Peri-articular Fat Pads: An Adjunctive Tool in the Diagnosis of Occult Injury

All Day Location: MK Community, Learning Center

Participants
Brett Larsen, Phoenix, AZ (Presenter) Nothing to Disclose
Mary J. Connell, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Dan G. Gridley, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Albert Roh, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The Purpose of this exhibit is: 1. To review location and anatomy of common peri-articular fat pads and their normal appearance 2. To recognize abnormalities in fat pads when occult soft-tissue or bony injury is present 3. To explain the utility of fat pads in the diagnosis of occult injury and correlate plain film findings with MRI
MR Signal Abnormalities of the Adolescent Growth Plate

All Day Location: MK Community, Learning Center

Participants
Iman Khodarahmi, MD, PhD, Newark, NJ (Presenter) Nothing to Disclose
Marcia F. Blacksin, MD, West Caldwell, NJ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
While some pediatric and adult joint pathologies overlap, there are significant differences, and therefore, interpreters of pediatric MR must be cognizant of these differences as well as normal variants. Upon completing this exhibit, the reviewer will become familiar with MR signal characteristics of normal adolescent physis as well as MR appearance of different growth plate physiologic and pathologic conditions based on images from our institution. Clinical significance and key imaging similarities and differences for these conditions will be reviewed. Finally, the readers will be provided with a table of take-home points so they will have familiarity when such lesions appear on their work queue.

TABLE OF CONTENTS/OUTLINE
MR characteristics of the normal adolescent growth plate. Focal epiphyseal edema Acute physeal traumatic fractures Chronic physeal stress injuries (Overuse syndrome) Marrow reconversion/residual red marrow Local physeal widening (Physeal extensions) Physeal bars Infection Neoplastic conditions Summary
Benign Soft Tissue Tumors of the Digits: MR Imaging with Pathologic Correlation

All Day Location: MK Community, Learning Center

Participants
Anastasia F. Barron, DO, Chicago, IL (Presenter) Nothing to Disclose
Anupam Basu, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Vivek Yedavalli, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Kathan A. Amin, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Christelle Chedrawy, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Discuss the diagnostic approach to soft tissue masses specifically located in the fingers and the importance of pathologic correlation.
2. Emphasize specific MRI imaging findings for this rather short list of begin lesions.
3. Highlight key anatomic and clinical features that aid in diagnosing soft tissue tumors in the digits.

TABLE OF CONTENTS/OUTLINE
1. Purpose: Emphasize MR imaging features, clinical presentation, and importance of histology in the diagnosis of soft-tissue masses of the digits.
2. Background
   a. focused review of pertinent anatomy
   b. overview of WHO classifications for malignant tumors of the digits
   c. highlight common clinical presentation
3. Discuss approach to evaluating tumors in the fingers
   a. preferred imaging modalities and why
4. Example cases for each diagnosis in the differential of benign soft tissue tumors of the digits
   a. common patient presentation and demographics
   b. key MR imaging findings
   c. pathology correlation with focused explanation of histology features
   d. emphasize lesion’s delineating characteristic
5. Clinical and medicolegal ramifications of misdiagnosis
6. Conclusion
Comprehensive Review of CPPD Arthropathy: Common and Unusual Imaging Findings

Participants
Mumtaz B. Syed, MD, Knoxville, TN (Presenter) Nothing to Disclose
Andrew J. Vincent, MD, Knoxville, TN (Abstract Co-Author) Nothing to Disclose
Peter T. Petruzzi, MD, Knoxville, TN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Calcium pyrophosphate deposition disease is a metabolic arthropathy caused by the deposition of calcium pyrophosphate dihydrate (CPPD) in and around joints, especially in articular and fibrocartilage. The etiology of CPPD is unknown. Excess calcium has a probable relationship with chondrocalcinosis, with hemochromatosis and hyperparathyroidism being two major risk factors. Although CPPD is often asymptomatic, with only radiographic changes such as chondrocalcinosis, various clinical manifestations may occur, including acute arthritis (pseudogout) and chronic arthritis. Bone destruction may occur as a result of the inflammation. Although almost any joint may be involved by CPPD, the knees, wrists, and hips are most commonly affected. Other joints involved by CPPD arthropathy include TMJ and atlanto-odontoid structures of the cervical spine. CPPD is the most common cause of secondary metabolic osteoarthritis. We review the radiographic findings of CPPD arthropathy with correlative CT and MRI mages of various joints affected with chondrocalcinosis.

TABLE OF CONTENTS/OUTLINE
Introduction Pathophysiology Review of Imaging Findings and Multimodality Correlation Differential Diagnosis Conclusion
A Pictorial Review of Peri-coccygeal Mass in Adult
All Day Location: MK Community, Learning Center

Participants
Jang Gyu Cha, MD, Bucheon, Korea, Republic Of (Presenter) Nothing to Disclose
Jisook Yi, MD, Bucheon-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun-Joo Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung-Moon Lee, MD, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sun Joo Lee, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To illustrate the various imaging feature of the common and unusual peri-coccygeal masses which include congenital lesions, infectious lesions and neoplastic lesions in adult with pathologic correlation.  
2. Recognize differential diagnosis of peri-coccygeal mass in adult, presenting as solid and cyst mass lesion.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Normal anatomy and embryology of peri-coccygeal area.
3. Congenital lesion A. Pilnodidal sinus/cyst
4. Benign lesion A. Cystic mass: Epidermal cyst, Bursitis, Synovial cyst B. Solid mass: Lipoma, Hemangioma, Schwannoma/Neurofibroma, Myxopapillary ependymoma
5. Malignant lesion A. Metastasis B. Chordoma

Summary
Various pathologic masses which include congenital, infectious and neoplastic condition can occur in the peri-coccygeal area. But peri-coccygeal mass in adult is uncommon and not well known to radiologists. Knowledge of the normal anatomy and familiarity with the imaging features of these lesions are important for determining the type of mass or narrowing the differential diagnosis.
Sound Imaging: What all Radiologists Should Know about Sonographic Evaluation of Peripheral Neuropathy

All Day Location: MK Community, Learning Center

Participants
Zachary R. Ashwell, MD, Aurora, CO (Presenter) Nothing to Disclose
Colin D. Strickland, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Seema M. Meraj, MD, Lindenhurst, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this study is: 1. To review the normal anatomy and ultrasonographic appearance of peripheral nerves. 2. To discuss important landmarks for orientation and evaluation of the upper and lower extremities. 3. To review the various pathologic appearances of peripheral neuropathy as it applies to various scenarios including direct and indirect trauma, overuse injuries and compression by external structures. 4. To show and discuss several of the more common entities and general radiologist is likely to encounter in practice and emphasize the importance of familiarity with ultrasound as a growing imaging modality.

TABLE OF CONTENTS/OUTLINE
Normal Anatomy and Sonographic Appearance: - Brachial Plexus - Radial, Median and Ulnar nerves - Femoral and Peroneal nerves
Common Pathologies: - Brachial Plexus Injury - Ulnar Neuritis - Radial Nerve Injury after Fracture - Carpal Tunnel Syndrome
Specific Advantages over other modalities: - Metallic Artifact - Motion - Cost/efficiency
MR Neurography Anatomy of the Articular and Cutaneous Innervation of the Knee Taught Through a Real-data-based 3D Computer Model

All Day Location: MK Community, Learning Center

Participants
Mesa Schumacher, MA, BA, Baltimore, MD (Presenter) Nothing to Disclose
David Rini, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Research Consultant, Siemens AG; Speaker, Siemens AG

TEACHING POINTS
1. Sensory innervation of the knee follows a characteristic pattern of constantly present nerves with minor variations of non-constant branches.
2. High spatial resolution 2D and 3D MR neurography facilitates detailed visualization of the constantly present nerves.
3. Knowledge of the course of the anterior, medial, lateral and posterior nerves of the knee in correlation with surgical incision and arthroscopy sites enables diagnosis of neuropathic pain related to neuromas and entrapment following surgery.

TABLE OF CONTENTS/OUTLINE
High spatial resolution 2D and 3D MR neurography protocols
Topography and layer pattern of the nerve about the knee
Femoral and sciatic origins and main branching pattern
Knee joint Innervation
Medial Medial retinacular n
Medial cutaneous n of the thigh
Infrapatellar br of saphenous n
Anterior br of obturator n
Lateral Lateral retinacular n
Superior lateral genicular n (SLGN) N to the vastus lateralis
N to the vastus intermedius
Posterior
Posterior division of obturator n
Posterior articular br of tibial n
Anterior Lateral femoral cutaneous n
Anterior femoral cutaneous n
Cutaneous nerves of the knee
Common surgical incisions and arthroscopy patterns in relation to nerve injury
Sacroiliitis: What Rheumatologist Needs to Know and Radiologist Must Report
All Day Location: MK Community, Learning Center

Participants
Angela P. Guarnizo Capera, MD, Bogota, Colombia (Presenter) Nothing to Disclose
Carolina Rumie Valois, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Camilo A. Barragan Leal, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Rafael Gomez, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Juan N. Useche, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Sonia Bermudez, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Oscar M. Rivero Rapalino, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the characteristic findings in different imaging modalities in patients with sacroiliitis. To identify key MRI findings associated with active inflammatory disease in patients with early stage sacroiliitis. To determine the imaging findings associated with chronic stage sacroiliitis. To determine the differential diagnosis of sacroiliitis.

TABLE OF CONTENTS/OUTLINE
Introduction
Sacroiliitis: characteristic findings in different imaging modalities (conventional radiography, CT, scintigraphy)
MRI findings in sacroiliitis: early stage, chronic stage
ASAS criteria
Differential diagnoses
Conclusions
Sonographic and Sonoelastographic Findings during and after Treatment of Plantar Fasciitis; A Common Pathology

All Day Location: MK Community, Learning Center

Participants
Minchul Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yun Sun Choi, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyoungseop Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung-Won You, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin-Su Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ki Won Young, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the imaging features concerning of ultrasound in the assessment of plantar fasciitis To review post-treatment sonographic findings of plantar fasciitis, including well demonstrated sonoelastography images

TABLE OF CONTENTS/OUTLINE
Review the clinical and imaging features of plantar fasciitis Description of radiologic findings (radiograph, B-mode ultrasound, sonoelastography) Review of treatment options - injection, extracorporeal shockwave therapy, low-level laser therapy and extracorporeal pulse-activated therapy Identify post-procedural changes and possible complications after injections for plantar fasciitis on US
Imaging of muscle disorders is challenging for many owing to significant overlap in imaging characteristics and under-recognition of some of the pathologies. However, familiarity with these entities will ease radiological diagnosis, and therefore, prevent unnecessary interventions which may lead to serious complications. In this exhibit, we present a variety of adult muscle disorders in different clinical scenarios with a primary focus on their cross-sectional imaging appearance. These pathologies include diabetic myonecrosis, overuse and medication-induced muscle infarction, dermatomyositis, pyomyositis, and abscess, necrotizing fasciitis, compartment syndrome, denervation-induced muscle atrophy, Klippel-Trénaunay syndrome, intramuscular lipoma, heterotopic ossification, and muscle tear.

