebrae marrow fat was unfolded by IDEAL IQ, showing different variations along the vertebrae axial by individual. Practically, one third acquisition time of IDEAL IQ versus PRESS would contribute greatly to the throughput of patients.

CONCLUSION

Comparing with MRS, IDEAL IQ provided a rapid and accurate FF and a quasi-3D evaluation of the adipose tissue, more comprehensive in reflecting the health condition of vertebrae marrow.

CLINICAL RELEVANCE/APPLICATION

IDEAL IQ can fulfil the clinical needs on multi-vertebrae FF examination valuable in assessing vertebral marrow health, such as in predicting vertebral fracture.
equation.

RESULTS
The histologic cellularities demonstrated statistically significant correlation with the left ilium MRI calculated cellularity \((r=0.59, p=0.001)\), and high correlation with the right ilium and between sides \((r=0.83, p<0.001)\). Decreases in cellularity were observed with ascending vertebral level from S1 to T11. Marrow cellularity also decreased with age, but less dramatically than the rule of thumb of "100 - age". The following calculation demonstrated marrow cellularity variation with age: cellularity \((\%) = 67.6 - (age \times 0.36)\)

CONCLUSION
Marrow cellularity from MRI shows statistically significant correlation compared to bone marrow biopsy. Significant differences in marrow cellularity between vertebral levels and changes in cellularity with age are also demonstrated.

CLINICAL RELEVANCE/APPLICATION
This simple method of marrow cellularity calculation from routine MRI may be applicable in the setting of osteoporosis, aplastic processes, or other marrow disorders to compare individual patients to age matched normals or to follow a disease and its response to treatment.

MKS390
Permeability Imaging in Sacroiliitis: Initial Report (Station #1)

PURPOSE
Conventional, dynamic contrast enhanced imaging (DCE) and diffusion MRI of the sacroiliac joints has been widely used in the daily clinical practice. Permeability measures has become calculable through DCE, are used in various CNS pathologies. The purpose of this paper is to compare these permeability measures derived from DCE with conventional, contrast enhanced and diffusion MRI techniques in diagnosis of patients with sacroiliitis (SI) at 3T.

METHOD AND MATERIALS
An institutional review board approval was obtained for this study. A total of 20 patients with SI were included. All patients were evaluated with routine laboratory exams, specific scoring methods (VAS, BASFI, BASDAI, ASQoL, BASMI) for disease activity and ASAS criteria at the rheumatology clinic before referral. Conventional (including T1, T2W and STIR images), dynamic contrast enhanced imaging with gadoterate meglumine and diffusion sequences were performed for each patient at 3T. ADC values from DWI; Ktrans, Kep and TTP values from DCE images were calculated, respectively. Quantitative evaluation was performed for the data driven from DCE time-intensity curve, ADC map and values of permeability by means of ROI placed within areas of bone marrow edema and contralateral normal appearing bone with the help of conventional images. Quantitative values obtained were statistically evaluated and correlated with disease activity scores obtained from the clinical evaluation methods.

RESULTS
Conventional, diffusion weighted and DCE images had successfully defined regions of edema and increased contrast uptake. Clinical scores of disease activity also showed good correlation with permeability values in all patients. Ktrans, Kep and TTP values showed greater difference between regions of bone marrow edema and contralateral normal appearing bone and correlated well with ADC measurements.

CONCLUSION
This initial report showed that permeability calculation of DCE is a promising technique in imaging of SI and can be usefull in establishing radiological correlation with disease activity.

CLINICAL RELEVANCE/APPLICATION
Permeability calculation of DCE in sacroiliac imaging is a promising technique which is expected to help early diagnosis, management of treatment and follow up procedures in SI.
Feasibility of DCE-MRI in the Detection of Active Lesions of Ankylosing Apondylitis in the Sacroiliac Joint (Station #2)

Ruxin Wang (Presenter): Nothing to Disclose, Yue Dong: Nothing to Disclose, Liwei Zhong: Nothing to Disclose, Liang Huang: Nothing to Disclose

PURPOSE
To evaluate the efficacy of DCE-MRI in the differential diagnosis of active lesions in the sacroiliac joint of ankylosing spondylitis (AS) patients.

METHOD AND MATERIALS
Two groups of patients were selected: confirmed cases and clinical suspected (35 cases), normal control group (21 cases). The age limit is 18 to 45 years old and male to female ratio is about 1 to 1. Two sequences are performed: fat suppressed T2WI and joint DCE-MRI T1WI of both sacroiliac joints in the sagittal and coronal plane. The slice thickness is 4 ~ 5 mm. The contrast is given every 10 ms, at an interval of 1 ms, when scan 20 phases. The patient is scanned in the coronal and sagittal section. The bilateral sacroiliac joints are examined for any synovial thickening and the synovium is measured. At each level, 3 ROI are taken from right to left, as far as possible when selecting ROI and synovial contours the consistent, according to the TIC curve we can respectively record time to the peak (TTP), peak signal strength (PSS), the maximum slope (MSI) and signal enhancement ratio (SER), Independent sample t test analysis is used to compare the average value.

RESULTS
Based on clinical, laboratory examination and image analysis, 17 cases had confirmed symptomatic AS and 18 cases had no confirmed AS. For the control group: the peak time is (9.48±4.11) ms; the peak signal strength is (430.51±146.55); the largest rise in slope is (78.78±42.84); the signal enhancement ratio is (85.89±36.10). For the lesion group: the peak time is (13.00±5.06) ms; the peak signal strength is (571.81±241.24); the largest rise in slope is (141.93±78.42); the signal enhancement ratio is (124.74±97.63). The comparison between lesion group and control group had statistical significance (P < 0.05). The peak time area under the ROC curve (AUC) is 0.71. The peak signal strength AUC is 0.74; the maximum peak AUC is 0.78; the signal enhancement ratio AUC is 0.72.

CONCLUSION
DCE-MRI is superior to conventional sequences of MRI in the differential diagnosis of active lesions in the sacroiliac joint of ankylosing spondylitis (AS). Parameters such as time to peak, peak signal strength, maximum rising slope, signal enhancement ratio of sacroiliac joint of active lesions has significance of differential diagnosis. The efficiency is the largest at the maximal increase in slope.

CLINICAL RELEVANCE/APPLICATION
It's a new method that is very helpful to diagnosis of AS.

Arthritis or Aging? A Review of the CT Findings in the Osseous Pelvis in an Aging Population (Station #3)

James D. Stensby MD (Presenter): Nothing to Disclose, Cree Michael Gaskin MD: Author with royalties, Oxford University Press Author with royalties, Thieme Medical Publishers, Inc, David Ansley Lawrence MD: Nothing to Disclose

PURPOSE
To determine trends in incidentally detected age- and gender-associated sacroiliac fusion and chondrocalcinosis on pelvic CT.

METHOD AND MATERIALS
IRB approved. We identified CT scans of the pelvis performed 2009-2013 and selected 20 patients of each gender at the center of each decade of life (age 5, 15, 25, . . .95 years) for a total of 400 pelvic CTs. We reviewed the electronic health record of each patient and excluded those with low back or sacroiliac pain; known afflictions of the pelvic joints or systemic rheumatologic conditions; history of sacroilitis, ankylosing spondylitis, inflammatory bowel disease, HLA B27 arthropathy, hemochromatosis, hyperparathyroidism, Wilson's disease, or hypothyroidism. We backfilled for any excluded patients to maintain 20 subjects in each set. CTs were reviewed in consensus by 2 MSK radiologists for SI joint fusion and chondrocalcinosis of any pelvic joint. Logistic regression was used to predict the presence/absence of SI fusion and chondrocalcinosis as a function of patient age and gender. The model predictors included a classification variable to identify patient gender, and linear and non-linear restricted cubic-spline functions of patient age.

RESULTS
SI fusion was associated with both patient age (P=0.003) and patient gender (P<0.001). SI joint fusion was seen more frequently in both older males and females, although at any particular age the odds of SI fusion was predicted to be 7.1 times greater (95% CI: [3.2, 15.7]) for males than females (P<0.001). The presence/absence of chondrocalcinosis was found to be associated with patient age (P=0.016) but not patient gender (P=0.929). (Fig.) (445)

CONCLUSION
Incidentally detected SI joint fusion is common in older patients, particularly in men. It is an uncommon finding in patients <45 years of age, particularly in women, and may warrant clinical evaluation. Chondrocalcinosis is more prevalent in older patients, without a gender predilection and is infrequently identified in patients younger than age 50.
**CLINICAL RELEVANCE/APPLICATION**

When SI joint fusion is detected in older male patients it likely reflects an age and gender related phenomenon rather than sequela of disease. For patients <45 years age, particularly women, SI joint fusion is suggestive of underlying disease process.

**MKS393**

**Intravoxel Incoherent Motion Diffusion-weighted MR Imaging for Characterization of Musculoskeletal Tumors at 3.0T (Station #4)**

Hyun Kyong Lim MD (Presenter): Nothing to Disclose, Won-Hee Jee MD: Nothing to Disclose, Joon-Yong Jung MD: Nothing to Disclose, Mun-Young Paek: Employee, Siemens AG, Robert Grimm: Employee, Siemens AG, Yang-Guk Chung MD: Nothing to Disclose

**PURPOSE**

To retrospectively evaluate the intravoxel incoherent motion (IVIM)-derived parameters for differentiating between benign and malignant musculoskeletal tumor at 3.0T diffusion-weighted magnetic resonance (DW) imaging.

**METHOD AND MATERIALS**

The institutional review board approved this HIPAA-compliant study, and informed consent was waived. Sixty-three patients with treatment-naïve musculoskeletal tumors who underwent MR imaging including IVIM DW imaging were included in this study: 47 malignant and 20 benign lesions. IVIM DW imaging was obtained with nine b values (0-800 sec/mm²) at 3.0T. IVIM-derived parameters included pure diffusion coefficient, perfusion related incoherent microcirculation (pseudodiffusion coefficient), and perfusion fraction. IVIM related parameters were retrospectively measured within the solid portion based on standard MR images by two independent musculoskeletal radiologists. Intraclass correlation coefficient (ICC) was used for interobserver reliability test. Mann-Whitney U test and two sample t-test were performed for comparison. The diagnostic performance of the parameters was evaluated by using receiver operating characteristic (ROC) analysis.

**RESULTS**

The pure diffusion coefficient of malignant tumors (920 ±360 μm²/sec) were significantly lower than those of benign tumors (1540 ±660 μm²/sec) (P<.001). The perfusion fraction of malignant tumors (9.56%) were significantly higher than those of benign tumors (6.80%) (P=.011). The pseudodiffusion coefficient showed no significant difference (P >.05). The area under the ROC curve of pure diffusion coefficient and perfusion fraction were 0.80 and 0.70, respectively (P<.01). Using cut-off values of pure diffusion coefficient of 1160 μm²/sec, the sensitivity and specificity were 90% and 75%, respectively. The ICC value showed good to excellent interobserver agreement between two readers (0.98 for pure diffusion coefficient; 0.70 for pseudodiffusion coefficient; 0.80 for perfusion fraction).

**CONCLUSION**

IVIM-derived pure diffusion coefficient and perfusion fraction were more valuable parameters in the differentiation of malignant from benign musculoskeletal tumors than pseudodiffusion coefficient at 3.0T IVIM DW imaging.

**CLINICAL RELEVANCE/APPLICATION**

IVIM-derived pure diffusion coefficient and perfusion fraction were more valuable parameters in the differentiation of malignant from benign musculoskeletal tumors than pseudodiffusion coefficient at 3.0T IVIM DW imaging.

**MKS394**

**Quality Management in Musculoskeletal Imaging: Form, Content and Diagnosis of Knee MR Reports and Effectiveness of Three Different Quality Improvement Measures (Station #5)**

Andrea Rosskopf MD (Presenter): Nothing to Disclose, Tobias J. Dietrich MD: Nothing to Disclose, Anna Hirschmann MD: Nothing to Disclose, Florian M. Buck MD: Nothing to Disclose, Reto Sutter MD: Nothing to Disclose, Christian W. A. Pfirrmann MD, MBA: Advisory Board, Siemens AG Consultant, Medtronic, Inc

**PURPOSE**

To evaluate the quality of reports of knee MR examinations in form, content and diagnosis and to assess the effect of three different quality improvement measures.