**TABLE OF CONTENTS/OUTLINE**

- Diabetic myonecrosis: in depth discussion of imaging appearance, clinical significance, treatment, complications
- Overuse myonecrosis
- Medication induced myonecrosis
- Dermatomyositis
- Pyomyositis and abscess
- Necrotizing fasciitis
- Compartment syndrome
- Denervation-induced muscle atrophy
- Klippel-Trénaunay (angioosteohypertrophy) syndrome
- Heterotopic ossification
- Intramuscular lipoma
- Muscle tear
Benign, Malignant, and Tumor Like Lesions of the Mandible: What to Look For?

All Day Location: MK Community, Learning Center

Participants
Christelle Chedrawy, MD, Chicago, IL (Presenter) Nothing to Disclose
Neetha Gandikota, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Kathan A. Amin, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Anastasia F. Barron, DO, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Anupam Basu, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Alexander Ree, MD, Oak Park, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review the differential diagnosis of benign and malignant mandibular lesions. Describe imaging features of mandibular lesions that aid in directing further management.

TABLE OF CONTENTS/OUTLINE
Osseous mandibular lesions are not infrequently encountered in a radiologist’s practice. A myriad of cystic and solid lesions exist and achieving a functional comfort level with relevant anatomy and imaging features is imperative in order for the radiologist to add value to the diagnostic work up. Outline: 1 - Cystic lesions: Periapical cyst Dentigerous cyst Odontogenic keratocyst Stafne cyst 2 - Solid lesions: > Benign: Ameloblastoma Cementoblastoma Ossifying fibroma Fibrous dysplasia Giant cell reparative granuloma > Malignant: Plasmacytoma Osteosarcoma Mucoepidermoid carcinoma 3 - Metabolic: Osteoporosis Brown Tumor 4 - Miscellaneous: Osteoradionecrosis Bisphosphonate osteonecrosis Familiarity with the prevalence, imaging appearance and location of particular lesions in the mandible help narrow the differential diagnosis to better guide patient treatment and prevent unnecessary biopsies.
Is This Normal or Abnormal on the Knee MRI?

All Day Location: MK Community, Learning Center

Participants
Sun Joo Lee, MD, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
Hye Jung Choo, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Mi Park, MD, PhD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hae Woong Jeong, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ok Hwa Kim, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seok Jin Choi, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the anatomic variants on the knee MRITo review the normal structures mimicking pathologic conditions on the knee
To be familiar with these pitfalls and variations

TABLE OF CONTENTS/OUTLINE
Variable Ultrasonographic Findings of Lymphoma in Musculoskeletal System

All Day Location: MK Community, Learning Center

Participants
Sun Joo Lee, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seong Jin Kim, MD, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
Hye Jung Choo, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Mi Park, MD, PhD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hae Woong Jeong, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ok Hwa Kim, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To illustrate variable US features of lymphoma in the musculoskeletal system To correlate with other imaging modality and pathologic findings

TABLE OF CONTENTS/OUTLINE
Musculoskeletal lymphoma is a heterogeneous disease and can involve more than one anatomical compartment and not lead to destruction of an anatomic structure. Thus, imaging manifestations vary among the different modalities. Lymphoma with nodal involvement Peripheral nerve lymphoma Skin and subcutaneous lymphoma - Cutaneous T-cell lymphoma (Mycosis fungoides) - Subcutaneous panniculitis-like T-cell lymphoma Muscle lymphoma - Focal involvement - Diffuse involvement Summary: Through the review of this exhibit, musculoskeletal lymphoma covers a broad spectrum of imaging manifestations. Familiarity with US and the other imaging manifestations of musculoskeletal lymphoma is important for detecting and characterizing of the lesion and improving diagnostic accuracy.
Pictorial Review of Features of Renal Osteodystrophy

All Day Location: MK Community, Learning Center

Participants
Shwayta Kukreti, MD, PhD, Los Angeles, CA (Presenter) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
George R. Matcuk Jr, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Sulabha Masih, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Renal osteodystrophy describes the variety of bone diseases and musculoskeletal abnormalities which occur in association with chronic kidney disease. Through this exhibit we review the most common radiologic musculoskeletal imaging findings with the associated pathophysiology.

TABLE OF CONTENTS/OUTLINE

(1) Osteoscleroris, including rugger jersey spine, and affecting pelvis, ribs, and long bones. (2) Osteomalacia and Rickets; features of osteomalacia including osteopenia, and bone deformities (milkman’s fracture/Looser’s zones). Manifestations of rickets such as diffuse bone mineralization, widened growth plate, and metaphyseal cupping and fraying. (3) Osteoporosis with fractures, such as in spine and femoral neck. (4) Soft tissue and vascular calcifications at subcutaneous, periarticular tissue, and arterial vessels, such as fluffy amorphous tumoral calcification. (5) Osteitis Fibrosa Cystica involving subperiosteal, subchondral, and subligamental bone resorption, spotty deossification of skull (salt and pepper skull appearance); as well as brown tumors, and chondrocalcinosis. (6) Other musculoskeletal manifestations include amyloid deposition, spondyloarthropathy, and osteomyelitis.
Participants
Minchul Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yun Sun Choi, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Darae Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yoon Young J. Jung, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Nam-Hong Choi, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To overlook operation-related CT findings after ACL reconstruction To demonstrate what to look for and how to evaluate abnormal findings in the early post-operative CT scans after ACL reconstruction

TABLE OF CONTENTS/OUTLINE
Recommended CT techniques and consensus of terminolog Review anatomic positions of tunnel and fixation devices by landmark Evaluation with measurements in CT studies Display examples of complications and abnormal findings in the early post-operative phase
A Radiological Overview of Knee Arthroplasty. Practical Keys in the Assessment of Knee Replacement

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Javier Azpeitia Arman, MD, Madrid, Spain (Presenter) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Antonio-David Murillo Vizuete, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Borja Limousin Aranzabal, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Elena Barcina-Garcia, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Nuria Santamaria Guinea, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- To know the different types of knee replacement.
- To review the role of imaging techniques (plain radiograph, CT, MR, US, scintigraphy) in the evaluation of prostheses.
- To understand usefulness and limitations of plain radiographs in the evaluation of knee replacements, emphasizing useful parameters and illustrating image analysis and interpretation.
- To become familiar with normal and abnormal postoperative imaging findings and signs of complications.

TABLE OF CONTENTS/OUTLINE

We review imaging of knee replacement, highlighting key concepts perceived as important variables by the surgeon and correlating images with clinical considerations and functional outcomes. We present:

1. A review of types of replacement: total knee (TKR) and unicompartimental knee replacement (UKR).
TEACHING POINTS

1. As bone lesions are commonly encountered on CT, having a systematic approach to assessment helps to accurately describe lesions, create relevant differential diagnosis and guide management. 2. Based on CT appearance, bone lesions can be categorized as aggressive and non-aggressive. 3. Radiologists should be aware of benign entities with aggressive features and malignant tumors that may appear non-aggressive. 4. Certain features (such as lesion matrix, multiplicity, location) allow to narrow differential diagnosis.

TABLE OF CONTENTS/OUTLINE

- Outline/Background/Role of CT
- Lesion Features (Location, Density, Matrix, Periosteal/Cortical reaction, Multiplicity)
- Aggressive vs. Non-aggressive features
- Sample cases of benign and malignant lesions
Angiosarcoma of the Musculoskeletal System: Imaging Features and Pathology Correlation

All Day Location: MK Community, Learning Center

Participants
Swati Deshmukh, MD, Baltimore, MD (Presenter) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Angiosarcoma is a rare aggressive neoplasm with a poor prognosis which can involve the skin, multiple soft tissue, and osseous structures. Angiosarcoma has a reported association with multiple infantile hemangiomas and is prone to local recurrence and common metastases.  
2. MRI is valuable for not only defining the extent of disease (which can be multifocal), but also for characterizing the aggressive and vascular nature of angiosarcomas, which typically appear as masses with heterogeneous signal intensity, serpentine vessels, and avid early arterial enhancement on dynamic MR angiography sequences.

TABLE OF CONTENTS/OFFLINE

1. Clinical Presentation
2. Imaging features of angiosarcoma, with a focus on MRI  
   Noncontrast imaging features
   Dynamic and static post-contrast imaging characteristics
3. Pathology: Gross and microscopic features of angiosarcoma
4. Treatment options and post-treatment imaging.
MK103-ED-X

Recent Advances in Spinal Cord MRI: How Should the Radiologist Use Conventional and Recent MRI Techniques for Diagnosing Spinal Cord Lesions?

All Day Location: MK Community, Learning Center

Participants
Nobuko Tanitame, MD, Hiroshima, Japan (Presenter) Nothing to Disclose
Keizo Tanitame, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Masayo Fujita, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Yoko Kaichi, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Yukiko Honda, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Arai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo
Wataru Fukumoto, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Chiaki Ono, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Shuji Date, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Spinal cord MRI involves 2-dimensional (2D)/3-dimensional (3D) T1-, T2-, and T2*-weighted sequences, diffusion-weighted imaging (DWI), time-resolved gadolinium-enhanced 3D MRA, fat-water imaging, and phase-contrast cine MRI. Radiologists must know the specificity of each MRI technique and choose the best imaging approach for each patient. We demonstrate the usefulness of each imaging technique in spinal infarct, tumors, arteriovenous malformation (AVM), cystic lesions, and demyelinating diseases.

TABLE OF CONTENTS/OUTLINE
A. Representative cases (useful MRI techniques) Infarct, malignant lymphoma, active multiple sclerosis (DWI) Hemangioma, hemorrhage (T2*-WI, DWI) AVM (gadolinium-enhanced 3d fat-sat T1-gradient recalled echo, TRICKS MRA) Syringomyelia, cystic tumors, congenital cysts (SSFSE, 3-point Dixon, balanced SSFP, phase-contrast cine MRI) Compressive myelomalacia (3D T2-acquisition) Lipoma (chemical shift, CHESS, 3-point Dixon) Astrocytoma, ependymoma, metastasis, demyelinating diseases, hereditary Alexander's disease (high-contrast conventional T1-WI, T2-WI, and gadolinium-enhanced MRI)B. Tips and pitfalls in diagnosing spinal cord lesions by using recent MRI techniquesC. Technical considerations for demonstrating spinal AVM: TRICKS MRA and 3D fat-sat T1-gradient recalled echo by slow injection of contrast material
Awards
Certificate of Merit

Participants
Scott S. Dalane, MD, Columbia, MD (Presenter) Nothing to Disclose
Adam Fehringer, Bethesda, MD (Abstract Co-Author) Nothing to Disclose
Alexander B. Galifianakis, MD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to review the spectrum of post-operative complications encountered following lower extremity amputations in soldiers and marines suffering blast injuries. Through pictorial review, the exhibit will illustrate the imaging findings associated with these complications, allowing early-identification and treatment. The learner will gain an understanding of the unique features and challenges associated with combat-related trauma and how imaging may help guide therapy.