**METHOD AND MATERIALS**

Reports of 500 consecutive knee MR studies (=first round) in our institution were retrospectively assessed by five musculoskeletal radiologists. In summary 15 different criteria were reviewed for formal and content-related quality of reports. Furthermore diagnostic discrepancies were categorized using a five-point scale: I:no deviation; II:undetected finding, clinically irrelevant; III:wrong interpretation of finding, clinically irrelevant; IV:undetected finding, clinically relevant; V:Wrong interpretation of finding, clinically relevant. In the second round three different quality improvement measures were applied to a total of 510 consecutive reports: a quiet work environment, double reading and the use of a structured report template. These 510 knee MR reports were assessed using the same criteria as described above.

**RESULTS**
In the second round reports a statistically significant improvement in 13 out of 15 criteria of form and content was found: orthographic errors improved from 32.4% to 22.0% (P<0.001) of reports and digital speech recognition errors from 8.4% to 7.6% (P=0.660). The rate of missing anatomical structures dropped from 6.3% to 0.4%. Diagnostic discrepancies decreased from 20.6% to 12.9% (P=0.001) with following changes in categorization (first round results in parentheses): I:87.1%(79.2%), II:9.2%(16.8%), III:2.3%(1.0%), IV:1.0%(2.6%), V:0.4%(0.4%). Quality improvement was found in all three measure groups. No statistically significance between the groups was found - except for the orthographic errors (P<0.001), which were most common in the template group.

CONCLUSION

Formal deviations were common. Clinically relevant diagnostic errors occurred rarely and were mostly associated with the detection of lesions rather than its interpretation. All three quality improvement measures significantly improved the quality of the knee MR reports, but no measure was clearly superior to the others.

CLINICAL RELEVANCE/APPLICATION

Our results demonstrate that each proposed quality improvement measure leads to a relevant reduction of errors in structure, content and diagnosis in knee MR reports.

MKS395

High Resolution Morphologic and Quantitative MR Evaluation of the Glenoid Labrum (Station #6)

Kenyu Iwasaki MD, PhD (Presenter): Nothing to Disclose, Monica Tafur MD : Nothing to Disclose, Sheronda Statum : Nothing to Disclose, Reni Biswas : Nothing to Disclose, Betty Tran : Nothing to Disclose, Eric Y. Chang MD : Nothing to Disclose, Graeme M. Bydder MBChB : Nothing to Disclose, Christine B. Chung MD : Nothing to Disclose

PURPOSE

The objective of this study is to implement novel MR pulse sequences to non-invasively unmask labral morphology and infrastructure, and to provide quantitative MR characterization.

METHOD AND MATERIALS

Six glenoid labra were dissected from donor shoulders within 24 hours of death. Age range at death is from 41 to 94 years. MR studies were performed on a 3T Signa TwinSpeed scanner (GE Healthcare). Morphologic evaluation included T1-weighted, proton density-weighted (PD), 3D spoiled gradient echo (SPGR) and 2D/3D ultra-short echo time (UTE) sequences in sagittal and axial planes. Quantitative evaluation included 2D/3D T1 rho, UTE T1 rho, T2 and UTE T2* sequences using an in-house MatLab analysis algorithm fitting two regions of interests (ROIs) to determine average values.

RESULTS

Labral infrastructure was better demonstrated using 2D and 3D UTE sequences as compared with PD SE sequences. The fibrocartilage was best depicted using very short TEs (0.03 ms) whereas the collagen network was better demonstrated using slightly longer TEs (6.6 ms) where the contrast between both components was greater. Foci of increased signal intensity secondary to labral pathology were also better demonstrated with 2D and 3D UTE sequences. Quantitative MR analysis showed a bi-component decay behavior in a normal labrum with T2* value of 3.38 ms and prolongation of T2 and T2* values with labral tears and/or degeneration.

CONCLUSION

2D and 3D UTE sequences are useful to demonstrate labral infrastructure and can unmask labral pathology as compared with the standard clinical sequences. Quantitative MR analysis of the labrum also reflected labral composition and changes in normal and pathologic stages.

CLINICAL RELEVANCE/APPLICATION

UTE MRI allows the visualization of labral infrastructure and can unmask pathology as compared with the standard clinical sequences.

MKE139

ISAKOS Classification of Meniscal Tears – Illustration on 3D Isotropic Spin Echo MR Imaging (Station #8)

Vibhor Wadhwa MBBS (Presenter): Nothing to Disclose, Hythem Adnan Omar MD : Nothing to Disclose, Avneesh Chhabra MD : Research Grant, Siemens AG Research Consultant, Siemens AG Research Grant, Integra LifeSciences Holdings Corporation Research Grant, General Electric Company Consultant, ICON plc

TEACHING POINTS

1. Review the International Society of Arthroscopy, Knee Surgery and Orthopedic Sports Medicine (ISAKOS) classification for meniscal tear evaluation, since it is most widely used and recommended by sports surgeons to ensure consistency of arthroscopic evaluation, avoid measurement errors and facilitate treatment outcome assessment. 2. Learn imaging appearances of different meniscal tears based on ISAKOS classification on 3D isotropic spin echo MR imaging technique and its multiplanar reconstructions. 3. Correlate the meniscal pathology with arthroscopy images.

TABLE OF CONTENTS/OUTLINE

1. Review the ISAKOS system of characterization of meniscal tears 2. 3D isotropic spin echo MR imaging technique in 3 Tesla scanner. 3. Demonstrate the various types of meniscal tears on multiplanar reconstructions from 3D imaging for reader understanding in a quiz format. 4. Relevant arthroscopy pictorial correlations.
Current Techniques in Percutaneous Image-guided Treatment of Benign and Malignant Lesions of the Spine (Station #9)

Kristen Alexa Lee MD (Presenter): Nothing to Disclose, Afshin Gangi MD, PhD: Proctor, Galil Medical Ltd, Michael V. Friedman MD: Nothing to Disclose, Travis J. Hillen MD: Consultant, Biomedical Systems Consultant, Vadicare Corporation, Jack William Jennings MD: Speakers Bureau, DFINE, Inc Consultant, DFINE, Inc

TEACHING POINTS
In the past decade, there has been increasing use of percutaneous techniques in the treatment of both benign and metastatic spine lesions. These techniques provide therapeutic options for patients, who have failed conventional therapies or exhausted spine radiotherapy. Review the most current and state of the art use of percutaneous image-guided interventions for benign and malignant lesions of the spine. Discuss specific challenges in thermal ablation of spinal lesions and the role of thermoprotection.

TABLE OF CONTENTS/OUTLINE
Overview of percutaneous image-guided techniques in treatment of both benign and malignant spinal lesions, including vertebral augmentation, radiofrequency ablation, ciblation, cryoablation, microwave and laser photocoagulation. Brief literature review on efficacy and safety profile of these techniques. Pictorial presentation of various benign and malignant spinal lesions pre- and post-treatment. Discuss specific challenges in thermal ablation of spinal lesions and the role of thermoprotection. Summary and future direction.

Freeze Frame: A Pictorial Review of Cryoablation in the Treatment of Osteoid Osteomas (Station #10)

Brathaban Rajayogeswaran MBCh (Presenter): Nothing to Disclose, Neal C. Chhaya MBBS, FRCR: Nothing to Disclose, Paul Ian Mallinson MBChB: Nothing to Disclose, Peter L. Munk MD: Nothing to Disclose

TEACHING POINTS
To review the pathophysiology of osteoid osteomas, principles of thermoablation and the advantages of cryoablation, planning interventional methods, potential complications of cryoablation and post-procedural imaging to confirm complete ablation zone.

TABLE OF CONTENTS/OUTLINE
The new ultralight thin argon based designed cryoablation probes are perfect for ablating small painful osteoid osteomas which can appear anywhere in the skeleton. Probe selection and placement can be challenging to create complete ablation zone and minimize complications. This pictorial educational review zooms in and snaps shots the process. 1) Description of the pathology and illustration of various examples of osteoid osteomas. 2) Discuss the principles and advantages of the use of cryotherapy to ablate the osteoid osteoma nidus. 3) Pictorial review of positioning and probe size selection to create complete ablation zone with tips and tricks. ‘When to park adjacent to the cortex and when to drill’, ‘overlapping ablation zones’. 4) Identify and minimize complications of cryoablation with intraoperative imaging. 5) Review of follow-up post-procedural imaging to confirm complete ablation of the osteoid osteoma.

Anatomy, Pathology and Imaging of the Coracohumeral Ligament (Station #11)

Guillermo Andres Azulay MD: Nothing to Disclose, Patrick Omoumi MD (Presenter): Nothing to Disclose, Santiago Andres MD: Nothing to Disclose, Andres Zanfardini MD: Nothing to Disclose, Ariel Oscar Vazquez MD: Nothing to Disclose, Eduardo Pablo Eyheremendy MD: Nothing to Disclose, Daniel Postan: Nothing to Disclose

TEACHING POINTS
1. Knowledge of the anatomy and the relations of the coracohumeral ligament (CHL) with surrounding structures is essential to the imaging study of the CHL. 2. MRI and MR arthrography are the imaging techniques of reference to image the CHL. 3. Ultrasound can be a useful technique through a dynamic evaluation.

TABLE OF CONTENTS/OUTLINE
1. Anatomy: 4 cadaveric specimens were studied with a focus on the relation of the CHL to the surrounding structures (biceps, supraspinatus and infraspinatus tendons, subcoracoid fat, acromiocoracoid ligament, subacromial subdeltoid bursa). The position and movement of the CHL in relation to internal and external rotation of the shoulder. 2. High-resolution ultrasound examination technique: positioning; anterior dynamic approach; landmarks (including acoustic shadows); taking advantage of the anisotropy artifact. 3. Clinical Findings / Therapeutic considerations (Adhesive capsulitis, traumatic and microtraumatic lesions), emphasizing the role of imaging.

Imaging of Soft Tissue Lesions: Role of Sonoelastography in the Diagnosis and Follow Up (Station #12)

Chiara Carducci MD (Presenter): Nothing to Disclose, Nicola Magarelli MD: Nothing to Disclose, Laura Filograna MD: Nothing to Disclose, Claudia Dell’Atti MD: Nothing to Disclose, Lorenzo Bonomo MD: Nothing to Disclose

TEACHING POINTS
Sonoelastography (SE) is an ultrasound technique that is increasingly used for the evaluation, characterization
and follow up of superficial soft tissue lesions. It measures the tissue hardness of the lesion by comparing the ultrasound radiofrequency signal before and after compression of the tissue. The principle of SE is based on the relationship between differences in tissue deformability and its elastic properties. The purpose of the exhibit is to: underline the role of SE in the diagnosis and follow up of the soft tissue lesions; improve radiologist's diagnostic skills with this technique.

**TABLE OF CONTENTS/OUTLINE**

- Technical principles and execution technique of SE.
- Qualitative and quantitative parameters of SE in the evaluation of superficial soft tissue presented in a flow chart. Case series presented to highlight the SE pattern of benign and malignant soft tissue lesions. Key points: integrated imaging in the diagnosis and follow up of soft tissue lesions; added value of SE in the management.

**SUMMARY**

SE could be a powerful imaging tool in the evaluation of superficial soft tissue lesions with unclear findings on grey-scale and colour and/or power Doppler ultrasound, to increase the diagnostic accuracy and useful for the follow-up of benign lesions.

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**Assessment of Sacroiliac Gouty Arthritis with Dual-energy CT: An Initial Study (Station #1)**

**Min Liu (Presenter): Nothing to Disclose , Fan Yang : Nothing to Disclose , Chang Liu : Nothing to Disclose**

**PURPOSE**

Gout is the most common crystal deposition arthropathy currently diagnosed clinically due to frequently involving the first metatarsophalangeal joint. To our best knowledge, monosodium urate (MSU) crystal deposition in the sacroiliac joint has rarely been reported to date. The purpose of this study is to examine the features of MSU crystal deposition and erosion in sacroiliac gouty arthritis with dual-energy CT (DECT).

**METHOD AND MATERIALS**

This study was approved by an institutional review board; patient informed consent was obtained. Twelve patients (10 men, 2 women; mean age, 47 years±12 [standard deviation]) with sacroiliac gouty arthritis and 10 normal controls (6 men, 4 women; mean age, 49 years±13 [standard deviation]) were enrolled in this study. DECT with gout protocol was performed in all patients for detection of MSU crystal deposition and bone erosion. A dedicate post-processing gout software was used to observe the color-coding MSU crystal. Two readers scored blindly the DECT scans for MSU crystal deposition and erosion, and kappa test was used to determine the observer agreement.