TABLE OF CONTENTS/OUTLINE
The intent of this exhibit is to provide a review of the imaging findings of post-operative complications following combat-related extremity amputations based on over ten years of institutional experience in caring for wounded warriors. The case-based format includes discussion of: Heterotopic ossification and suboptimal osseous angulation Osseous and soft tissue infections, with emphasis on unique pathogens encountered in the combat-setting Inflammation and fluid collections and their clinical significance Neuroma development following nerve injury Clinical and imaging considerations related to retained foreign bodies
The Usefulness of Ultrasound Imaging in Subungual Glomus Tumors with MRI Correlation

Participants
Filipa G. Vieira, MD, Braga, Portugal (Presenter) Nothing to Disclose
Robertha Nakamura, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Flavia M. Costa, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Silvana M. Mendonca, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Glomus tumours are rare vascular tumors arising subungually in fingernails, which derive from the glomus body, that contributes to thermoregulation.
- The clinical presentation is classic triad of paroxysmal pain, pinpoint pain and cold hypersensitivity. There may be a purplish discoloration under the nail and nail plates deformity.
- Its diagnosis was previously based on history and physical examination alone.
- Recent years have witnessed an increase in the use of ultrasound imaging of the skin in the field of dermatology, including in inflammatory diseases, tumors and even esthetics.
- The purpose is to illustrate the importance of imaging studies in glomus tumour diagnosis, especially of ultrasound with color Doppler imaging, with clinical and MRI correlation.

TABLE OF CONTENTS/OUTLINE
1- To review the main clinical and radiological features of glomus tumor, with special focus on ultrasound and magnetic resonance imaging.
2- To describe the anatomic and technical specificities in nail ultrasound.
3- To demonstrate the usefulness of ultrasound as a simple, quick and noninvasive study to identify and characterize the exact location of the lesion for surgical removal.
4- To demonstrate the ability of ultrasound in the detection of small tumors and recurrence cases, reflecting its effectiveness in the early diagnosis.
Chronic Recurrent Multifocal Osteomyelitis: The Role of Whole-Body MRI in Evaluation and Diagnosis

Awards
Certificate of Merit

Participants
Filipa G. Vieira, MD, Braga, Portugal (Presenter) Nothing to Disclose
Flavia M. Costa, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Blanca E. Bica, MD, PhD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Silvania M. Mendonca, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Chronic recurrent multifocal osteomyelitis (CRMO) represents a rare condition characterized by chronic multiple aseptic inflammatory lesions of bone in children and adolescents. - The diagnosis of CRMO is a diagnosis of exclusion. The clinical, radiologic and pathologic findings are non-specific and the recognition of this entity is often delayed with several unnecessary procedures. - It comprises an insidious onset of pain and soft-tissue swelling, with periodic remissions. Systemic manifestations are unusual and laboratory tests are unremarkable. - Tissue cultures in biopsy specimens are negative for infectious agents, but usually show different stages of subacute and chronic inflammation. - Whole-body MRI is useful for the radiation-free detection of occult sites of disease in CRMO. - Familiarity with CRMO is indispensable in differential diagnosis with other bone diseases, including those suggestive of malignancy.

TABLE OF CONTENTS/OUTLINE
1- To review the main clinical, radiologic and histopathologic features of CRMO.
2- To illustrate with conventional MRI different presentations forms of CRMO.
3- To illustrate differential diagnosis simulating CRMO.
4- To emphasize the importance of Whole-body MRI in the diagnosis of CRMO by its ability to access multifocality, allowing early management.
Assessment Bone Lesions in POEMS Syndrome

All Day Location: MK Community, Learning Center

Participants
Filipa G. Vieira, MD, Braga, Portugal (Presenter) Nothing to Disclose
Luiz F. DiPE, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Bruno Schau, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Flavia M. Costa, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Silvana M. Mendonca, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- The purpose is to recognize different patterns of bone lesions in POEMS syndrome using computed tomography.- POEMS syndrome is a rare paraneoplastic disorder characterized by plasma-cell dyscrasia with Polyneuropathy, organomegaly, endocrinopathy, M-protein and skin changes.- The pathogenesis is yet poorly understood.- Bone lesions occur in 95% of patients with POEMS and more than 50% are multiple.- The majority of bone lesions occur in the spine and pelvis.- Most are well-defined or fluffy sclerotic lesion and others are lytic lesion with peripheral sclerosis.- Bony excrescences are particularly prominent in the posterior elements of the spine and at tendinous and ligamentous insertion sites, and are virtually pathognomonic for POEMS syndrome.- CT is particularly sensitive to find bone lesions, allowing early diagnosis and specific therapy, improving survival and life quality of such patients.

TABLE OF CONTENTS/OUTLINE
1- To review the major and minor criteria for the diagnosis of POEMS syndrome. 2- To describe and illustrate the main radiological features of bone involvement in POEMS syndrome. 3- To discuss the differential diagnosis for this entity (including sclerotic lesions and osseous proliferation in the spine). 4-To demonstrate the usefulness of bone findings in treatment strategies.
Myxofibrosarcoma - A Tail Not to be Missed

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Angela E. Li, MBBS, MMed, New York, NY (Presenter) Nothing to Disclose
Cristina Antonescu, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Robert A. Lefkowitz, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jonathan Landa, DO, New York, NY (Abstract Co-Author) Nothing to Disclose
David M. Panicek, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Purpose
Outline the pathology of myxofibrosarcoma (MFS) Demonstrate the MRI appearances of MFS
Illustrate the unusual tail-like growth pattern of MFS Emphasize the importance of determining the full extent of local tumor spread in planning surgical resection
Review differential diagnoses of other tumors that can have a similar appearance

TABLE OF CONTENTS/OUTLINE

1. Pathology of MFS2. Imaging appearance at MRI Primary tumor Location: subcutaneous or deep location in the extremities High T2 signal on MRI due to myxoid content Nodular mass-like or superficial spreading growth pattern Tapering "tails" of enhancement extending along fascial planes Metastases: lung and atypical locations (pleura, adrenal glands, mesentery, bone)3. Sample cases4. Differential diagnoses, including other myxoid tumors Intramuscular myxoma Benign peripheral nerve sheath tumor Undifferentiated pleomorphic sarcoma Myxoid liposarcoma Extraskeletal myxoid chondrosarcomaConclusion Myxofibrosarcoma has an extensively infiltrative growth pattern, which often manifests as "tails" of enhancement extending from the main mass. Determining the full extent of the tumor, including its infiltrative margins, on MRI is critical in preoperative planning to ensure complete resection, and thus minimize the risk of local recurrence.
Imaging of Posterior Tibial Function and Dysfunction: A Multimodality Approach

All Day Location: MK Community, Learning Center

Participants
Lara Berrocal, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Sandra Mecho Meca, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jaume Pomes, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Javier Alvarez Moro, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Santiago Medrano, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Judit Mestres, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Marta Gomez Chiari, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Miguel Angel Tejero, 08017, Spain (Abstract Co-Author) Nothing to Disclose
Joan M. Gimenez Ruiz, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The major teaching points of this exhibit are:
- Knowledge of the spectrum of Posterior Tibial Dysfunction (PTD), focusing on the main plantar arch stabilizer, the Posterior Tibial Tendon (PTT), and its relationship/link/connection with other anatomic structures, such as the talo-navicular ligament (spring ligament), or the sinus tarsi, among others.
- Study the normal anatomy and function of this biomechanical complex, with drawing schemes.
- Recognize the radiological signs that are useful in its correct evaluation, emphasizing on MRI and US.
- Learn the main treatment options, conservative or surgical.

TABLE OF CONTENTS/OUTLINE
1- Introduction to Posterior Tibial Dysfunction (PTD)
2- Anatomy and biomechanics of the plantar arch and the Posterior Tibial Tendon
3- Clinical presentation of PTD
4- Radiological assessment of PTD: plain radiograph, ultrasonography and MRI
5- Treatment options
6- Conclusions
TEACHING POINTS
- Ultrasound (US) is an effective, accessible, and inexpensive modality that can be used with a high degree of diagnostic confidence to evaluate common shoulder pathologies.
- Review standard shoulder US technique, common shoulder pathologies, and differential diagnosis based on patient history and presentation.
- Identify characteristic imaging features (US with MRI correlation) of common shoulder pathologies.

TABLE OF CONTENTS/OUTLINE
- Introduction and overview of shoulder US including technique and normal US imaging appearance.

Summary:
- Familiarity with the US appearance of common shoulder pathologies aids in establishing a specific diagnosis or limiting differential diagnosis.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Scott Sheehan, MD - 2014 Honored Educator
Hypertrophic Osteoarthropathy (HOA) - What Lies Beneath Hippocrates' Fingers

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Felix Y. Yap, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
Eric A. White, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Aaron Schein, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Anderanik Tomasian, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Sulabha Masih, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to educate the radiologist about the pathogenesis, classification, imaging features, and differential diagnosis of hypertrophic osteoarthropathy (HOA), as well as its potential association with pulmonary and non-pulmonary conditions. The reader will be given a series of imaging-based cases demonstrating key findings in hypertrophic osteoarthropathy using various imaging modalities. A discussion of other causes of multifocal periostitis, differentiating features, and imaging examples will also be provided.

TABLE OF CONTENTS/OUTLINE
Etiology and pathogenesis of HOA Classification of HOA (primary or pachydermoperiostosis vs. secondary HOA) Signs and symptoms of HOA including painful clubbing of the digits Imaging features of HOA (radiography, CT, MR, and nuclear medicine) Radiological imaging cases of HOA and pulmonary vs non-pulmonary causes Differential diagnosis of HOA including thyroid acropachy, chronic venous insufficiency, and voriconazole-induced periostitis Clinical significance and prognosis of HOA References
Musculoskeletal Applications of Spectral CT- Principles, Physics and Clinical Applications

All Day Location: MK Community, Learning Center

Participants
Christos Kosmas, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Majid Chalian, MD, Cleveland Heights, OH (Abstract Co-Author) Nothing to Disclose
Mojgan Hojjati, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Jason DiPoce, MD, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
Jacob Sosna, MD, Jerusalem, Israel (Abstract Co-Author) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV
Prabhakar Rajiah, MD, FRCR, Cleveland, OH (Presenter) Institutional Research Grant, Koninklijke Philips NV

TEACHING POINTS
Dual energy/spectral CT scanners can provide material characterization capabilities of different tissues. There are several implementations of dual energy CT, including a recently introduced dual-layer technology. There are several areas of application in musculoskeletal imaging.

TABLE OF CONTENTS/OUTLINE
- Dual energy CT- Physics and principles
- Implementations of dual energy CT- Dual source, rapid kv switching, dual spin dual layer, photon counting
- Advantages and disadvantages
- Types of spectral images
- Phantom studies
- Musculoskeletal applications of spectral CT with illustrations
  - Gout- Identification of monosodium urate crystals; diagnosis; monitoring therapeutic response
  - Artifact reduction- Metal, beam hardening
  - Visualizing tendons
  - Visualizing ligaments
  - Identify bone marrow edema
  - CT arthrography- Low dose, detection of meniscal and labral tears
  - Rotator cuff tears
  - Calcium pyrophosphate dehydrate, calcium hydroxyapatite disease
  - Iron deposition in pigmented villonodular synovitis

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator
Jacob Sosna, MD - 2012 Honored Educator
Jason DiPoce, MD - 2013 Honored Educator
Training Camp 101: An Interactive Resident Tutorial on Sports-Related Injuries Seen on MRI during an NFL Training Camp and Season

All Day Location: MK Community, Learning Center

Participants
Andrew Nimry, MD, Cleveland, OH (Presenter) Nothing to Disclose
Salim E. Abboud, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Christos Kosmas, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Peter C. Young, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Nathan P. Fergus, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Marcus Kirkpatrick, MD, Cleveland Heights, OH (Abstract Co-Author) Nothing to Disclose
Nicholas Bhojwani, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Vijaya K. Kosaraju, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Mark R. Robbin, MD, Cleveland Hts, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
Teaching Points

1. To provide an overview of the biomechanics of patellar maltracking (PM).
2. To discuss the cross-sectional imaging features of the various PM indicators.
3. To identify the structural changes that can be seen in the patellofemoral joint in association with PM disorder.

Table of Contents/Outline

1. Biomechanics of PM
2. Imaging evaluation of PM
3. PM indicators: Patella alta, trochlear dysplasia, lateralization of the tibial tuberosity, lateral patellar tilt and patellar lateralization
4. PM and Hoffa's fat pad impingement
5. PM and early patellofemoral articular cartilage damage: Review of the current evidence
6. Conclusion

MRI is a vital tool in evaluating the causes of anterior knee pain, including patellar maltracking, due to the complexity of the structure and biomechanics of the patellofemoral joint. Early recognition of the morphologic features associated with patellar maltracking disorder can have a significant impact in developing treatment strategies that may potentially prevent the progression or the development of early articular cartilage damage.
**Evidence-based Levels, Guidelines and Recommendations in Interventional Spine Treatments According to Clinical Diagnoses**

**All Day Location: MK Community, Learning Center**

**Participants**
Hugues G. Brat, MD, Sion, Switzerland (Presenter) Nothing to Disclose
Tarik Bouziane, MD, Tournai, Belgium (Abstract Co-Author) Nothing to Disclose
Dominique Fournier, MD, Sion, Switzerland (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
This evidence-based spine pain presentation aims at: 1. understanding management algorithms based on clinical symptoms, 2. learning the levels of evidence, guidelines and recommendations of diagnostic and therapeutic interventions, 3. including existing controversies in the decision making process of specific treatments.

**TABLE OF CONTENTS/OUTLINE**

Femoroacetabular and Other Atypical Forms of Hip Impingement: New Concepts and Spectrum of Imaging Findings

All Day Location: MK Community, Learning Center

Participants
Noelia Arevalo, Madrid, Spain (Presenter) Nothing to Disclose
Nuria Santamaria, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Elena Diez Uriel, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Juan Gredilla, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Miguel Grande, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To describe hip anatomy and radiological measurements pertinent to hip impingement syndromes. 2. To discuss the role of imaging in the evaluation of femoroacetabular and other atypical forms of hip impingement (including ischiofemoral, anterior inferior iliac spine/subspine and iliopsoas impingement), doing a review of current concepts. 3. To illustrate the main radiologic features of different forms of hip impingement with the use of case examples.

TABLE OF CONTENTS/OUTLINE
1. Background
2. Diagnostic imaging considerations concerning hip impingement syndromes - hip anatomy - basic and advance hip imaging techniques (X-ray, CT, MRI, MR arthrography) - radiographic measurements
3. Hip impingement forms
   3.1 Femoroacetabular impingement
      - clinical presentation
      - diagnosis and imaging findings
      a) cam form
      b) pincer form
   - treatment
3.2 Extra-articular forms of hip impingement
   a) Ischiofemoral impingement
      - clinical presentation
      - diagnosis and imaging findings
      - treatment
   b) Anterior inferior iliac spine or subspine impingement
      - clinical presentation
      - diagnosis and imaging findings
      - treatment
   c) Iliopsoas impingement
      - clinical presentation
      - diagnosis and imaging findings
      - treatment
4. Take home messages
It's Complicated... When Fractures Don't Unite

All Day Location: MK Community, Learning Center

Participants
Gitasree D. Borthakur, MD, Indianapolis, IN (Presenter) Nothing to Disclose
Lauren M. Ladd, MD, Indianapolis, IN (Abstract Co-Author) Departmental Research Grant, Siemens AG
Trenton D. Roth, MD, Indianapolis, IN (Abstract Co-Author) Institutional research support, Siemens AG; Institutional research support, Koninklijke Philips NV
Laurence Kempton, MD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review fundamental concepts of fracture and bone healing physiology. 2. To define and exemplify the spectrum of fracture healing complications, emphasizing nonunion and infection. 3. To discuss special imaging considerations for postoperative fracture evaluation.

TABLE OF CONTENTS/OUTLINE
Musculoskeletal radiology is replete with the names of individuals who have contributed greatly to not only orthopedics and musculoskeletal imaging, but also to society as a whole. The purpose of this exhibit is as follows: 1. To provide a list of anatomic structures and conditions which have been named after such individuals. 2. To review relevant clinical information regarding these anatomic structures and conditions. 3. To discuss the lives and contributions of the individuals these structures and conditions were named after.

TABLE OF CONTENTS/OUTLINE

1. Review musculoskeletal structures named after historic individuals, as well as discussing their locations and functions. These include Lister's tubercle, the Stieda process, the Lisfranc ligament, the ligament of Struthers, and Gerdy's tubercle. 2. Review pathologic processes named after historic individuals, discussing pathophysiology, physical manifestations and radiologic findings. These include Colles fracture, Pellegrini-Stieda disease, Osgood-Schlatter's, Sindig-Larsen-Johannson syndrome, Freiberg's infraction, and Bankart and Hill-Sachs lesions. 3. Discuss the historic figures these diseases and structures were named after, including where they were from and educated, the reasons these structures and diseases bear their names, and additional interesting facts.
Awards
Certificate of Merit

Participants
Udit Rawat, MD, Charlottesville, VA (Presenter) Nothing to Disclose
Nicholas C. Nacey, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Understand the MRI appearance of the major soft tissue and osseous structures of the thumb, with an emphasis on the first CMC and MCP joints.
2. Learn about normal variations in the appearance of these structures on MRI.
3. Appreciate how these structures are different in the thumb than in the other fingers.

TABLE OF CONTENTS/OUTLINE
Thumb muscles and tendons at the level of the wrist
Extensors
Abductor pollicis longus tendon and extensor pollicis brevis in compartment 1
Extensor pollicis longus in compartment 3
Thenar musculature
Opponens pollicis
Flexor pollicis brevis
Abductor pollicis brevis
Adductor pollicis
Carpal tunnel
Flexor pollicis longus (FPL)
Dorsal and volar ligaments of the first carpometacarpal (CMC) joint
Sesamoids, volar plate, and dorsal plate with emphasis on the first metacarpophalangeal (MCP) joint
Radial collateral ligament (RCL) and ulnar collateral ligament (UCL) proper and accessory with emphasis on the first MCP joint
Extensor tendons and extensor mechanism
FPL and thumb pulley system
Thumb abductors
Beyond the Greater Trochanter: The Many Bursa about the Pelvis

All Day Location: MK Community, Learning Center

Awards
Magna Cum Laude

Participants
Stephen A. Currie, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Instructor, DFine, Inc
Jeremiah R. Long, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
James D. Stensby, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Qi Xiao, St Louis, MO (Abstract Co-Author) Nothing to Disclose
Michael V. Friedman, MD, Saint Louis, MO (Presenter) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: Illustrate examples of the most common and lesser-known bursa located throughout the pelvis
Review pertinent osseous and musculotendinous anatomy specific to each bursa location
Review and illustrate common causes of bursitis including overuse, trauma, and infection
Highlight differentiating radiologic features to aid in diagnosis

TABLE OF CONTENTS/OUTLINE
Pathophysiology of bursitis
Review imaging findings and differentiating radiologic features to aid in the diagnosis of bursitis
Review and provide case examples of the many bursa located throughout the pelvis
More common: Subgluteus maximus (Greater trochanteric), Iliopsoas, Ischial
Less common: Obturator Internus, Ischiogluteal, Ischiofemoral, Subgluteus medius/minimus
Discuss pertinent osseous and musculotendinous anatomy specific to each location
Discuss current treatment options
Ultrasound and Magnetic Resonance Imaging of Soft Tissue Masses of the Ankle and Foot: What the Clinician Needs to Know

All Day Location: MK Community, Learning Center

Participants
Elena Ocon, MD, PhD, Madrid, Spain (Presenter) Nothing to Disclose
Karla H. Vivancos Costaleite, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Luz Parra Gordo, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Alfonso Ascension Diaz, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Nieves Gomez Leon, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To illustrate the imaging spectrum of benign and malignant soft tissue masses of the foot and ankle and its differential diagnosis. To determine key features in Ultrasound (US), Doppler US and Magnetic Resonance (MR) to establish the nature and extent of lesions and their relationship to anatomic boundaries and vital structures.