**RESULTS**

Of 12 patients, the serum urate levels were partly elevated (7 cases) and partly normal (5 cases). MSU crystal deposition was observed in sacroiliac joints (7 cases), lumbar facet joints (5 cases) and discs sacroiliac joints (4 cases). Bone erosion was found in 6 cases. Compared with sacroiliac gouty arthritis patients, no MSU crystal deposition was detected in all normal controls (p<0.001). Good agreement was obtained between two reader for observing the MSU crystal deposition (κ= 0.93) and bone erosion (κ= 0.91).

**CONCLUSION**

DECT can serve as a promising imaging technique for visualization of MSU crystal deposition and erosion in sacroiliac gouty arthritis.

**CLINICAL RELEVANCE/APPLICATION**

Diverse factors can lead to sacroilitis besides gout. Sometimes imaging differential diagnosis is difficult. DECT provides a relative new non-invasive imaging modality that is able to distinguish urate crystals. These findings will benefit the diagnosis of gouty arthritis.

**Functional Evaluation of Traumatic Tears of the Medial Meniscus of the Knee using Weight-bearing MRI (Station #2)**

**Alice La Marra MD (Presenter): Nothing to Disclose , Silvia Mariani MD : Nothing to Disclose , Lorenzo Maria Gregori : Nothing to Disclose , Lucia Patriarca : Nothing to Disclose , Antonio Barile MD : Nothing to Disclose , Carlo Masciocchi MD : Nothing to Disclose**

**PURPOSE**

To determine prospectively the role of 1.5 T, dedicated low-field standard and upright-MRI in the evaluation of stable or unstable traumatic tears of medial meniscus in comparison with arthroscopy.

**METHOD AND MATERIALS**
Our series included 3500 knee MRI scans performed with a high field MRI scanner from January 2010 to March 2014. On the basis of the concordance between clinical and high-field MRI diagnosis, we selected two groups. In the first group (group A) we included 70 MRI exams of normal knee and in the second group (group B) we included 275 MRI exams of knee with clinical evidence of medial meniscus traumatic lesions. In the same session, after conventional 1.5T and “dedicated” 0.25T supine MRI exam, the patients underwent upright weight-bearing examination with the same dedicated MRI unit. We used sagittal and coronal scans (SE T1-W) in all cases. All 275 patients were submitted to arthroscopy between 7 and 21 days after diagnostic examination.

RESULTS

In group A, there were no statistically significant anatomical changes of the signal intensity, position and morphology of the medial meniscus between standard 1.5T, dedicated supine and upright MRI. In group B, the images acquired in the supine position (dedicated and 1.5T MRI) documented, in 32 cases (group B1) a meniscocapsular separation, in 106 cases (group B2) a longitudinal lesion, in 67 cases (group B3) horizontal lesion and in 70 cases a radial tear (group B4). In group B1, weight-bearing MRI showed presence of unstable tear in 32 out of 32 cases. In group B2, weight-bearing MRI showed presence of unstable tear in 89 out of 106 cases. In group B3, weight-bearing MRI showed an unstable meniscal tear in 45 out of 70 cases. In group B4, weight-bearing MRI showed an unstable meniscal tear in 65 out of 70 cases. Arthroscopy confirmed weight-bearing MRI diagnosis in all cases of Group B1, B2 and B3; in group B4 arthroscopy showed unstable tear in 65 out of 70 cases (20 cases of WB-MRI false negative).

CONCLUSION

The upright MRI allows to record load-induced physiological variation, thus showing both the meniscal stability and a latent instability only for meniscocapsular separations, longitudinal and horizontal medial meniscal tears.

CLINICAL RELEVANCE/APPLICATION

The knowledge of an unstable medial meniscal tear is very useful to correctly guide the orthopedic surgeon towards an appropriate surgical treatment.

MKS398

Increased Signal Intensity of Lateral Collateral Ligament at Femoral Attachment on Fat-suppressed Proton-density-weighted MR Images: Is it Normal or Abnormal? (Station #3)

Han Na Lee MD (Presenter): Nothing to Disclose, Ji Seon Park MD, PhD: Nothing to Disclose, Sung Eun Ahn : Nothing to Disclose, Kyung Nam Ryu MD, PhD : Nothing to Disclose, Wook Jin : Nothing to Disclose, So Young Park : Nothing to Disclose, Jung Eun Lee : Nothing to Disclose, Sohee Yoon MD : Nothing to Disclose

PURPOSE

Even in asymptomatic knees, the increased signal intensities(SI) of lateral collateral ligament(LCL) at femoral attachment are commonly seen on fat-suppressed(FS) proton-density-weighted(PDW) MR images, unlike the midportion of LCL. We evaluated the histological differences between the above two portions of LCL and clarified the cause of these signal differences using cadaveric knees.

METHOD AND MATERIALS

MRI was obtained from 11 cadaveric knees (M:F = 7:4, mean age at death = 77.5 years, age range, = 58~96 years). Two musculoskeletal radiologists evaluated the SI at both the femoral attachment and midportion of LCL using FS PDW coronal and axial images. The SI are classified into 3 grades (I = low, II = slightly high, III = high or fluid-like). These MR findings were correlated with the corresponding gross and histological sections.

RESULTS

All LCLs revealed the increased SI at femoral attachment including 9 cases of grade II and 2 cases of grade III. Two cases of grade III had a thin layer of fluid-like high signal, but smooth contour was preserved. SI of LCLs at midportion was grade I in all cases. On histological examinations, LCL at femoral attachment showed loose collagen fibers with twisted or irregular distribution, whereas LCL at midportion revealed dense collagen fibers with parallel or well-organized distribution. Additionally, interspersed vessels within loose fibrous layer were found. These findings were prominent at deeper portion than superficial layer within the femoral attachment. Degeneration or tear of LCL was none even in the cases of grade III.

CONCLUSION

Based on this study, increased SI of LCL at femoral attachment on FS PDW image is due to differences in density and orientation of collagen fibers, rather than true degeneration or tear.

CLINICAL RELEVANCE/APPLICATION

Normal LCL at femoral attachment can demonstrate the increased SI on FS PDW MR images caused by histological differences.

MKS399

Bone Marrow Fat Quantification of the Lumbar Spine Using Dual Energy CT (DECT) and Single Voxel 1H-MR Spectroscopy (1H-MRS)—A Feasibility Study (Station #4)

PURPOSE

Quantification of marrow fat has been proposed as a predictor of bone weakening, independent of bone mineral density (BMD). 1H-MRS is able to reliably quantify bone marrow fat fraction in a single voxel, however, the ability of measuring larger areas of heterogeneous marrow is limited. Advances in DECT allow quantification of BMD of the entire axial and appendicular skeleton with no additional radiation exposure compared to standard QCT. The purpose of our study was to test the performance of DECT in assessing marrow fat content of the lumbar spine, using 1H-MRS as a reference standard.

METHOD AND MATERIALS

The study was IRB approved and complied with HIPAA guidelines. Written informed consent was obtained from all subjects. Seven healthy men (mean age: 39±13 y) who participated in a clinical obesity trial underwent single voxel 1H-MRS at 3T (Siemens Trio) of the L2 vertebra using a PRESS sequence without water suppression. DECT (Siemens Definition Flash) of the L2 vertebra (80 kVp @ 210 mAs, 140 kVp @ 80 mAs) was performed with use of a calibration phantom. Average basis material composition relative to the phantom was estimated within an elliptical cylinder (3 cm3) positioned in the anterior cancellous bone region of L2. The resulting basis material composition was then fit to a cancellous bone model yielding a description in terms of volumes of model mineralized collagen, yellow and red marrow from which the volume fraction of yellow marrow within the marrow space was derived. Pearson correlation coefficient and Bland-Altman 95% limit of agreement of fat fraction obtained from 1H-MRS and DECT were calculated.

RESULTS

There was a strong correlation between marrow fat fraction obtained by 1H-MRS and DECT (r=0.90, p= 0.006). Using Bland-Altman analysis, there was good agreement between 1H-MRS and DECT without evidence of bias. The mean difference in fat fraction between the techniques was 0 with a 95% confidence interval between -0.26 and 0.25.

CONCLUSION

DECT is a reliable method to measure marrow fat content of the lumbar spine. DECT provides data that closely correlate with 1H-MRS. Therefore, DECT could potentially be used to assess both BMD and marrow fat content in a single examination.

CLINICAL RELEVANCE/APPLICATION

DECT is a novel imaging technique that can assess BMD and marrow fat content in a single examination, thereby providing important information on skeletal integrity.

Discordance between Radiologists and Orthopedists in Meniscal Tear Morphology Nomenclature: Orthopedic Support for Implementing a Validated MRI Standard (Station #5)

Laura Watson MD (Presenter): Nothing to Disclose, Allen Prober MD : Nothing to Disclose, S Paran Yap BA : Nothing to Disclose, Jeffrey B. Driban PhD : Nothing to Disclose, Tyler L. Skaife MD : Nothing to Disclose, Robert J. Ward MD : Nothing to Disclose

PURPOSE

To assess the heterogeneity in the classification of meniscal tear morphologies between orthopedists and radiologists, and whether this has lead to confusion when interpreting MRI reports. To determine orthopedic support for implementing a specific validated classification system for MRI reporting.

METHOD AND MATERIALS

3032 surveys were emailed to members of the Arthroscopic Association of North America. The survey included questions on specific tear morphologies with illustrated examples, signal classification, tear localization, frequency of confusion in reading other radiologists reports, and on the importance of standardization. 860 surveys including the same 6 questions on specific tear morphologies with illustrated examples were emailed to members of the Society of Skeletal Radiology. Chi-square analysis was used to compare meniscal tear morphology nomenclature between radiologists and orthopedists on each of the six meniscal tear illustrations.

RESULTS

401 orthopedists responded (13%) while 250 radiologists (29%) responded to a separate but similar survey. Chi-square analysis demonstrated statistically significant differences in descriptions of five out of the six morphologic tear types between orthopedists and radiologists. While 61% of orthopedists stated that meniscal tear morphology nomenclature on knee MRI reports was important to them, nearly 70% of the responders reported being confused by descriptions of tear morphology at least some of the time with MRI reports from radiologists within their institution/practice; this number increased to 85% when reading reports from outside radiologists. The responding orthopedists overwhelmingly (91%) favored the adoption of ISAKOS tear morphology on knee MRI reports.

CONCLUSION

Nearly two-thirds of responding orthopedists indicated that description of tear morphology on knee MRI reports is important to them; however, the differences in description of meniscal tear morphology between orthopedists and radiologists was statistically significant in five of the six provided illustrations. There was overwhelming support by the surveyed orthopedists for implementation of the ISAKOS classification system by radiologists for meniscal tear reporting on MR reports.

CLINICAL RELEVANCE/APPLICATION
Lack of standardization has led to MR report confusion with respect to meniscal tear morphology. There is support in the orthopedic community for radiologic report standardization.

**MKS401**

**Acromial Apophysiolysis of the Skeletally Immature Shoulder: Prevalence, Risk Factors and Association with os Acromiale and Rotator Cuff Tears (Station #6)**

**Johannes B. Roedl MD, PhD (Presenter):** Nothing to Disclose, **William B. Morrison MD:** Consultant, General Electric Company Consultant, **AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc,** **Adam C. Zoga MD:** Nothing to Disclose

**PURPOSE**

To investigate whether edema at the acromial apophysis (ossification center) in young patients ( < 25 years) is associated with a superior shoulder pain syndrome and acromial non-fusion.

**METHOD AND MATERIALS**

Institutional review board approval was obtained, the requirement for informed consent was waived. A retrospective report review of 2372 consecutive patients, between 15 and 25 years of age who underwent shoulder MRIs for shoulder pain was performed. Individuals with edema at the acromial apophysis and no other pathology on MRI were included in the study group. Association of acromial edema with incomplete fusion, baseball pitching (based on a pre-MRI pitching questionnaire) and clinical findings were determined in the study group and in an age and sex matched control group by two readers.