TABLE OF CONTENTS/OUTLINE
Our aim is to show the anatomical distribution and imaging features of benign and malignant soft tissue masses of the ankle and foot and to evaluate the efficacy of US, Doppler US and MR in the diagnosis and management of these lesions. We show key findings at each modality with emphasis on potential pitfalls, diagnostic difficulties and differential diagnosis. We compare with the underlying pathologic features when available. Specific topics addressed include: Morton's neuroma, ganglion cyst, lipoma, vascular lesions, fibromatoses, rheumatoid nodule, pigmented villonodular synovitis/giant cell tumor of tendon sheath, peripheral nerve sheath tumours [PNSTs], synovial sarcoma, liposarcoma, extraskeletal Ewing sarcoma (PNET) and soft tissue chondromyxoid fibroma.
MRI of Acute Groin Muscle Injuries in Soccer and Concomitant Pathology

All Day Location: MK Community, Learning Center

Participants
Daichi Hayashi, MBBS, PhD, Bridgeport, CT (Presenter) Nothing to Disclose
Ali Guermazi, MD, PhD, Boston, MA (Abstract Co-Author) President, Boston Imaging Core Lab, LLC; Research Consultant, Merck KgaA; Research Consultant, Sanofi-Aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophic; Research Consultant, AstraZeneca PLC
Andreas Serner, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Per Holmich, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Adam Weir, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Frank W. Roemer, MD, Boston, MA (Abstract Co-Author) Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC

TEACHING POINTS
- To describe the epidemiology of acute groin muscle injuries in athletes
- To illustrate types and mechanisms of acute groin injuries sustained by soccer players
- To review the anatomical descriptions of injury including grading and concomitant pre-existing findings

TABLE OF CONTENTS/OUTLINE
Groin injuries are common in soccer. It is a complex topic in regard to diagnosis and therapy. There is little epidemiological data on groin injuries in professional football. Imaging plays an increasingly important role in the evaluation of acute groin injuries. Our exhibit includes:
1. Overview of published epidemiology of groin muscle injuries
2. Pictorial review of acute muscle injuries sustained by soccer players, including illustration and specifics for each pathology and explanation of injury mechanisms - Adductor longus, brevis and pectineus strains - Rectus femoris - Iliopsoas - Rectus abdominis - Other such as gracilis, obturator internus and externus and tensor fasciae lata - Concomitant findings such as perisynphysisal bone marrow edema, secondary cleft sign, labral tears and cysts
3. Role of MRI grading, differentiation of acute vs. chronic muscle injury, central tendon involvement and detailed description for treatment decisions
4. Role of other imaging modalities such as ultrasound and CT

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ali Guermazi, MD, PhD - 2012 Honored Educator
Participants
Hye Yeon Oh, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Sung Hwan Hong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ja-Young Choi, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Hye Jin Yoo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee-Dong Chae, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review etiology of gas in the musculoskeletal system 2. To suggest imaging grading of musculoskeletal gas on the importance of the meaning 3. To discuss differential diagnosis of musculoskeletal gas

TABLE OF CONTENTS/OUTLINE
• Etiology of gas in the musculoskeletal system- physiological, degenerative, necrotic, traumatic, infectious and iatrogenic gas
• Imaging grading of musculoskeletal gas- trivial gas: intradiscal/intraarticular vacuum and procedure-related gas- notable gas: Kummel’s disease and posttraumatic gas- critical gas: emphysematous spondylitis/osteomyelitis and necrotizing soft tissue infection
• Differential diagnosis of musculoskeletal gas
• Confusing gas and mimickers

The major teaching points of this exhibit are: 1. Gas in the musculoskeletal system varies with different types of etiology 2. Radiologic classification of musculoskeletal gas can be made based on clinical significance 3. The presence of gas in the musculoskeletal system can either exclude or suggest infectious condition. Extensive gas within bone, joint or soft tissue is more likely indicative of musculoskeletal infection.
Posterior Root Meniscal Tears: Preoperative, Intraoperative, and Posteroperative Imaging for Transtibial Pullout Repair

All Day Location: MK Community, Learning Center

Participants
Ron R. Winters, MD, MBA, Houston, TX (Presenter) Nothing to Disclose
Theodore B. Shybut, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Marc H. Willis, DO, Houston, TX (Abstract Co-Author) Nothing to Disclose
Collin D. Bray, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Andrew R. Palisch, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
• Discuss clinical implications of posterior root meniscal tears leading to osteoarthritis• Examine recent radiologic and orthopedic classification of meniscal root tears• Review preoperative imaging and what the surgeon wants to know for transtibial pullout repair• Identify postoperative imaging appearance of transtibial pullout repair

TABLE OF CONTENTS/OUTLINE
• Introduction Anatomy of posterior meniscal root Physiology of meniscus and hoop strength Root tears lead to meniscal extrusion and altered biomechanics resulting in osteoarthritis• Recent classification of posterior root tears Radiologic classification by MRI Orthopedic classification by arthroscopic morphology• Preoperative imaging of meniscal root tear and what the surgeon wants to know Radiographic evaluation for osteoarthritis and Kellgren-Lawrence grading MRI evaluation of root tear including type and location, extrusion, and cartilage grading• Transtibial pullout repair Recent technique to repair root tears to maintain meniscal anatomy and physiology Intraoperative images and video of repair• Postoperative imaging of posterior root tear with transtibial pullout repair Radiographic appearance of transtibial tunnel and cortical button MRI evaluation of root tear repair, extrusion, and cartilage grading• Conclusion and References
Walking the "TightRope": Complications of the Mini TightRope Procedure for Correcting Hallux Valgus Deformity

Participants
James C. Haug, DO, Converse, TX (Presenter) Nothing to Disclose
Liem T. Mansfield, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Mini TightRope procedure is an osteotomy-sparing alternative to correcting hallux valgus deformity. Understanding the anatomy, key steps of the technique, and biomechanics of the foot helps the radiologist become more aware of the common potential surgical complications. Evaluation of intermetatarsal distance and hallux valgus angle are key components that help radiologists detect subtle cases of hardware complications.

TABLE OF CONTENTS/OUTLINE
Arthritis in Blue and Green: Clinical Application of Dual Energy CT (DECT) in Patients with Suspected Crystalline Arthropathy

All Day Location: MK Community, Learning Center

Participants
Michael D. Berven, MD, Fort Sam Houston, TX (Presenter) Nothing to Disclose
Lien T. Mansfield, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Dual energy CT has been shown to be an accurate method of differentiating monosodium urate crystals in gout from calcium pyrophosphate deposition of pseudogout frequently seen within the joints and soft tissues. Differentiating urate from calcium is accomplished by scanning an area using two different CT x-ray tubes in the same gantry simultaneously with energies of 80 kV and 140 kV, which results in characteristic differences in CT numbers in urate and calcium compounds. The characterization of mineral deposition without joint aspiration for crystal analysis with polarized light microscopy allows for rapid, noninvasive diagnosis or exclusion of crystalline arthropathy. DECT may also be used to monitor response to medical therapy. The basic physics of DECT, common associated artifacts, and potential pitfalls will be presented by clinical case examples.

TABLE OF CONTENTS/OUTLINE
Review fundamentals of DECT Interpretation of DECT: conventional, 3D reconstructed, and fused color images DECT artifacts: nail or nail bed, skin, coloring of single pixels or areas less than 1 mm, beam hardening, calcified vessels, motion, thin bone, and clothing Potential pitfalls: calcified intraarticular bodies, acroosteolysis, fracture callus Clinical case examples of crystalline arthropathy characterized by DECT in the different joints of the extremities and spine
Are You Ready to Muscle Up? The Imaging of CrossFit Injuries

All Day Location: MK Community, Learning Center

FDA Discussions may include off-label uses.

Awards
Certificate of Merit

Participants
Jeremiah R. Long, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Daniel E. Wessell, MD, PhD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Michael V. Friedman, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jennifer L. Demertzis, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
John S. Symanski, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Research Consultant, Biomedical Systems
Eric Weiner, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The activity of CrossFit continues to gain popularity as an exercise program. Specific unique exercises in a CrossFit workout can put athletes at risk for common and uncommon injuries. Familiarity with unique exercises in a CrossFit workout is beneficial to the radiologist who is asked to image an athlete injured during a CrossFit workout by better understanding the mechanism of injury and possible pathologies.

TABLE OF CONTENTS/OUTLINE

Purpose/Aim: The purpose of this exhibit is to spotlight several exercises unique to CrossFit and explore cases of injuries which occurred with each exercise. Content Organization: • Review the basic principles and components of a CrossFit exercise program. • Highlight several exercises unique to CrossFit using diagrams and videos. • For each spotlighted CrossFit exercise, we will provide examples of injuries which resulted from the exercise with a focus on the injury mechanism. • In addition, for each injury we will review the relevant anatomy, clinical presentation, imaging appearance and treatment options. Summary: CrossFit is an exercise program which continues to gain popularity. Familiarity with a variety of different CrossFit exercises allows the radiologist to better understand potential injuries that these athletes may encounter.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel E. Wessell, MD, PhD - 2013 Honored Educator
How New MRI Measures of Pelvic Morphology Can Help Us Identify Patients Predisposed to Ischiofemoral Impingement (IFI)

All Day Location: MK Community, Learning Center

Participants
Imran Hafeez, Brooklyn, NY (Presenter) Nothing to Disclose
Giuseppe Cruciata, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Eric J. Ledermann, DO, MBA, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1.) To understand the clinical significance, presentation and evolution of ischiofemoral impingement, and how it is to be diagnosed with MR imaging of the hip and/or pelvis.  
2.) To understand how new MRI measures, namely an increased ischial angle and increased femoral neck angle, are correlated with and may predispose towards ischiofemoral impingement.

TABLE OF CONTENTS/OUTLINE
Clinical Presentation and pathophysiology of ischiofemoral impingement (IFI)  
Comparison with femoral acetabular impingement (FAI)  
Review of recently proposed MRI measures - Ischial angle - Femoral neck angle  
Sample cases  
Future directions and summary
Posterolateral Corner: How to Make it Easy. Multimodality Imaging with Illustrative Review of Anatomy and Component Injuries

All Day Location: MK Community, Learning Center

Participants
Pablo Schwartzman, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Jose Buteler, PhD, Tucuman, Argentina (Abstract Co-Author) Nothing to Disclose
Diego Salgado, MD, Ciudad Autonoma de Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Veronica Alarcon, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Agustin Fernandez Vina, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Gonzalo Galparsoro, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The posterolateral corner is an uncommon site of lesions, which are usually found in the spectrum of ACL or PCL tears. It has several tendinous and ligamentous structures, which makes it particularly difficult to evaluate in a conventional MRI. His knowledge is of fundamental importance as it can modify the surgical treatment. The goal of this exhibit is to present in detail the complex anatomy and imaging findings of posterolateral corner anatomy and associated pathology

TABLE OF CONTENTS/OUTLINE
**Musculoskeletal Correlates of Intra-abdominal Disease: What to Look For**

Participants
Cynthia A. Britton, MD, Pittsburgh, PA (Presenter) Nothing to Disclose

**TEACHING POINTS**

After review of known musculoskeletal manifestations associated with intraabdominal disease in this exhibit, the reader should be capable of: 1. Detection of pertinent accompanying skeletal findings in the company of known intraabdominal disease and guide further clinical or radiologic work-up if appropriate. 2. Suggest further investigation of a previously unsuspected intraabdominal pathology upon discovery of skeletal abnormalities which may be associated with intraabdominal disease.

**TABLE OF CONTENTS/OUTLINE**

Intraabdominal diseases which have musculoskeletal correlates include the following categories which will be illustrated: 1. Syndromes: Gardner's syndrome, nail-patella syndrome, Erdheim-Chester disease. 2. Metabolic diseases: oxalosis, hemosiderosis, amyloidosis, Gaucher's disease, sickle-cell disease. 3. Auto-immune disorders: scleroderma, HLA B27 associated inflammatory bowel disease. 4. Organ failure related to bone metabolism: CRF/secondary hyperparathyroidism, pancreatitis and cirrhosis.
Myxoinflammatory Fibroblastic Sarcoma: A Review of Cases at a Large Academic Institution

All Day Location: MK Community, Learning Center

Participants
Kara D. Gaetke-Udager, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Corrie M. Yablon, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
David R. Lucas, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Yoav Morag, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
After review of this exhibit, the learner will be able to: Discuss the tumor's demographic and pathologic characteristics Describe its range of imaging findings on radiographs and MR Understand clinical and surgical considerations

TABLE OF CONTENTS/OUTLINE
Introduction Low-grade soft tissue neoplasm Most common in distal extremities Pathologic characteristics Complex mixture of ganglion-like cells on inflamed myxoid and fibrosclerotic background Rarely cause osseous destruction Rarely metastasize Clinical considerations Frequently recur Complete surgical resection is crucial Use of adjuvant therapy uncommon Imaging findings in our case series Radiographs Soft tissue mass sometimes seen Osseous destruction is rare MRI T1-weighted images Usually low signal Some lesions have fat signal T2-weighted images Usually high signal Can be heterogeneous Post-contrast images: variable Diffuse homogeneous enhancement Thin peripheral enhancement Conclusions Rare tumor, usually of distal extremities Varied clinical and radiologic presentation Should be considered in the differential diagnosis of soft tissue masses in hands and feet Local recurrence is frequent and complete resection is needed
MK142-ED-X

Bone Metastases from Head and Neck Cancer: Retrospective Analysis of Whole Body MRI (WB-MRI), FDG-PET and CT

All Day Location: MK Community, Learning Center

Participants
Katsuyuki Nakanishi, MD, PhD, Osaka, Japan (Presenter) Nothing to Disclose
Naoyuki Kanayama, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Takashi Fujii, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Toshinari Yagi, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Nobuhiro Araki, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose

TABLE OF CONTENTS/OUTLINE

Educational Abstract Review on a New Procedure. WB-MRI as a new method for bone metastases from HNC which are rare.
Utility of PET-MRI in Musculoskeletal Neoplasms

All Day Location: MK Community, Learning Center

Participants
Ammar A. Chaudhry, MD, Corona, CA (Presenter) Nothing to Disclose
Maryam Gul, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Abbas A. Chaudhry, BSc, Westbury, NY (Abstract Co-Author) Nothing to Disclose
Mubashir Sheikh, Corona, CA (Abstract Co-Author) Nothing to Disclose
Sohaib Mohiuddin, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Elaine S. Gould, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Kevin S. Baker, MD, Stony Brook, NY (Abstract Co-Author) 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 neoplasms.

TABLE OF CONTENTS/OUTLINE

Angles and Measurements of the Hip: A Practical Guide

All Day Location: MK Community, Learning Center

Participants
Felipe D. Castro, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Maira C. Leite, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fernando M. Lima, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Carolina L. Jesus, Campinas, Brazil (Abstract Co-Author) Nothing to Disclose
Luana Belusso, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Rosenfeld, MD, Recife, Brazil (Abstract Co-Author) Nothing to Disclose
Hamilton Guidorizzi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Carlos H. Longo, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Importance of knowing the angles and measurements obtained in pelvic and hip radiography to achieve a correct diagnosis. Pathologies related to changes in the angles and measurements of the pelvis and the hip. Practical step-by-step guide to obtain the angles and measurements.

TABLE OF CONTENTS/OUTLINE
Diagnoses of hip and pelvis disorders are based on the detailed medical history, physical examination and laboratory tests, as appropriate for each condition. Plain radiography is still the initial examination of choice and is used to assess the hips for features and abnormalities associated with hip dysplasia or femoroacetabular impingement, and to exclude other joint conditions such as osteoarthritis and avascular necrosis. Certain lines and angles plotted on radiographs of the pelvis or the hip are useful in diagnosing those congenital or acquired abnormalities, and therefore, the purpose of this article is to create a step-by-step guide to help radiologists to quickly obtain those measurements on their daily routine.
The Patella: Anatomy, Imaging, Variants and Pathology

All Day Location: MK Community, Learning Center

Participants
Luis E. Diaz, MD, Needham, MA (Presenter) Nothing to Disclose
William F. Arndt III, MD, Littleton, MA (Abstract Co-Author) Nothing to Disclose
Ajay R. Goud, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Frank W. Roemer, MD, Boston, MA (Abstract Co-Author) 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, Boston, MA (Abstract Co-Author) President, Boston Imaging Core Lab, LLC; Research Consultant, Merck KgaA; Research Consultant, Sanofi-Aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophic; Research Consultant, AstraZeneca PLC

TEACHING POINTS
Review of anatomy and imaging appearance of the normal patella and adjacent structures Description and assessment of advantages of the different radiographic projections and advanced imaging modalities available for evaluation of patellar disease Imaging analysis of normal/developmental variants encountered at the patella and their differential diagnosis Depiction of common and uncommon patellar pathology including trauma, arthritis, infection and tumors

TABLE OF CONTENTS/OUTLINE
Normal anatomy of the patella and adjacent structures with imaging correlation Radiographic projections and advanced cross-sectional imaging techniques: uses and advantages Developmental and normal variants of the patella Patellar pathology: Trauma, infection, depositional and other conditions.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ali Guermazi, MD, PhD - 2012 Honored Educator
MR Imaging Highlighting Obstacles to Successful Reduction in Developmental Dysplasia of the Hip: A Pictorial Review

All Day Location: MK Community, Learning Center

Participants
Sarah Ebert, BS, Burlington, VT (Presenter) Nothing to Disclose
Thomas G. Powers, MD, Burlington, VT (Abstract Co-Author) Nothing to Disclose
Timothy J. Higgins, MD, Burlington, VT (Abstract Co-Author) Nothing to Disclose
Jennifer Lisle, South Burlington, VT (Abstract Co-Author) Nothing to Disclose
David Aronsson, South Burlington, VT (Abstract Co-Author) Nothing to Disclose
Diego F. Lemos, MD, Shelburne, VT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

This educational exhibit will review key obstacles to successful hip reduction in developmental dysplasia of the hip (DDH). This exhibit will include discussions of: the scope and relevance of DDH, how it is typically diagnosed, and common imaging modalities used to assess DDH as well as a review of imaging, emphasizing key findings known or suspected to contribute to failed hip reduction. The imaging findings will be reviewed with a particular emphasis on MRI.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Review the clinical features of DDH
3. Current imaging algorithm and imaging features of DDH
4. Review key imaging findings of obstacles to successful hip reduction
   a. Interposed labrum
   b. Interposed iliopsoas tendon
   c. Pulvinar hypertrophy
5. Summary
Imaging of Reverse Total Shoulder Arthroplasty: What Radiologists Need To Know

All Day Location: MK Community, Learning Center

Awards
Cum Laude

Participants
Abhijit Datir, MD, Atlanta, GA (Presenter) Nothing to Disclose
Tarek N. Hanna, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Nabile M. Safdar, MD, Alpharetta, GA (Abstract Co-Author) Shareholder, Montage Healthcare Solutions, Inc;
Yulia Melenevsky, MD, Augusta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to: Review basic concepts of reverse total shoulder arthroplasty (rTSA) with indications and contraindications Learn pre- and post-operative imaging analysis of rTSA Illustrate post-operative complications that may lead to prosthesis failure

TABLE OF CONTENTS/OUTLINE

Introduction of rTSA with emphasis on terminology used in surgical literature Pre-operative assessment using radiographs and CT Normal post-operative appearance of rTSA Review of complications of rTSA
**Image-Guided Joint Injections and Aspirations: A Review of Data-driven Decision Points**

All Day Location: MK Community, Learning Center

**FDA**
Discussions may include off-label uses.

**Awards**
Cum Laude

**Participants**
David B. Khatami, MD, PhD, Boston, MA (Presenter) Nothing to Disclose
Jennifer Nimhuircheartaigh, MBBCh, Boston, MA (Abstract Co-Author) Nothing to Disclose
Samuel D. Madoff, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mary G. Hochman, MD, West Roxbury, MA (Abstract Co-Author) Stockholder, General Electric Company; Stock options, Nomir Medical Technologies, Inc; Author, UpToDate, Inc

**TEACHING POINTS**

1. Infection rates and strategies for infection control during joint interventions.
2. Potential side effects and toxicity of intra-articular anesthetics.
3. Benefits and potential harm from injectable steroids.
4. Safety and efficacy of different gadolinium contrast media in MR arthrography.

**TABLE OF CONTENTS/OUTLINE**

The use of image-guided percutaneous joint procedures has become increasingly popular, with considerable variation in protocols across institutions. The musculoskeletal interventionalist should understand the rationale and safety profiles for the actions and medications s/he uses during joint interventions. This exhibit reviews current literature for percutaneous joint procedures, in general, as it pertains to patient safety and procedural efficacy. Topics include (a) Rate of septic arthritis from interventional procedures and role of measures to reduce risk of infection. (b) Local anesthetic formulations’ mechanism of action, dose considerations, and potential adverse effects, including potential chondrotoxicity. (c) Corticosteroid preparations’ mechanism of action, contraindications, and potential adverse effects, including tissue necrosis and tendon rupture and measures to mitigate injury. (d) Optimization of gadolinium for MR arthrography including types of agents, concentrations, and safety considerations.
TEACHING POINTS

1. Radiologists, radiology technologists, sonographers, radiology nurses, and other departmental personnel are at risk of a wide variety of musculoskeletal injuries, especially those caused by repetitive stress to the upper extremities.  
2. Musculoskeletal radiologists play an important role in diagnosing and treating work-related injuries that can occur in a radiology department.