**RESULTS**

Edema at the acromial apophysis was found in 2.6% (61/2372) of patients. Edema was associated with incomplete fusion of the acromial apophysis (Chi-square, p < 0.001) and superior shoulder tenderness (p < 0.001). The entity was named acromial apophysiolysis accounting for the combination of non-fusion (lysis) and painful edema at the apophysis. In a multivariate regression analysis, a pitch count of more than 100 pitches per week was a risk factor for acromial apophysiolysis (OR=6.5, p=0.017). Six out of the 61 patients with acromial apophysiolysis had a normal MRI of the contralateral (non-throwing shoulder) within 2 weeks. Follow-up imaging with shoulder MRI was available in 29 of 61 patients in the study group and in 22 of 61 patients in the control group. Follow-up imaging showed that acromial apophysiolysis was significantly associated with the development of an os acromiale (OR=138, p < 0.001) and rotator cuff tears (OR=5.4, p=0.015) later in life, after age 25.

**CONCLUSION**

Acromial apophysiolysis is characterized by incomplete fusion and edema at the acromial apophysis. It is a cause of shoulder pain in young patients ( < 25 years) and pitching is a risk factor. It predisposes to the development of an os acromiale and rotator cuff tears after age 25.

**CLINICAL RELEVANCE/APPLICATION**

Young pitchers should not throw more than 100 pitches per week to prevent acromial apophysiolysis, a cause of shoulder pain and risk factor for os acromiale and rotator cuff tears later in life.

**MKE145**

**Radiological Evaluation of a Painful Total Knee Replacement (Station #7)**

**Natasa Devic MBBS, MRCS (Presenter):** Nothing to Disclose, **Sahar Naaseri MBBS, BSc:** Nothing to Disclose, **Sze Mun Mak FRCR:** Nothing to Disclose, **Emma Katrina Cheasty MBChB:** Nothing to Disclose, **Annelies F R Maenhout MD:** Nothing to Disclose, **Nikhil Kapse FRCR:** Nothing to Disclose, **Adrian James Wilson MBBS, BSc:** Research Consultant, Arthrex, Inc

**TEACHING POINTS**

How to adopt a logical approach to radiological assessment of a painful knee replacement - this approach can then be applied to evaluation of any painful joint replacement.

How best to utilise a variety of modalities available in investigating this often complex clinical problem.

The summary of imaging appearances of two of the commonest causes of a painful knee replacement - septic and aseptic loosening, and their impact on patient outcome.

Brief explanation of non-radiological adjuncts to radiological assessment.

**TABLE OF CONTENTS/OUTLINE**

Painful knee replacement - incidence, symptoms and signs.

- X-ray appearances of prosthesis loosening (infective and aseptic)
- CT protocols for assessment of prosthesis rotation - Imperial, Freemantle and Perth protocols.
- CT and MRI appearances of loosening.
- Nuclear medicine utilisation in investigation of painful knee replacements.
- Algorithm for radiological assessment of painful knee replacement

**MKE177**

**Multimodality Imaging of Stress Fractures (Station #8)**
Rafael Morcillo Carratala MD (Presenter): Nothing to Disclose, Yolanda Gomez-Herrero: Nothing to Disclose, Vivian Artiles Valle: Nothing to Disclose, Soledad Fernandez Zapardiel: Nothing to Disclose, Mar Cespedes Mas: Nothing to Disclose, Ivan Mauricio Vargas Orozco MD: Nothing to Disclose, Pilar Sanchez Camacho: Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:

- To describe the most common locations of stress fractures
- To illustrate the radiological features of stress fractures using a multimodality approach with conventional radiography (CR), computed tomography (CT) and magnetic resonance (MR)

TABLE OF CONTENTS/OUTLINE

- Etiology, epidemiology and pathophysiology of stress fractures
- Review of imaging findings
- Imaging findings in CR
- Imaging findings in CT
- Imaging findings in MR
- Most common sites of stress fractures
- Vertebral arch (spondylolysis)
- Pelvic bones
- Femoral neck
- Tibia
- Fibula
- Tarsal bones
- Metatarsal bones
- Summary and conclusions

MKE303

Ultrasound of the Peripheral Nerves of the Lower Extremity: A Landmark Approach (Station #9)

Matthew Ryan Hammer MD (Presenter): Nothing to Disclose, Corrie Marlene Yablon MD: Nothing to Disclose, Yoav Kalume Brigido MD: Nothing to Disclose, Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

TEACHING POINTS

After reviewing this exhibit, the viewer will be able to: 1. Describe the course of the peripheral nerves of the lower extremity, including their motor and sensory innervation. 2. List the important anatomical landmarks and transducer position used to locate the peripheral nerves of the lower extremity when performing sonographic evaluation. 3. Describe how US is useful for the evaluation of the lower extremity nerves

TABLE OF CONTENTS/OUTLINE

- I. Background
  1. Clinical impact
  2. Correlation to electrodiagnostic studies
- II. Technical considerations
- III. Normal US anatomy with correlation to MRI and illustrations
  1. Thigh: Lateral femoral cutaneous, saphenous, femoral, sciatic
  2. Knee: Saphenous, Tibial, Common Peroneal
  3. Calf: Deep and Superficial branches of the common peroneal, Sural, Saphenous, Tibial
  4. Ankle and foot: Lateral sural, tibial including medial and lateral plantar branches, medial calcaneal, saphenous, deep peroneal, distal branches of superficial peroneal

MKE323

Imaging techniques in Diagnosis and Prognosis of Multiple Myeloma: Which Will Win the Battle? (Station #10)

Maria Paramo Alfaro MD (Presenter): Nothing to Disclose, Jose Maria Bondia MD: Nothing to Disclose, Romina Zalazar MD: Nothing to Disclose, Damasoch Aquerreta: Nothing to Disclose, Maite Millor MEd: Nothing to Disclose, Paula Barquin Garcia MD: Nothing to Disclose, Lidia Sancho Rodriguez: Nothing to Disclose

TEACHING POINTS

1.- To define the Durie-Salmon criteria for staging Multiple Myeloma (MM) 2.- To review the Durie-Salmon PLUS criteria 3.- To analyze the advantages and disadvantages of different imaging techniques 3.1- Plain radiography 3.2- Computed Tomography (CT) 3.3- Low dose CT (LDCT) 3.4- MRI 3.5- PET-CT 4.- Implications of MRI and PET-CT in the prognosis of MM 5.- Controversial aspects in recent guidelines: LDCT vs MRI vs PET-CT for MM detection, staging and prognosis

TABLE OF CONTENTS/OUTLINE

1. MM definition
2. MM laboratory data
3. Imaging techniques - Morphological techniques: advantages and disadvantages
   - Plain radiography
   - CT, LDCT
   - MRI
3.1- Morpho-functional techniques: advantages and disadvantages
   - MRI (diffusion)
   - 18FDG PET-CT
4.- Implications of MRI and PET-CT in the prognosis of MM
5.- Controversial aspects
6. Future directions and summary

MKE105

MRI of the Diabetic Foot: A Comprehensive Review of the Biomechanics of the Foot, the Pathophysiology and Imaging of the Various Soft Tissue Changes Seen at Different Stages of the Disease (Station #11)

Claude Pierre-Jerome MD, PhD (Presenter): Nothing to Disclose, Hasan Banitalebi MD: Nothing to Disclose, Mehdi Sadat Akhavi: Nothing to Disclose, Arne Borthne MD, PhD: Nothing to Disclose

TEACHING POINTS

This exhibit will: 1) walk the readers a step-by-step description of the biomechanics of the foot, 2) clarify the pathophysiology of the soft tissue lesions resulting from vascular and neurologic damages associated with diabetes, 3) display and explain the MR images of the changes the most subtle sorts to the gross derangements in a didactic fashion, 4) the readers will acquire a better understanding of the Charcot foot from a clinical and radiological stand point.

TABLE OF CONTENTS/OUTLINE

- Schematic illustration of the biomechanics of the foot
- Pathophysiology
- Imaging of the various soft tissue changes
- See the stages of the disease

MKE383

MRI of the Diabetic Foot: A Comprehensive Review of the Biomechanics of the Foot, the Pathophysiology and Imaging of the Various Soft Tissue Changes Seen at Different Stages of the Disease (Station #11)

Claude Pierre-Jerome MD, PhD (Presenter): Nothing to Disclose, Hasan Banitalebi MD: Nothing to Disclose, Mehdi Sadat Akhavi: Nothing to Disclose, Arne Borthne MD, PhD: Nothing to Disclose
Schematic illustration of the biomechanics of the foot, description of the three columns of the foot, role the navicular bone and the cuboid bone as keystones of the medial and lateral columns of the foot, the presentation of hypothesis beyond the different steps of the pathophysiology of vascular and neurologic disorders affecting the soft tissues of the foot, presentation of the following lesions of the foot: skin and subcutaneous fat (callus, sinus tract, necrosis), fascia (fasciitis), muscles (atrophy, infarction and denervation), tendons (tear, tendinosis, tendinitis, tenosynovitis and ossification), ligaments (ligament tear), paratenon (paratenonitis), synovium (synovitis), bursa (bursitis).

On the Outside Looking in: Use of Dynamic Hip Ultrasound to Evaluate Intra-articular and Extra-articular Causes of Impingement (Station #12)


TEACHING POINTS

Describe normal hip anatomy by ultrasound and MRI. Discuss ultrasound technique for evaluation of the hip, including dynamic maneuvers. Differentiate intra-articular and extra-articular causes of hip impingement.

TABLE OF CONTENTS/OUTLINE


Imaging of Renal Osteodystrophy (hardcopy backboard)

Mitchell Harrison Storace MD (Presenter): Nothing to Disclose, Robert Alan Koenigsberg DO: Nothing to Disclose

TEACHING POINTS

Renal osteodystrophy is a multisystem process involving renal, endocrine, and musculoskeletal systems. Secondary hyperparathyroidism, osteoporosis, osteosclerosis and osteomalacia are major musculoskeletal manifestations of this condition. Furthermore, changes related to chronic hemodialysis, renal transplantation, and medications used to treat renal disease frequently complicate radiologic assessment. Both synergistic and antagonistic effects on bone mineralization and trabecular patterns may result from these complex interactions. Often, involved bones include those of the hands and the axial skeleton, particularly the sacroiliac joints. A careful understanding of renal osteodystrophy is extremely helpful for the radiologist, particularly in cases of overlap or similarity between renal osteodystrophy and other metabolic musculoskeletal disorders. This educational exhibit will explore the pathophysiology and imaging findings of this complex condition.

TABLE OF CONTENTS/OUTLINE


Interventional Oncology Series: Lung and Bone

Series Courses

*AMA PRA Category 1 Credits™: 4.25  ARRT Category A+ Credits: 5.00*

Thu, Dec 4 1:30 PM - 6:00 PM Location: S405AB

Participants

Moderator
Matthew Raymond Callstrom MD, PhD: Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd

Sub-Events

MW vs RFA vs Cryo for Lung Mass Ablation—Which/When/Where?

Damian E. Dupuy MD (Presenter): Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

LEARNING OBJECTIVES

1) Understand differences between the various thermal technologies as applied to lung tumors. 2) Review current clinical thermal ablation data with regard to the treatment of lung tumors. 3) Comprehend the usage of
the various thermal modalities with clinical examples of lung tumor treatment.

**VSIO51-02** Latest Advances in Lung Surgery for Metastatic Disease

Francis C. Nichols MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify appropriate patients who are felt to benefit from pulmonary metastasectomy. 2) Discuss the pros and cons of pulmonary metastasectomy done via a traditional open thoracotomy versus minimally invasive Video-Assisted Thoracic Surgery (VATS). 3) Describe a localization technique for the small difficult to locate pulmonary metastasis(es). 4) Discuss the rationale for mediastinal lymphadenectomy during pulmonary metastasectomy and its prognostic implications.

**VSIO51-03** Quantitative Validation of Thermal Ablation: An Improved Image Fusion Algorithm to Reflect Treatment Coverage

David Thomas Glidden BS (Presenter): Nothing to Disclose, Grayson L. Baird MS: Nothing to Disclose, Derek Merck: Nothing to Disclose, Damian E. Dupuy MD: Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

**PURPOSE**

To propose the foundation of a quantitative method for validation of thermal ablations.

**METHOD AND MATERIALS**

24 patients (M:F= 10:14) with solitary lung tumors underwent microwave ablation under CT-guidance. Each tumor was treated with one of four MW applicators (BSD Medical, Salt Lake City, UT, Neuwave Medical, Madison, WI) for 5-15 minutes according to the manufacturers’ specifications. Each case included a CT scan pre- intra- and post-procedure. Tumor volumes were manually segmented from pre-scans and ablation volumes from post-scans using the ground glass halo surrounding the tumor. Pre-scans were fused onto post-scans using two algorithms—a rigid registration, and a rigid plus deformable registration. Volume overlap resulting from both algorithms were calculated. Bland-Altman plots and Deming regression were used to identify possible differences in these image fusion techniques.