TABLE OF CONTENTS/OUTLINE

Review common and rare musculoskeletal injuries that can occur during a typical workday to radiology personnel, including radiologists, technologists, and nurses. Review the literature on this subject. Detail a variety of these conditions, highlighting the role of musculoskeletal radiology in diagnosis and treatment of these conditions. Topic covered will include (but are not limited to):

- Cubital Tunnel Syndrome
- Carpal Tunnel Syndrome
- DeQuervain's Tenosynovitis
- Tendinitis
- Joint injuries (bursitis, osteoarthritis, synovitis)
- Back/disc injury
- Repetitive strain injuries

Image-rich exhibit will review etiology of injuries, how to diagnose, treatment options, and ways to prevent such injuries from recurring or occurring in the first place.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:

https://www.rsna.org/Honored-Educator-Award/

Douglas S. Katz, MD - 2013 Honored Educator
Douglas S. Katz, MD - 2015 Honored Educator
Radiographic Assessment of the Post-Operative Knee with Surgical and Imaging Correlation

All Day Location: MK Community, Learning Center

Participants
Adam D. Singer, MD, Atlanta, GA (Presenter) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Paul D. Clifford, MD, Miami Shores, FL (Abstract Co-Author) Nothing to Disclose
Abhijit Datir, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Juan Abelardo Augusto Pretell, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Michael Baraga, Miami, FL (Abstract Co-Author) Nothing to Disclose
Jonathan Tresley, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Monica B. Umpierrez, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Jean Jose, MS, DO, Miami Beach, FL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- A wide variety of surgical procedures are performed on the knee. The radiologist must be able to identify post-operative findings seen on radiographs as a history may not be provided. Radiographic features suggesting surgical failure must be recognized.

TABLE OF CONTENTS/OUTLINE
- Review intra-operative and post-operative radiographic appearances of commonly performed knee surgeries with arthroscopic and MRI correlation
- Describe the role of the radiologist when reporting on these radiographs
- Sports - ACL reconstruction - PCL - MCL - Chondral injury - Extensor mechanism
- Trauma - Tibial plateau - Patellar fracture - Distal femoral - Proximal tibiofibular joint instability
- Degenerative - Arthroplasty - Total knee arthroplasty - Hemiarthroplasty
- Tumor - Curetting and grafting/cementoplasty - Endoprosthesis
A Case Based Review of Syndromes Associated with Musculoskeletal Pathology

Participants
Christina Ma, MD, Los Angeles, CA (Presenter) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
Kira Chow, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Sulabhata Masih, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Musculoskeletal syndromes are often challenging to remember due to their uncommon incidence and assortment of symptoms/features. The purpose of this educational exhibit is to use a case-based approach to review multiple syndromes associated with musculoskeletal pathology. Each entity will be accompanied by a discussion of pertinent epidemiology, pathology, clinical presentation, imaging features, treatment and prognosis, and differential diagnosis.
Tendons, Entheses and Peritendinous Environment on High Resolution MRI: Which Findings Can Predict Symptoms, Which Are Usually Asymptomatic and Which Are Pitfalls or Normal Variants?

Awards
Certificate of Merit

Participants
Eric M. Bimbato, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Carlos H. Longo, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hamilton Guidorizzi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, SAO PAULO, Brazil (Abstract Co-Author) Nothing to Disclose
Bruna O. Aburjeli, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paula Musa Aguiar, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo V. Espirito Santo, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Juliana S. Goncalves, MD, Brasilia, Brazil (Abstract Co-Author) Nothing to Disclose
Ana Laura G. Palma, MD, Itu, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review high resolution and less known structural anatomy of tendons, entheses and peritendinous environment. Demonstrate, through high quality MR images, findings that are most usually associated with symptoms, those that are commonly asymptomatic, and differentiate them from pitfalls and normal variants. Highlight the importance of clinical correlation in the evaluation of these imaging findings.

TABLE OF CONTENTS/OUTLINE
Recognize normal tendon anatomy and its surrounding structures, anatomical variants and artifacts are extremely important, but not always enough for adequate interpretation of some HR MRI findings. Similar tendon changes may be present in different individuals with and without symptoms, characterizing or not pathological processes, what can be challenging for radiologists. Thus, it is mandatory to know how to identify unequivocal pathological tendon changes and search for associated findings that might help the radiologist in the diagnostic work up through close clinical correlation. Therefore, the purpose of this review is mainly to provide some tools that can assist the radiologist in the determination of which tendon and peritendinous changes should be stressed, according to the clinical picture, which is a fundamental aspect for proper imaging interpretation.
Simple Approach to Lauge-Hansen Classification of Ankle Injuries

All Day Location: MK Community, Learning Center

Participants
Andrew L. Chang, MD, Orange, CA (Presenter) Nothing to Disclose
Taiki Nozaki, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Shoichiro Takao, MD, PhD, Tokushima, Japan (Abstract Co-Author) Nothing to Disclose
Shigeo Hagiwara, MD, PhD, Chiba, Japan (Abstract Co-Author) Nothing to Disclose
Yasuhito Kaneko, MD, PhD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Hiroshi Yoshioka, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review ankle anatomy and mechanism of ankle injuries. 2. To present 3 step-approach to Lauge-Hansen classification which is easy and facilitates diagnosis of ankle injuries.

TABLE OF CONTENTS/OUTLINE

Look for "avulsion" - medial, lateral, or superior of the ankle mortise. Injury starts with avulsion (widening), which tells you either adduction, abduction, or external rotation injury. Look for "fibular fracture" - below or above the ankle mortise. Level of fibular fracture tells you either adduction, abduction, or external rotation injury. Staging matrix consists of ankle position and clockwise/counterclockwise progression. Staging starts with an avulsion site and progresses with clockwise direction in adduction/abduction injury and with counterclockwise direction in external rotation injury on the right ankle.

6. Clinical case quiz
Normal Skeletal Development and Imaging Pitfalls of the Calcaneal Apophysis: MRI Features

Awards
Cum Laude

Participants
Ignacio Rossi, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Chimere Mba-Jonas, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jonathan S. Zember, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Christopher Morley, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Annie M. Wang, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Increased sports participation of children has given rise to greater incidence of localized heel pain and calcaneal apophysitis (Sever's disease). The available literature, however, provides minimal guidance for distinguishing normal MRI of the calcaneal apophysis from true disease. This exhibit will familiarize the viewer with, previously unreported, sequential MRI stages in development of the posterior calcaneal apophysis and provide clues for distinguishing normal maturation from pathology.

TABLE OF CONTENTS/OUTLINE

The following topics, regarding the development of the calcaneal apophysis, will be discussed. MRI morphology and signal characteristics of the non-ossified apophysis. Time table for formation and fusion of the secondary ossification centers. Morphology of the secondary ossification centers at different stages of maturation. Signal characteristics of the secondary ossification centers. Other features simulating disease such as foci of low signal in non ossified cartilage and linear low signal within the ossification centers, distinct from the growth plate. Clues to distinguishing normal MRI development from imaging pitfalls such as avascular necrosis, Sever's disease, osteomyelitis, and fracture.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Zehava S. Rosenberg, MD - 2014 Honored Educator
Ultrasound Evaluation of Peripheral Nerve Injury and Postoperative Treatment

All Day Location: MK Community, Learning Center

Participants
Alberto A. Simoncini, MD, Shreveport, LA (Presenter) Nothing to Disclose  
Anne Hollister, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose  
Eduardo C. Gonzalez-Toledo, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose  
Cinzia A. Bartoletti, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose  
Guillermo P. Sangster, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose  
Simon Long, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1-Describe the normal sonographic appearance of the peripheral nerve.  
2-Discuss the capabilities and limitations of ultrasound to evaluate the nerve in trauma.  
3-Review the role of ultrasound in the postoperative follow up.

TABLE OF CONTENTS/OUTLINE

1) Ultrasound appearance of the normal peripheral nerve  
2) Classification of peripheral nerve injury  
3) High resolution ultrasound in acute trauma  
   a. Nerve Laceration  
   -Gunshot wound  
   -Stab wound  
   b. Nerve injury after fracture  
   c. Nerve injury after joint dislocation  
   -Stretch injury  
   -Extrinsic compression  
   d. Nerve dislocation  
4) Limitations of ultrasound  
   -Soft tissue air  
   -Foreign bodies  
   -Edema  
   -Pain  
5) Status post nerve repair  
   -Nerve discontinuity  
   -Postoperative neuroma in continuity  
   -Perineural fibrosis  
6) Conclusion  
1- Ultrasound should be the first line imaging technique in patients with suspected nerve injury  
2- Ultrasound is adequate and cost effective for the evaluation of the affected nerve and adjacent soft tissues  
3- Ultrasound is an invaluable tool for the postoperative evaluation
TEACHING POINTS

There are a variety of hip preservation surgeries which are increasing in prevalence. Many radiologists may be unfamiliar with these surgical procedures as they are innovative and constantly evolving. Radiologists need to be aware of the expected post surgical findings along with post-surgical complications to adequately care for the patients undergoing these surgical procedures. The purpose of this educational exhibit is to review the expected post-surgical appearance of patients undergoing hip preservation surgery along with the unexpected post-surgical complications.

TABLE OF CONTENTS/OUTLINE


**Osseous and Non-Osseous Tumors and Tumor-Like Lesions of the Foot and Ankle**

All Day Location: MK Community, Learning Center

**Participants**
Simmi Deo, BS, Chula Vista, CA (Presenter) Nothing to Disclose
Rubens C. Santos Neto, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Edward Smikaman, MD, West Hartford, CT (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
- Use imaging features to formulate a limited DDx of lesions about the foot and ankle
- Prevent delay/misdiagnosis of malignant lesions, and avoid tumor mimickers.

**TABLE OF CONTENTS/OUTLINE**

Title: Osseous and Non-Osseous Tumors and Tumor-Like Lesions of the Foot and Ankle

Teaching Points:
- Use imaging findings to create a DDx for tumors and tumor-like lesions about the ankle and foot
- Prevent delay/misdiagnosis of malignant lesions, and avoid tumor mimickers

Outline:
- Zones of the Foot
- Radiographs
- Osteochondroma
- Subungal Exostosis
- Dupuytren Exostosis
- Ultrasound
- Cystic vs noncystic lesions
- MR T1 vs T2
- Bone tumors vs soft-tissue tumors vs tumor-like lesions
- Lesions Will go over 20 diagnoses, both benign and malignant lesions.
  - Including, but not limited to: Vascular lesions
  - Lipomas/Xanthomas
  - Inflammatory: gout/rheumatoid nodules
  - Tumors
  - Tendon tears
  - Accessory muscles

Conclusions:
- Knowledge of imaging features, disease behavior, and location can help narrow DDx of foot and ankle lesions
- Malignancy should NOT be ruled out based on chronicity
- If a lesion remains indeterminate consider biopsy
- Keep tumor-like lesions and mimickers in mind
The Anesthesiologists' Blind Side: Anatomy of the Spine and Its Importance in Central Blockades

All Day Location: MK Community, Learning Center

Participants
Maria Eugenia Arias L., MD, Sant Joan D'Alacant, Spain (Presenter) Nothing to Disclose
Patricia Martin, MD, Alicante, Spain (Abstract Co-Author) Nothing to Disclose
Paula Bartumeus, PhD, San Juan De Alicante, Spain (Abstract Co-Author) Nothing to Disclose
Jorge Hernando, MD, Alicante, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To review the radiological anatomy of the spinal region. To explore the notions of lumbar puncture and central blockades techniques. To describe the possible variants and pathologies that have to be considered when performing these techniques.