**RESULTS**

The volume overlap between tumors and ablation zones increased proportional to tumor size when deformable registration was applied ($p < 0.001$). Deming regression showed a significant deviation from perfect concordance between rigid and deformable registration (95% CI: [1.13, 1.39]) in which more volume overlap was attributable to deformable registration.

**CONCLUSION**

Quantitative validation of thermal ablation margin analysis remains challenging due to inherent tumor position and morphology changes after ablation. Rigid registration techniques rarely reflect how an ablation zone covers the tumor and margin because of movement (e.g. respiratory, tumor displacement, patient position). The addition of deformable registration may more accurately reflect how the tumor and ablation zone overlap, thus improving local control outcomes.

**CLINICAL RELEVANCE/APPLICATION**

Improved fusion between pre- and post-scans using deformable registration will provide a basis for quantitative validation of thermal ablations by correcting for anatomical movement.

**VSIO51-04** Lung Mass SBRT Current Results and Ongoing Trials

Kenneth Richard Olivier MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review definitions of SBRT. 2) Discuss results of SBRT for pulmonary nodules. 3) Review current and proposed clinical trials for pulmonary nodules. 4) Review currently accepted indications for SBRT.

**ABSTRACT**

Stereotactic Body Radiotherapy (SBRT), also known as Stereotactic Ablative Radiotherapy (SABR) has become an important new tool for oncologists looking to treat patients with primary lung cancers or pulmonary metastases. In this talk we will discuss some of the fundamentals of SBRT, review relevant literature, and current indications of SBRT for either primary lung cancers or metastases.

**VSIO51-05** Percutaneous Microwave Ablation of Pulmonary Malignancies: Survival, Imaging Follow-up, and Complications

Mark William Little MBBS, MSc (Presenter): Nothing to Disclose, Daniel Yiu Fai Chung MBBS, FRCR: Nothing to Disclose, Eoghan John Patrick McCarthy MBBS: Nothing to Disclose, James Henry Briggs: Nothing to Disclose, Fergus Vincent
Survival analysis, technical success, safety and imaging follow-up of malignant pulmonary nodules treated with a novel high power microwave ablation system.

METHOD AND MATERIALS

Over a three year period, 55 patients, 33 male, mean age 64 years (31-88) with 92 unresectable pulmonary malignancies of mean diameter 18mm (6-59mm) underwent computed tomography (CT)-guided percutaneous microwave ablation in 72 ablation sessions. Primary non-small cell bronchogenic carcinoma was treated in 28 lesions, whilst metastatic tumors were ablated in the remainder (colorectal=28, renal=9, sarcoma=17, adrenal=3, esophageal=2, melanoma=3, breast=1, tcc=1). Tumors were diagnosed by biopsy, or PET avidity (median SUV max = 9.5) and interval growth. Technical success was defined as needle placement in the intended lesion without death or serious injury. Adequacy of ablation was assessed at 24 hours on contrast-enhanced CT, for a circumferential solid or ground glass margin > 4mm. Patients were followed with contrast-enhanced CT 3-monthly until death, or local tumor progression (LTP), or for at least 12 months post procedure. LTP was defined as contiguous enlargement or a change in the shape of the ablation zone or the development of contrast enhancement in part of the zone. Survival rate was evaluated by Kaplan-Meier analysis.

RESULTS

Microwave ablation was technically successful in n=88 (96%) of lesions. Mean ablation duration was 4 minutes (1-22 minutes). 21(29%) pneumothoracies were diagnosed on chest x-ray after 72 ablation sessions; chest drain was required in 8 (11%) sessions. 30-day mortality rate was 0%. The mean hospital stay was 1.1 days (1-11 days). Local tumor progression was present in 6 tumors; for tumors under 4cm (n=88), LTP was identified in 3 (3%) at a median follow up of 13 months. The mean diameter of lesions with LTP were significantly larger than those without (mean diameter 41mm vs 17mm; p=0.009). The cancer-specific survival was 79% (95%CI 0.68-0.9) at 1 year, and 66% (95% CI 0.51-0.83) at 2-years.

CONCLUSION

Microwave ablation of pulmonary malignancies is a safe, successful technique. Local control rates and survival analysis are encouraging, with rapid treatment times.

CLINICAL RELEVANCE/APPLICATION

Primary and metastatic lung tumors are extremely common; surgical options are often limited due to advanced disease and or poor respiratory function. Microwave ablation offers a robust method of local disease control.
predictor of survival after RFA of lung metastases. The same predictive factors have been reported as predictive of survival after surgical metastasectomy. One of the advantages of RFA over other techniques such as surgery and SBRT is that it can be easily repeated in case of occurrence of new metastases which is difficult with surgery due to the aggressive nature of the procedure. Subsequent surgical resection is limited by pulmonary reserve. The same applies to stereotactic radiation therapy where multiple irradiations result in toxicity to lung parenchyma, skin or mediastinum. Consequently, RFA is today part of routine practice armamentarium against lung metastases. However, better determination of the role of RFA relative to other therapies is needed. In addition, the need and benefit from combining local ablation and systemic therapy must be evaluated. Future trends in treatment of pulmonary metastases will favor minimal aggressive treatments and percutaneous ablation have a role to play. Evidence-based medicine supporting the use of lung RFA metastatic disease and defining what is the best population to target with ablation or SBRT. For today the ideal candidate has less than 3 tumors less than 3 cm.

VSIO51-09 Lung Tumor Board
Moderator Matthew Raymond Callstrom MD, PhD: Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd

LEARNING OBJECTIVES

1) Describe the characteristics of lung and bone tumors amenable to interventional oncologic treatment. 2) Describe new techniques for the percutaneous treatment of lung tumors and bone metastases. 3) Describe the role of percutaneous ablation for lung tumors and bone metastases in the context of other treatments including surgery and radiation oncology.

VSIO51-10 Treatment of Complex Benign Skeletal Disease
Afshin Gangi MD, PhD (Presenter): Proctor, Galil Medical Ltd

LEARNING OBJECTIVES

1) Identify the best indications of percutaneous technique and list them. 2) Describe the methods used in treatment of benign skeletal tumors and the advantages and limits of each of them. 3) Identify the risks of the percutaneous procedures and their limits. 4) Explain the measures used to protect the surrounding tissues to avoid major complications. 5) Learn how to follow up the patients and analyze the results.

URL’s
http://www.openradiology.org

VSIO51-11 Pain Palliation of Bone Metastases and Local Tumor Control with Magnetic Resonance Guided Focused Ultrasound Surgery (MRgFUS) Treatment
Brachetti Giulia MD: Nothing to Disclose, Valeria De Soccio: Nothing to Disclose, Fabrizio Andran: Nothing to Disclose, Gianluca Caliolo: Nothing to Disclose, Fulvio Zaccagna MD: Nothing to Disclose, Alessandro Napoli MD (Presenter): Nothing to Disclose

PURPOSE

to evaluate the efficacy of MRgFUS for treatment of painful bone metastases and its potential for local tumor control.

METHOD AND MATERIALS

after IRB approval 42 patients were scheduled for treatment using the Exablate system (InSightec). Before and 1, 2 and 3 months after MRgFUS treatment, pain scores were assessed according to Brief Pain Inventory-Quality of Life (BPI-QoL) criteria. Imaging (CT and ceMR: Bracco) follow-up was obtained at 1 and 3 months; in survivors, follow-up was extended at 6 and 12 months. For local tumor control, imaging changes were evaluated with the MD Anderson (MDA) criteria. Patients were classified in responder and non-responders. The extent of necrosis within the ablated metastasis was evaluated using non-perfused volume (NPV).

RESULTS

All 42 patients underwent MRgFUS (20 recurrence post-RT; 22 primary treatment). Statistically significant difference between baseline and follow-up values for both pain severity and pain interference scores was observed (p<0.05; no statistical difference between the post-RT and primary treatment group). Stable pain score (VAS<2) was observed in survival group at 6 (15 patients) and 12 (9 patients) month control. Increased bone density was observed in 10 (23.8%) patients. Complete response was found in 20 (47.6%) patients; partial response was found in 22 (52.3%) patients (pain recurrence in 3 patients), according to both the MDA and clinical criteria. NPV values ranged between 23% and 94%. There was no difference in non-perfused volume between responders and non-responders (p=0.7). No adverse events were recorded.

CONCLUSION

MRgFUS is an effective and durable treatment for pain palliation of bone metastasis; moreover, a positive role in local tumor control and bone restoration was demonstrated.

CLINICAL RELEVANCE/APPLICATION
Radiofrequency Ablation of Spinal Disease

Jack William Jennings MD (Presenter): Speakers Bureau, DFINE, Inc Consultant, DFINE, Inc

LEARNING OBJECTIVES

1) Metastatic spine overview 2) Patient selection and treatment evaluation 3) Current guidelines for treatment of metastatic spine lesions 4) Imaging of lesions 5) Role of vertebral augmentation in metastatic disease 6) Targeted Radiofrequency ablation (RFA) 7) RFA and radiotherapy (RT) 8) Multi-disciplinary treatment algorithm

ABSTRACT

Bone metastases are a major cause of morbidity in patients with cancer and represent a common occurrence in these patients. The vertebral column is the most common site for bone metastases with an incidence of 30–70% in patients with metastatic cancer and is likely related to the high hematopoietic activity and vascularization of the spine. Management of these patients is challenging and traditionally involves a combination of radiation and chemotherapy in adjunct with analgesics. Surgery has remained a mainstay of treatment in patients with neurologic deficit, instability requiring stabilization, or with a longer life expectancy. Surgical options in these patients with decreased life expectancy are often morbid and present a therapeutic dilemma. Minimally invasive procedures, including thermal ablation, are safe and effective treatments of painful osseous metastatic lesions in patients who are not surgical candidates or have exhausted or are unable to have radiation therapy. Radiofrequency ablation (RFA) has been increasingly utilized in management of osseous metastases. In the spine, this treatment has traditionally been limited to lesions within the anterior vertebral body since this location is more accessible and further away from sensitive neural elements. Many spinal tumors will continue to grow and cause pain after radiation therapy. Posterior vertebral body lesions will often progress and extend through the posterior cortex into the spinal canal making therapeutic options very limited. The development of an articulating bipolar electrode has allowed for targeted RFA and the ability to treat posterior spinal lesions via a transpedicular approach. Review of the existing literature and current treatment guidelines demonstrates the need for future prospective studies of spine tumor ablation and for the development of a treatment algorithm defining its role with the current accepted treatment options.

Sequential Interventional Treatment of Pelvic/Sacral Tumors via Angiographic Embolization, Cryoablation, and Stabilization Plasty Combinational Therapy


PURPOSE

The purpose of the study is to review the treatment experiences of patients treated at our institution with combination angiographic embolization, cryoablation or thermal ablation, and stabilization plasty for their pelvic/sacral tumor burden. This study hopes to assess if such combinational interventional therapy has the potential to become a mainstay treatment option in managing pelvic and sacral neoplasms.

METHOD AND MATERIALS

A combined interventional paradigm was employed in 8 patients thus far over the last year: Phase I: Angiographic embolization of neoplasm Phase II: Cryoablation of solid tumor, followed by supportive sacroplasty Phase III: Image-guided drainage/TPA flush, followed by sclerosis of residual bed Procedures were performed under general anesthesia. Phase I was within 1 day to 1-2 weeks prior to Phase II and III dependent on lesion location and patient tolerance. Neurological monitoring were utilized in Phases 2 and 3 to assess integrity of sacral nerve function during procedures. Each patient underwent pretreatment CT and/or MRI examination prior to therapy. All patients have undergone post-therapy follow-up imaging within 1-3 months. Medical records and imaging portfolios for these patients will be reviewed. A reassessment of pre and post procedure lesion measurements and quality of life outcomes will be performed. Linear regression will be performed to correlate results of imaging and quality of life assessment.

RESULTS

It is hypothesized that patients undergoing sequential combinational therapy will demonstrate significant decrease in lesion growth, as well as improved pain control and quality of life. It is unclear if survival will be affected by such measures, as patients with terminal disease pursued such procedures more so for symptomatic relief.

CONCLUSION

An interventional paradigm consisting of combinational implementation of angiography-mediated embolization, thermal/radiofrequency ablation, and mechanical drainage followed by cavity sclerosis is expected to become a mainstay treatment option of pelvic and sacral neoplasms. The results of our review is expected to provide insight into its use in patients needing physical and symptomatic reduction of their pelvic/sacral tumor burden.

CLINICAL RELEVANCE/APPLICATION

Sequential incorporation of several effective interventional treatments may play a role in the treatment paradigm of pelvic and sacral neoplasms.
Avoiding Complications with Bone and Soft Tissue Ablation
Anil Nicholas Kurup MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Identify critical anatomic structures to be avoided during bone and soft tissue tumor ablation. 2) Apply displacement techniques to minimize risk of collateral damage during bone and soft tissue ablation. 3) Understand radiographic and neurophysiologic monitoring techniques that may be employed during bone and soft tissue ablation. 4) Recognize the role of bone consolidation as an adjunct to bone ablation.

Treatment of Oligometastatic Disease: What Is the Role of Ablation?
Peter John Littrup MD (Presenter): Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc

LEARNING OBJECTIVES
1) Understand how ablation of limited, or oligo-, metastases could produce a major impact on numerous cancer types. 2) Describe the major anatomic locations that are considered common oligometastatic sites. 3) Describe the outcomes for procedure complication and recurrence rates for the major anatomic sites. 4) Describe the potential economic impacts of ablation as part of palliative care for major cancer types (e.g., renal, lung, colorectal, ovarian).

Preoperative Embolization in Surgical Treatment of Spinal Metastases: Single-Blind, Randomized Controlled Clinical Trial of Efficacy in Decreasing Intraoperative Blood Loss
Caroline Clausen MD (Presenter): Nothing to Disclose, Benny Dahl MD, PhD: Nothing to Disclose, Susanne Christiansen Frevert MD: Nothing to Disclose, Lars Valentin MD: Nothing to Disclose, Michael Bachmann Nielsen MD, PhD: Nothing to Disclose, Lars Lonn MD, PhD: Nothing to Disclose

PURPOSE
To assess whether preoperative embolization reduces intraoperative blood loss, the need for blood transfusion, and operative time in the surgical treatment of symptomatic metastatic spinal cord compression.

METHOD AND MATERIALS
A single-blind, randomized (balanced 1:1), controlled, parallel-group trial conducted as a single-center study; 48 participants were included from May 2011 until March 2013. Participants scheduled for decompression and posterior thoracic/lumbar instrumented spinal instrumentation because of symptomatic metastatic spinal cord compression were randomly assigned to either preoperative arteriography and embolization - the intervention group or preoperative arteriography - the control group. Primary outcome: intraoperative blood loss. Secondary outcomes: Intra- plus postoperative blood loss, blood transfusion and duration of surgery. Outcomes were reported as intention-to-treat analyses (ITT) including all randomized patients with a standing consent to participate and meeting the inclusion criteria.

RESULTS
Of the 48 randomized patients, 45 (23:22) were available for the ITT after exclusion of patients violating inclusion criteria. Mean intraoperative blood loss did not differ significantly between the embolization group (618 ml; SD 282 ml) and the control group (735 ml; SD 415 ml). This was also the case for intra- plus postoperative blood loss and the need for blood transfusion. The duration of surgery was shorter in the embolization group compared to the control group (p=0.031); median 90 minutes (range 54-252) vs. 124 minutes (range 80-183).

CONCLUSION
Preoperative embolization does not result in a reduction of intraoperative blood loss and blood transfusion, but reduces the duration of surgery. The general routine use of preoperative embolization cannot be recommended in decompression and posterior instrumented spinal instrumentation for symptomatic metastatic spinal cord compression.

CLINICAL RELEVANCE/APPLICATION
This randomized controlled clinical trial displays that preoperative embolization has the advantage of reducing the duration of surgery for symptomatic metastatic spinal cord compression.

Bone Metastases Tumor Board
Moderator Matthew Raymond Callstrom MD, PhD: Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd

LEARNING OBJECTIVES
1) Describe the characteristics of lung and bone tumors amenable to interventional oncologic treatment.
Describe new techniques for the percutaneous treatment of lung tumors and bone metastases. 3) Describe the role of percutaneous ablation for lung tumors and bone metastases in the context of other treatments including surgery and radiation oncology.

SPDL51

RSNA Diagnosis Live™: Musculoskeletal/Pediatric/Interventional Radiology

Special Courses

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.

SPSH51

Hot Topic Session: Tendon Injections: Which One Works Best?

Special Courses

AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 1.00
Thu, Dec 4 3:00 PM - 4:00 PM   Location: E353B

Participants

Moderator
Martin Torriani MD : Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the indications of ultrasound-guided percutaneous tendon treatments such as tendon dry needling, autologous platelet-rich plasma and hyperosmolar dextrose injections, among others. 2) Discuss the technical requirements to perform ultrasound-guided percutaneous tendon treatments. 3) Review the state of the science in percutaneous tendon treatments.

ABSTRACT

The range of applications for ultrasound-guided percutaneous tendon treatments, such as dry needling, autologous platelet-rich plasma and hyperosmolar dextrose injections is rapidly increasing in the practice of musculoskeletal intervention. These novel procedures have specific indications and technical demands, which may influence clinical outcomes. This session will highlight common applications and techniques for percutaneous tendon treatments and review the current clinical evidence-based literature.

Sub-Events

SPSH51A  Tendon Fenestration

Jon A. Jacobson MD (Presenter): Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSH51B  Platelet-Rich Plasma Therapy of the Tendon

Kenneth S. Lee MD (Presenter): Research Consultant, SuperSonic Imagine Speakers Bureau, Medical Technology Management Institute

LEARNING OBJECTIVES

View learning objectives under main course title.
Other Tendon Treatments
Mary Margaret Chiavaras MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

RC704
Musculoskeletal Tumor Imaging

LEARNING OBJECTIVES
1) Radiologic staging of MSK tumors. 2) MSK tumors with characteristic imaging. 3) Pitfalls in MSK tumor imaging. 4) Radiologic treatment of MSK tumors. 5) Imaging of MSK tumors after treatment.

Sub-Events
RC704A Pitfalls in MSK Tumor Imaging
Mark Douglas Murphey MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize the imaging differentiation of cystic lesions from myxoid neoplasms. 2) Understand the imaging appearance that allows distinction of hematoma from hemorrhagic neoplasm. 3) Identify the imaging characteristic of myositis ossificans. 4) Improve recognition of the concept of impending pathologic fracture and its clinical relevance.

RC704B MSK Tumors with Characteristic Imaging
Mark J. Kransdorf MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize the most common musculoskeletal tumors with characteristic imaging features. 2) Identify distinguishing imaging features so these diagnoses can be made with confidence.

RC704C Radiologic Treatment of MSK Tumors
Jean-Denis Laredo MD (Presenter): Research Consultant, Cardinal Health, Inc Research Consultant, Laurane Medical Research Consultant, F. Hoffman-La Roche Ltd Research Grant, SERVIER

LEARNING OBJECTIVES
1) Indications and technique of percutaneous destruction of osteoid osteomas. 2) Indications and technique of percutaneous treatment of vertebral hemangiomas. 3) New drugs available in the treatment some primary bone tumors.

RC704D Imaging of MSK Tumors after Treatment
Daniel Vanel MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the reasons of the frequent recurrences of soft tissue sarcomas. 2) Select the best MRI sequences to detect recurrences, especially the role of dynamic imaging. 3) Select the best imaging schedule to follow the patients. 4) Understand the specific problems of imaging isolated limb perfusion in soft tissue sarcomas.

ABSTRACT
Soft tissue sarcomas are 100 times rarer than benign tumors. They often grow slowly and look well limited. The general surgeon, not used to the problem, often treats sarcoma as a benign lesion by very limited resection, leaving a part of the tumor. Recurrences are very frequent, and their detection a common problem. MRI is the exam to use. T2W sequence is the first to use. If everything has a low signal, there is no recurrence. Diffuse high signal lesions without a mass, usually indicate radiation induced changes. A high signal intensity mass requires contrast medium injection, to differentiate recurrences and sequel masses. Dynamic studies may be useful in difficult cases. The best schedule is not known, and a control every six months is often proposed. In the limbs, only a clinical control may be more efficient, MR being performed only if clinical suspicion. After isolated limb perfusion, dynamic MR is the gold standard to evaluate the patients.

**Radiologic Staging of MSK Tumors**

David M. Panicek MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the rationale and systems for musculoskeletal tumor staging. 2) Learn the components of local staging of musculoskeletal tumors with MRI. 3) Become familiar with various imaging pitfalls in staging musculoskeletal tumors.

**Interactive Game: Extreme Imaging of the Extremities—Significant, Subtle, and Soft Tissue Injuries**

*Refresher/Informatics*

*ER MR CT MK DL*

AMA PRA Category 1 Credits ™: 1.50
ART Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM  Location: E350

**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**

**RC708A**

**Soft Tissue Injuries of the Ankle: Emphasis on CT and MRI**

Manickam Kumaravel MD, FRCR (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand in depth the normal anatomy of the ankle on CT and MRI. 2) Appreciate subtle and catastrophic soft tissue injury patterns of the ankle. 3) Evaluate post-operative imaging. 4) Effectively utilize CT and MRI in management of patients with ankle injuries.

**ABSTRACT**

Ankle injuries are common presentations in all emergency departments. A wide spectrum of injuries present from subtle to catastrophic in nature. Identification of these injuries makes significant impact on treatment of such injuries. Detail is much better appreciated in cross-sectional imaging such as CT and MRI. Knowledge of injury patterns help in identification of associated injuries. CT and MRI will be used to illustrate a wide gamut of presentation of soft tissue injuries. Emphasis will be placed on clinical significance of these injuries and also on treatment options and postoperative imaging of such injuries. Examples will be inclusive of injuries of the retinaculum, tendon, ligament, subtle bony avulsion injuries and other soft tissues. Other modalities of plain radiography and ultrasound will also be used to explain the injuries. At the end of the course learners will have a comprehensive understanding of ankle soft tissue injuries patterns and their treatment methodology.

**RC708B**

**Knee Injuries: When Radiographs Are Not Enough**

Ken Floris Linnau MD, MS (Presenter): Speaker, Siemens AG Royalties, Cambridge University Press

**LEARNING OBJECTIVES**

1) Identify clinical scenarios requiring advanced knee imaging in the emergency department setting. 2) Select appropriate imaging modality and exam parameters for advanced knee imaging. 3) Summarize radiology findings of selected knee injuries, which warrant advanced imaging in order to aide in efficient clinical decision making and treatment planning.

**ABSTRACT**

The knee is very commonly injured in blunt and penetrating extremity trauma. Knee radiographs are the most common initial imaging study for evaluation of knee injuries. Unfortunately, radiography can be of limited utility for complete assessment of the bones and soft tissues of the knee. As a result advanced imaging (including CT,
MRI or sonography) may be required to fully characterize knee injury. Sometimes the immediate full evaluation of the knee is warranted. The purpose of this presentation is to explore clinical settings which may require advanced imaging of knee injuries in addition to radiography while the patient is still in the emergency room.

**Wrist Injuries**
Claire Kalsch Sandstrom MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the normal anatomy of the wrist on CT and MRI. 2) Appreciate subtle and catastrophic soft tissue injury patterns of the wrist. 3) Effectively utilize CT and MRI in management of patients with wrist injuries.

**ABSTRACT**

Wrist injuries are common presentations in all emergency departments. A wide spectrum of injuries present from subtle to catastrophic in nature. Identification of these injuries makes significant impact on treatment of such injuries. While most injuries can be identified or inferred from radiographs, diagnoses can be confirmed and refined on cross-sectional imaging such as CT and MRI. Knowledge of injury patterns helps in identification of associated injuries.

CT and MRI will be used to illustrate a wide gamut of presentations of soft tissue and subtle osseous injuries. Emphasis will be placed on clinical significance of these injuries and also on treatment options and postoperative imaging of such injuries. Examples will be inclusive of injuries of tendon, ligament, subtle bony avulsion injuries and other soft tissues.

At the end of the course learners will have a comprehensive understanding of wrist soft tissue injury patterns and their treatment methodology.

**Finger and Thumb Injuries**
Bharti Khurana MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the relevant anatomy of finger and thumb. 2) Review the most commonly encountered osseous and soft tissue injury patterns seen in traumatic finger injuries.

**ABSTRACT**

Hand injuries are common presentations in all emergency departments. Knowledge of injury patterns helps in identification of associated subtle and soft tissue injuries. Emphasis will be placed on clinical significance and treatment options.

At the end of the course learners will have a comprehensive understanding of soft tissue and osseous injuries of hand.

**Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on Workshop)**

Refresher/Informatics

**LEARNING OBJECTIVES**

1) Describe and demonstrate methods for patient selection, evaluation and technique for Image-guided injection procedures.
used in spine pain management. 2) These procedures will include epidural steroid injections, nerve root blocks, facet blocks, sacroiliac joint injections, lumbar synovial cyst therapy, radiofrequency ablations. 3) Review procedural complications and how to avoid them. 4) Discuss pertinent anatomy, instruments and pharmacology. 5) These objectives will be accomplished using didactic lectures complemented by procedure videos, supervised hands on lab work with training models and round table case discussions.

**ABSTRACT**

Neck and back pain complaints are very common in the general population. Radiologists can contribute to the diagnosis and management in patients who are not responding to conservative management. Spine injection procedures can frequently be performed on an outpatient basis with a brief recovery phase. These procedures are performed with imaging guidance, such as a multi-directional fluoroscope or under CT guidance, in order to correctly localize the specific anatomic sites in or about the spine for diagnostic and or therapeutic needle localization. An understanding of patient selection, indications and contraindications, are paramount to the safety and success of these procedures. The diagnostic and therapeutic potential of these procedures is also facilitated by a thorough evaluation of the spine, with respect to both anatomy and potential pathology, with cross sectional imaging techniques as well as other radiologic tests. Communication of these results between the Radiologist and the spine proceduralist will contribute to optimal patient outcomes.

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**VSMK61**

**Musculoskeletal Series: Shoulder Imaging**

**Series Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>MR</td>
<td>VSMK61</td>
<td>Musculoskeletal Series: Shoulder Imaging</td>
<td>3.50</td>
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</tbody>
</table>

**Participants**

Moderator

Lyne S. Steinbach MD : Nothing to Disclose

Lawrence M. White MD, FRCP : Advisory Board, Siemens AG

**Sub-Events**

**VSMK61-01**

**Shoulder Instability**

Lyne S. Steinbach MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand normal anatomy related to anterior shoulder instability on MRI. 2) Review role of MR arthrography and ABER positioning. 3) Identify labral and osseous abnormalities associated with anterior shoulder instability as seen on MRI.

**ABSTRACT**

This presentation will cover several aspects of MRI of shoulder instability. Immediate papers that follow include evaluation of Hill Sachs lesions and the ABER position. Along with those concepts, normal variants and abnormalities of the anterior labrum and glenohumeral ligaments will be discussed.

**VSMK61-02**

**Hill-Sachs Lesion Location: Does It Play a Role in Engagement?**

Annie M. Wang MD (Presenter): Nothing to Disclose , James S. Babb PhD : Nothing to Disclose , Soterios Gyftopoulos MD : Nothing to Disclose

**PURPOSE**

To see if there is an association between engagement on physical examination and the location of the Hill-Sachs lesion [HSL] as assessed by the modified biceps angle.

**METHOD AND MATERIALS**

62 consecutive patients with a history of anterior shoulder dislocation, who underwent pre-operative MRI and arthroscopy at our institution, and tested for engagement on physical examination [PE] were collected over an 18 month period. The test for engagement was performed at the beginning of the arthroscopy under anesthesia by one of four fellowship-trained shoulder/sports medicine orthopaedic surgeons. Two blinded musculoskeletal radiologists reviewed the MR studies of these patients, noted the presence of a HSL and documented the location of the HSL with the modified biceps angle, which consisted of the angle between the center of the biceps groove and medial margin of the HSL. The angle accounts for the medial extent of the HSL, the portion of the lesion that would first engage onto the glenoid during abduction and external rotation. Statistical analysis included Mann-Whitney test and ROC curve.

**RESULTS**

There were 58 males/4 females with mean age of 30 (range 18-59). 20 patients demonstrated engagement on PE, while 42 did not. All 62 patients had a Hill-Sachs lesion on MRI and arthroscopy. The mean modified biceps angle for the engaging group was 151.5±13.9°, and 142.4±17.3° for the non-engaging group. According to a Mann-Whitney test, the modified biceps angle was statistically significantly higher among patients who had engagement compared to those who did not (p=0.027). Overall, diagnostic accuracy was highest for a modified biceps angle > 149°,which resulted in a sensitivity of 70%/specificity of 67%. According to a receiver operating
characteristic (ROC) curve to assess the utility of the modified biceps angle as a test criterion for the detection of patients who had engagement, the area under the curve (AUC) measured 0.67, which was statistically significant ($p=0.017$) when compared to the AUC associated with random guessing.

CONCLUSION

The modified biceps angle, as measured on MRI, was significantly higher in patients who demonstrated engagement on physical examination than in those who did not have engagement.

CLINICAL RELEVANCE/APPLICATION

This supports the theory that the location of the Hill-Sachs lesion may play a role in engagement, and may be the Hill-Sachs’ most important characteristic when determining its significance.

VSMK61-03 Benefit of Additional ABER Series in Direct MR Arthrography of the Shoulder at 3T

Aline Maehringer-Kunz MD (Presenter): Nothing to Disclose, Roman Kloeckner MD: Nothing to Disclose, Stephan Mueller-Haberstock: Nothing to Disclose, Christoph Dueber MD: Nothing to Disclose, Karl Friedrich Kreitner MD: Nothing to Disclose

PURPOSE

To evaluate the diagnostic benefit of an additional series acquired in abduction and external rotation (ABER) during direct MR arthrography at 3T.

METHOD AND MATERIALS

We analyzed 23 patients with persistent shoulder pain who underwent direct MR arthrography of the shoulder from 03/2010 - 03/2013. After arthrography with diluted Gadolinium-DTPA (0.02mmol Magnevist, Bayer Schering Pharma, Germany), conventional shoulder MRI was performed in axial, sagittal and coronal plane followed by additional series in ABER position. All examinations were performed on a 3T MRI (Trio® and Skyra®, Siemens Healthcare, Germany). Mean patient age was 36 years, 15 were male, 8 were female. Blinded analysis was performed by a senior radiologist with >20 years of experience in shoulder MRI who first analyzed conventional MR arthrography followed by a conjoined analysis of conventional and ABER imaging.

RESULTS

ABER series provided additional information in 18 of 23 (78%) patients. Especially pathologies of the superior labrum (n=12), the attachment of the joint capsule (n=12), and the articular surface of the rotator cuff (n=6) were either better displayed or only detectable on ABER images. The implementation of ABER imaging enabled the diagnosis of microinstability or atraumatic instability in 4 of 23 (17%) patients.

CONCLUSION

Though only a small series is presented, there may be a potential role of ABER imaging at direct MR arthrography. Especially in patients with suspected superior labral pathologies, partial articular sided tears of the rotator cuff, and microinstability the technique may be beneficial.

CLINICAL RELEVANCE/APPLICATION

In all patients with suspected superior labral pathologies, partial articular sided tears of the rotator cuff, and microinstability an additional ABER series should be performed.

VSMK61-04 Use of T1p MRI For Assessment of Glenohumeral Joint Cartilage Injury Following Subacute Shoulder Dislocation

J. Bruce Kneeland MD (Presenter): Nothing to Disclose, Kevin D’Aquilla BS: Nothing to Disclose, Vishal Saxena MD: Nothing to Disclose, Joshua Gordon MD: Nothing to Disclose, Anup Singh: Nothing to Disclose, Hari Hariharan PhD: Nothing to Disclose, Brian Sennett MD: Nothing to Disclose, Ravinder Reddy PhD: Nothing to Disclose

PURPOSE

To detect injury to glenohumeral articular cartilage following subacute dislocation in the absence of morphologic defects (GLAD) using T1p MRI

METHOD AND MATERIALS

12 subjects ages 18-40 underwent MRI at 3T using both conventional (FSE) sequences and T1p MRI. T1p MRI was performed using an anistropic 3D gradient echo sequence acquired in the coronal plane with 256×256 acquisition matrix and 8 slices with 3.6 mm slice thickness. The sequence was repeated using spin lock pulses of 0-40 msec duration (in 10 msec increments) to permit the pointwise calculation of T1p. Humeral and glenoid cartilage were manually segmented and displayed in color-coded images with color dependent on quantitative T1p calculations. Comparison of T1p values of the humeral and glenoid cartilage in these patients was made to 5 asymptomatic subjects.

RESULTS

In comparison to the values in the asymptomatic subjects, the mean T1p values of the humeral articular cartilage in patients with subacute dislocations were increased by more than 1 standard deviation, while mean T1p values of cartilage in the glenoid were increased by more than 2 standard deviations. These indicate
CONCLUSION
T1ρ maps in patients with subacute shoulder dislocation demonstrated a diffuse increase in the value of both the humeral and articular cartilage that was both statistically significant and that indicated on the basis of prior work with cartilage degeneration a significant degeneration of the proteoglycan macromolecular matrix.

CLINICAL RELEVANCE/APPLICATION
Extent and severity of cartilage injury can impact rehabilitation and other conservative means of management following shoulder dislocation.

VSMK61-05 Indirect MR Arthrography in Adhesive Capsulitis of the Shoulder: A Clinico-Radiological Correlation
Bora Yang (Presenter): Nothing to Disclose, Jae Hyuck Yi MD: Nothing to Disclose

PURPOSE
The purpose of this study was to evaluate the correlation between indirect MR arthrographic findings and clinical findings, and whether MR findings can reflect the prognosis in primary adhesive capsulitis.

METHOD AND MATERIALS
We evaluated 69 patients with primary adhesive capsulitis of the shoulder, the mean age was 54.5 years (standard deviation 8.3). Capsular thickness of the axillary pouch, capsular enhancement of the axillary pouch and soft tissue thickening of rotator interval on indirect MR arthrographic images were investigated. Severities of clinical symptom were evaluated by three scoring systems (Simple Shoulder Test, Contant Score, and ASES). Comparing with clinical symptoms after 6 months, we analyzed whether MRI finding correlated with prognosis of adhesive capsulitis.

RESULTS
Capsular thickness and capsular enhancement of the axillary pouch, soft tissue thickening of the rotator interval was significantly higher than normal control group (p < 0.001). Capsular thickness of the axillary pouch was not correlated with clinical symptom by three scoring systems (p = 0.510, 0.138, 0.104). In contrast, capsular enhancement of the axillary pouch showed a good correlation with severity of clinical symptom (p = 0.006, 0.077, 0.035). Although soft tissue thickening of the rotator interval was not correlated with severity of clinical symptom (p = 0.706, 0.612, 0.384), more thickening showed more limitation of motion. Any three findings did not correlate with clinical symptom at 6 months follow-up.

CONCLUSION
On MR arthrography, capsular enhancement of the axillary pouch showed a good correlation with severity of the clinical symptoms although soft tissue thickening of the rotator interval wasn’t.

CLINICAL RELEVANCE/APPLICATION
Indirect MRI arthrography could be an ancillary method for evaluating clinical severity of primary adhesive capsulitis.

VSMK61-06 Biceps Tendon and Rotator Interval
Jenny T. Bencardino MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To review normal anatomy and pathology of the biceps tendon and rotator interval, with an emphasis on MRI.

ABSTRACT
This presentation will review the normal MR anatomy of the biceps tendon and rotator interval as well as the following pathologic conditions: 1) Biceps tendinopathy and tears, 2) Biceps pulley injuries; 3) Rotator Interval laxity and 4) Adhesive Capsulitis.

VSMK61-07 Rotator Cuff Pathology
Brian David Petersen MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To demonstrate rotator cuff pathology, with an emphasis on MRI.

VSMK61-08 MR Arthrography Characteristics of Partial Articular-sided Supraspinatus Tendon Avulsion (PASTA) Lesion Repaired with Arthroscopy: Comparison with Conservatively Treated Patients

VSMK61-09
Eun Hae Park: Nothing to Disclose, Seok Hahn MD (Presenter): Nothing to Disclose, Young Han Lee MD: Nothing to Disclose, Sungjun Kim MD: Nothing to Disclose, Ho-Taek Song MD: Nothing to Disclose, Jin-Suck Suh MD: Nothing to Disclose

PURPOSE
To evaluate the accuracy of MR arthrography (MRA) at diagnosis of Partial Articular-sided Supraspinatus Tendon Avulsion (PASTA) lesion in arthroscopically confirmed patients and to retrospectively compare the MRI characteristics of surgically treated patients and conservatively treated patients.

METHOD AND MATERIALS
Institutional review board approval was obtained. In the first session, MRA of 251 patients who underwent arthroscopic repair of supraspinatus tendon from 2011 to 2013 were reviewed and diagnostic accuracy (sensitivity, specificity, positive and negative predictive value) of MRA in PASTA lesion were calculated. In the second session, the MRA of two groups (group 1 = 239 patients who were treated with conservative care, group 2 = 53 patients who underwent arthroscopy) were retrospectively reviewed to assess the following features: vertical grade, transverse location, acromion type, coexisting other rotator cuff tendon tear, biceps tendinopathy, calcific tendinopathy, SLAP lesion, bursitis, Bankart lesion, and osteoarthritis. Student T-test and multivariate logistic regression models were used to determine whether there is difference of MRI characteristics in two groups.

RESULTS
In the first session, the sensitivity and specificity of MRA in diagnosis of PASTA were 77.3% and 88.4%. In the second session, vertical grade of PASTA and coexisting other rotator cuff full thickness tear was the most significant characteristic of two groups. In group 1, 25 of 53 (47.1%) patients were grade 3 whereas 49 of 239 (20.5%) patients were grade 3 in group 2. In group 1, 35 of 53 (66.0%) patients had Coexisiting additional rotator cuff tendon tear was present at 35 of 53 (66.0%) in group 1, and 76 out of 239 (31.7%) in group 2, respectively. For PASTAs not combined with other rotator cuff tear, MRI features significantly associated with surgical group included a vertical grade 3 (p = p < 0.001), combined with Bankart lesion (p = 0.01).

CONCLUSION
MRA is accurate in diagnosis of PASTA. When vertical grade 3 and coexisting additional rotator cuff tendon tear is noted in MRA, surgical treatment is likely to be performed so radiologist should pay attention in such findings.

CLINICAL RELEVANCE/APPLICATION
MR arthrography (MRA) is known to be more accurate imaging methods than conventional MRI in assessment of rotator cuff tears.

VSMK61-09
Evaluation of the Subscapularis Tendon on MR Arthrography and Ultrasound: How Accurate Are We in Diagnosis of Tears?
Jung-Ah Choi MD (Presenter): Nothing to Disclose, Eugene Joe: Nothing to Disclose, Eugene Lee: Nothing to Disclose, Hee Seok Jeong MD: Nothing to Disclose, DaeHyun Hwang MD, PhD: Nothing to Disclose

PURPOSE
To evaluate and compare the diagnostic efficacy in diagnosis of subscapularis (SSC) tendon tears on ultrasound (US) and MR arthrography (MRA) and compare between examiners with differing levels of experience.

METHOD AND MATERIALS
198 cases of arthroscopically confirmed rotator cuff tendon tears were prospectively evaluated on MRA and US (by two examiners with differing levels of experience) before arthroscopic surgery. The status of SSC tendons were graded as follows: 0 - normal/tendinopathy, 1- articular low grade partial tear, 2- bursal low grade partial tear, 3 - high grade partial/full thickness tear. Arthroscopy was used as the gold standard. Sensitivity, specificity, and agreement were calculated according to each modality, compared between the two modalities, and compared between the two examiners. Agreement between each modality and arthroscopic finding was determined by weighted kappa. Diagnostic values were compared between US and MRA using McNemar's test.

RESULTS
On arthroscopy, 64 cases had low grade partial tears, 52 had high grade/full thickness tears, 82 showed no tear. The overall weighted kappa for US was 79.63%, whereas it was 81.06% for MRA. For the staff radiologist, the weighted kappa was 81.99% for US, whereas for the fellow, it was 78.36%. The sensitivity and specificity of US for diagnosis of SSC tears were 76.4% and 97.6%, respectively; those of MRA were 82.9% and 98.1%, respectively, with no significant difference for diagnosis of SSC tears. For the staff radiologist, the sensitivity and specificity of US were 86.3% and 97.6%, respectively, whereas for the fellow, the values were 72.8% and 99.5%, respectively.

CONCLUSION
MRA showed slightly better agreement and higher sensitivity for diagnosis of SSC tears although not statistically different. US performed by the staff radiologist had higher sensitivity for diagnosis of SSC tears.
CLINICAL RELEVANCE/APPLICATION

US has comparable diagnostic sensitivity and specificity to MRA in diagnosis of SSC tears; however, sensitivity is higher if performed by a more experienced examiner.

VSMK61-10

Fatty Infiltration and Traction Suprascapular Neuropathy: Evaluation of Rotator Cuff Muscles with Differing Nerve Supply with MR Chemical Shift Fat Quantification

Sonia Lee MD (Presenter): Nothing to Disclose, Robert Lucas: Nothing to Disclose, Drew Lansdown: Nothing to Disclose, Lorenzo Nardo MD: Nothing to Disclose, Thomas M. Link MD, PhD: Research funded, General Electric Company Research funded, InSightec Ltd, Lynne S. Steinbach MD: Nothing to Disclose, C. Benjamin Ma MD: Nothing to Disclose, Roland Krug PhD: Nothing to Disclose

PURPOSE

To assess traction suprascapular neuropathy in rotator cuff muscles by comparing fatty infiltration in muscles supplied by suprascapular nerve to that of axillary nerve in subjects with and without severe retraction.

METHOD AND MATERIALS

After IRB approval, nine consecutive patients with retraction to the glenoid (severe retraction, SR) and nine age and rotator cuff tendon tear sized matched control subjects with less retraction (LR) were included. All subjects underwent routine clinical 3 Tesla non-contrast shoulder MR exam with additional chemical shift 6 point dixon IDEAL sequence for fat quantification. Rotator cuff muscles fat fractions were calculated by averaging the manually drawn region of interest on four consecutive sagittal fat fraction maps in each rotator cuff muscle at the scapular Y-view following previously published protocol. The average age, rotator cuff tendon tear size, degree of retraction and rotator cuff muscle fat fraction of SR were compared to LR using student t-test.

RESULTS

No significant difference was present in age or over all rotator cuff tear size between the two groups, SR and LR (65.1 vs. 67.4 years, P 0.27 and 4.9 vs. 4.9 cm, P 0.52). Average tendon retraction in SR and LR were 5.1 cm and 3.0 cm (P < 0.001). All patients had full thickness full width tear of supraspinatus tendon. SR group had larger infraspinatus tear (P 0.05), and smaller subscapularis tear size(P 0.07) compare to LR. SR showed increased muscle fat in not only supraspinatus (22.2 vs. 12.8 %, P 0.03*), but also in infraspinatus (22.3 vs. 13.0 %, P 0.05) and subscapularis (19.9 vs. 12.3 %, P 0.08) to a similar degree despite less subscapularis tendon involvement. Teres minor fat fraction did not increase with rotator cuff tendon retraction (SR vs. LR, 6.3 vs. 8.6 %, P 0.84).

CONCLUSION

Significant elevation in fatty infiltration was seen in those with severe retraction in all rotator cuff except for teres minor supplied by axillary nerve. These results support supraspinatus neuropathy as significant contributor of muscle fatty infiltration.

CLINICAL RELEVANCE/APPLICATION

Rotator cuff fatty infiltration, an indicator of poor post-surgical outcome, is not only affected by tendon tear but also significantly affected by neuropathy. MR fat quantification provides reliable and accurate assessment to study the association and possible causation of muscle infiltration, tendon pathology and nerve involvement.

VSMK61-11

Postoperative Technical Considerations

Kenneth A. Buckwalter MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Define the best imaging technique for post-operative patients. 2) Understand how to reduce post-operative artifacts at MRI. 3) Understand how to reduce post-operative artifacts at CT.

VSMK61-12

Comparison of New CT Metal Artifact Reduction Technique to Filtered back Projection for Evaluation of Shoulder Arthroplasties: A Prospective Study


PURPOSE

To compare a new prototype CT reconstruction technique for reduction of artifacts from metal implants called Iterative Metal Artifact Reduction (IMAR) with standard filtered back projection (FBP), both quantitatively and qualitatively.
**METHOD AND MATERIALS**

40 patients undergoing total shoulder arthroplasties were enrolled in a prospective study. Preoperative CT scans were performed with varying standard clinical protocols with FBP reconstructions. All postoperative scans were performed on one of three CT scanners (Definition Flash, Definition Edge or Definition AS+, Siemens, Erlangen, GE) with a standard protocol (140 kVp, 300 mAs, 0.6 mm collimation, effective pitch 0.5 - 0.9). FBP and IMAR images reconstructed using same kernel (B30 - smooth), slice thickness (2 mm) and slice interval (2 mm). After randomization and blinding, 2 musculoskeletal radiologists independently evaluated the bone (glenoid), bone metal interface and soft tissue (supraspinatus and subscapularis tendons) structures in each case. Using a 10 point scoring system, each structure was evaluated for the degree of streak artifact (1=none to 10=marked) and diagnostic confidence (1=no confidence to 10=high confidence). The accuracy and variance of attenuation near hardware was also measured quantitatively in the bone (glenoid), soft tissue (deltoid muscle) and subcutaneous fat as the absolute difference between the mean HU within a region of interest (ROI) near hardware on the postoperative scan and the mean HU within a ROI in the same location on the preoperative scan.

**RESULTS**

Qualitatively, both readers graded IMAR images with significantly lower streak artifact and significantly higher diagnostic confidence scores than FBP images for all of the structures (p<0.001) (Table 1a). Quantitatively, the attenuation near hardware was statistically significantly closer to preoperative attenuation for IMAR than FBP (p<0.001) (Table1b) and the variance between preop and postop attenuation was significantly lower for IMAR than FBP.

**CONCLUSION**

IMAR was superior to FBP in reducing metal artifact both qualitatively and quantitatively in patients with total shoulder arthroplasties with more accurate and less variable attenuation, less streak artifact and improved diagnostic confidence.

**CLINICAL RELEVANCE/APPLICATION**

IMAR is a promising new CT metal artifact reduction technique that improves visualization of tissues near hardware compared to standard CT technique.

**Reconstruction of Glenoid Defects Using a Statistical Shape Model**

Anish Ghodadra MD (Presenter): Nothing to Disclose, Alex Rothy: Nothing to Disclose, Aaron Bois: Nothing to Disclose, Morgan Jones MD: Nothing to Disclose

**PURPOSE**

Present methods used to estimate glenoid bone loss in recurrent shoulder instability rely on imaging of the contralateral shoulder or simple estimations of glenoid shape (e.g. a circle). The purpose of this work was to develop a robust method to reconstruct the original shape of the anterior glenoid rim following a glenoid defect using statistical shape modeling.

**METHOD AND MATERIALS**

Fifty-eight pairs of human glenoids (age 15-35) from the Hamman-Todd Collection (Cleveland, OH) were digitized using a 3-dimensional laser scanner. Using custom Matlab software, 2-dimensional glenoid contours were generated. The contours were then resampled to have a fixed number of points for all glenoids. Seventy percent (n = 81) of the glenoid contours were then randomly selected as a training set for generation of a statistical shape model using principal component analysis of the covariance matrix of the coordinates along the contours. The remaining 35 glenoid contours were used for model validation. Anterior glenoid defects were simulated in 5% increments in the anterior-posterior direction. The statistical shape model was then fit to the remaining points in the contours using an iterative algorithm seeking to minimize mean error in the contour fitting.

**RESULTS**

Principal component analysis yielded five major modes of variation in glenoid shape. Mode 1 corresponded to radius of the posterior half of the glenoid. Mode 2 described the radius of the anterior glenoid. Mode 3 corresponded to the size/curvature of the superior glenoid. Mode 4 described the depth of the glenoid notch and Mode 5 described the curvature of the anterior/superior portion of the inferior glenoid rim. The root mean square median error in defect contour reconstruction was 0.95 mm (Quartiles: 0.6 and 1.7) with a 90th percentile of 2.7 mm and a maximum of 3.5 mm. Figure 1 shows four randomly selected glenoids with defects and their reconstructions.

**CONCLUSION**

We were able to successfully reconstruct the contours of glenoid defects using a statistical shape model with a relatively small margin of error. This technique could be used to estimate the original contours of glenoid defects thereby aiding in their surgical reconstruction.

**CLINICAL RELEVANCE/APPLICATION**

This technique could allow accurate estimation of the amount of bone loss which can help predict the failure rate of soft tissue reconstruction and inform the decision between soft tissue and bony reconstruction procedures.
LEARNING OBJECTIVES

1) To review expected imaging findings and complications after shoulder surgery.