TABLE OF CONTENTS/OUTLINE
MRI Evaluation of Brachial Plexus. A Pictorial Review of Traumatic and Non-traumatic Conditions

All Day Location: MK Community, Learning Center

Participants
Rupak Dutta, FRCR, Singapore, Singapore (Presenter) Nothing to Disclose
Pratik Mukherjee, MBBS, FRCR, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Krishna M. Gummalla, DMRD, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Matthew George, FRCR, MMed, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. MRI anatomy and localization.
2. Determine injury type in trauma.
3. Imaging findings in neoplasia.
4. Radiation induced plexopathy.
5. Treatment options.

TABLE OF CONTENTS/OUTLINE
MRI imaging is the modality of choice for evaluation of brachial plexus. Accurate localization and characterizing the injury type i.e., preganglionic or postganglionic with severity neuropraxia/axonotmesis/ neurotmesis or mixed type are essential for deciding the treatment options. Clinical assessment, EMG with nerve conduction studies and MR imaging form the basis of treatment, conservative or surgical. A retrospective study of 25 cases done from 2008 to 2014 at our hospital. Supraclavicular involvement was the commonest. Supra and retroclavicular injuries were more commonly seen with trauma and tumours. Infraclavicular was common with penetrating and post radiation injury. Conservative treatment was adopted in most cases with the MR and EMG/ NCS diagnosis of Neuropraxia. Complete avulsion of the preganglionic nerve on MR was considered neurotmesis. EMG and NCS was used for assessment and follow up. A few residual fibres may give false results. Preganglionic avulsion injuries was surgically treated with nerve graft and nerve transfers was used for postganglionic injuries for patients showing no improvement even after 6 to 9 months of conservative T/t.
Beyond Hardware Loosening: Multi-modality Imaging of the Postoperative Ankle

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Ashley Burt, MD, San Diego, CA (Presenter) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Jackie Holt, Anchorage, AK (Abstract Co-Author) Nothing to Disclose
Alice S. Ha, MD, Seattle, WA (Abstract Co-Author) Grant, General Electric Company
Karen C. Chen, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Ankle injuries are common injury; however, postoperative instrumentation, beyond open reduction and internal fixation of fractures of the ankle, is less common. The objective of this educational exhibit is to:
1. Familiarize the reader with various surgical procedures at the ankle.
3. Identify post-surgical complications associated with the various surgical procedures.

TABLE OF CONTENTS/OUTLINE

- Briefly review normal ankle anatomy.
- Discuss imaging optimization in magnetic resonance imaging, computed tomography, and ultrasound.
- Identify common injuries of the ankle and expected postoperative appearance after surgical fixation.
1. Achilles tendon
   1a. Direct tendon repair
   1b. Tendinosis debridement and Flexor Hallucis Longus Transfer
2. Posterior tibialis tendon
3. Tibialis anterior tendon
4. Lateral ligamentous reconstruction
   4a. Brostrom procedure
   4b. Evans procedure
   4c. Chrisman-Snook procedure
5. Plantar fascia injuries
6. Osteochondral allograft
7. Tibiotalar arthroplasty
- Showcase potential complications of surgical procedures.
TEACHING POINTS

Review the anatomy of the triangular fibrocartilage complex (TFCC) in detail. Illustrate all the different kinds of lesions in TFCC, including PALMER and No PALMER. To simplify the classifications described in the literature, and determining which are the important points to describe in MRI and Arthro MRI (ARM) report in order to help the orthopedic surgeon to decide best therapeutic option.

TABLE OF CONTENTS/OUTLINE

Anatomy of TFCC
Clinic and mechanism of the TFCC injuries
Palmer injuries of TFCC: Palmer I Palmer I A Palmer IIB and spectrum of injuries
Palmer IC Palmer ID Palmer II (unocarpal impaction) Palmer II A, IIB,IIIC,IIID and IIIEDifferential diagnosis of ulnocarpal impaction syndrome (UCI)
Ulnar variance as a factor in UCI
Palmer injuries: Dorsal capsular detachment: Dorsal carpal detachment or Nishikawa lesion.
Horizontal tear. Mixed lesions.
Conclusión: Propose an simple way to understand and describe TFCC injuries in the radiological report based in the morphology and localization of the injuries and whether there are associated lesions to avoid erroneous interpretations.
Importance and use of Arthro MRI in TFCC injuries: We need to understand the anatomy so that we can understand the different types of injuries.
Multimodality Imaging Features of Reflex Sympathetic Dystrophy Syndrome (Chronic Regional Pain Syndrome)

All Day Location: MK Community, Learning Center

Participants
Rammohan Vadapalli, MD, Hyderabad, India (Presenter) Nothing to Disclose
Anuj Jain, MD, Hyderabad, India (Abstract Co-Author) Nothing to Disclose
Abhinav Sriram S. Vadapalli, Pune, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To elucidate the common and uncommon Multimodality Imaging features of RSD (Reflex sympathetic Dystrophy).
2. To illustrate clinical scenarios associated with this condition and introduce the resident an easy to remember clinical and imaging check list and characterization mantras with differential diagnosis.

Reflex sympathetic dystrophy syndrome (RSDS) is a disorder of unclear etiology. It is characterized clinically by pain, vasomotor disturbances (vasospasm or vasodilatation) and trophic skin changes (skin atrophy, pigmentation abnormalities, hypertrichosis, hyperhidrosis, and nail changes) and radiographically by regional osteoporosis in the affected area. Reported instigating causes of RSDS include myocardial infarction, cerebrovascular disorders, degenerative disease of the cervical spine, discal herniation, polymyalgia rheumatica, calcific tendinitis, vasculitis, neoplasm elsewhere (lung, brain, breast, ovary, pancreas, bladder, etc.), and a variety of posttraumatic, postsurgical, and postinfectious states.

TABLE OF CONTENTS/OUTLINE
1. Reflex sympathetic dystrophy, its pathophysiology, clinical scenarios, risk factors are showcased.
2. Radiographic, CT, MRI and Bone scan findings of RSD are illustrated.
**Awards**

**Certificate of Merit**

**Participants**

Ana Laura G. Palma, MD, Itu, Brazil *(Presenter)* Nothing to Disclose  
Eric M. Bimbato, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Bruna O. Aburjeli, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Paula Musa Aguiar, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Marcelo V. Espirito Santo, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Juliana S. Goncalves, MD, Brasilia, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Fabiano N. Cardoso, MD, SAO PAULO, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Andre Y. Aihara, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Hamilton Guidorizzi, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Carlos H. Longo, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**

Characterize imaging findings of myositis ossificans during its different phases. *Key findings to help you make the diagnosis of myositis ossificans. Illustrate the main differential diagnosis according to its stages.*

**TABLE OF CONTENTS/OUTLINE**

Myositis ossificans in its early stages has a non-specific imaging appearance, which can mimic a number of different pathologies. It starts as a rapidly evolving soft tissue mass, normally associated with inflammatory signs and symptoms, driving the attending physician towards more ominous diagnosis, particularly when it is not associated with a traumatic event. MR imaging, the method of choice when evaluating a soft tissue mass, can have an aggressive appearance, particularly in early phases, simulating malignant pathologies and making the correct understanding of myositis ossificans' maturation even more relevant to radiologists. Diagnostic highlights include zoning organization in histological analysis, large perilesional edema, not proportional to mass' size and centripetal ossification pattern.
Massys' 16th century portrait 'The Ugly Duchess' depicts an unfortunate lady who was later thought to have suffered from Paget's disease of bone. While this remains a common condition, the incidence of this non-inflammatory, metabolic disorder is on the decline, yet its aetiology eludes us to this day. Once advanced, this disease causes significant morbidity in affected individuals. The pathognomonic radiological features of Paget's disease often allow for a confident diagnosis to be made on conventional radiography alone. These features correlate with the histopathological process at each stage of the disease be it the osteolytic, mixed osteolytic/osteoblastic or osteosclerotic phase. These phases may present in the same patient, or indeed in the same bone, in a synchronous or metachronous manner. The most commonly affected sites in the appendicular skeleton are proximal long bones, the femur being the most favoured. Complications range from bowing and deformity, banana fractures, complete shaft fractures which exhibit non-union, and sarcomatous change.
The concept of female beauty has changed throughout time, but the form and size of the breasts and gluteal region have remained constant as symbols of maximum femininity. The growing number of buttock implant surgery in Latin countries and even in USA brought the radiologist the need for knowledge on how to interpret and describe the gluteal implants.

Two types of implants have been used for gluteal augmentation; silicone gel breast (rarely used in the USA); and solid/semi-solid gluteal implants, the only device FDA-approved for this purpose. Both implants can be inserted intramuscularly, but the silicone-gel can also be inserted subfascially. Post-operatively, the aspects to be evaluated on imaging are localization, symmetry, presence of capsular contracture and distance from the sciatic nerve. The presence of peri-implant fluid collection can be physiologic and it should be differentiated from seroma, hematoma and abscess. The most common complication of these procedures is dehiscence of the suture. Implant rupture with or without silicone leakage in the adjacent soft tissues can also be seen when silicone gel is used. In this study we demonstrate the normal aspect and common complications of gluteal implants on CT and MRI.
TEACHING POINTS

Importance of disc herniations. Presentation of the new lumbar disc nomenclature by the North American Spine Society. Practical guide to crystalize current concepts in radiological practice.

TABLE OF CONTENTS/OUTLINE

Disc herniations are common clinical events and are responsible for most of imaging studies performed. Therefore it is necessary to establish a standard nomenclature that can be used and understood among different groups of physicians. An update of the 2001 original article was launched in November 2014 by the North American Spine Society, the American Society of Spine Radiology and the American Society of Neuroradiology, with some modifications, which include, among others: replacement of the term broad based hernia for bulging disc and the disuse of the annular tear term, which should be replaced by annular fissure. The purpose of this article is to present the new classification of disc disease and crystalize current concepts in radiological practice, contributing to its acceptance among physicians involved in the diagnosis and treatment of disc disease.
Radiographic Evaluation of Lower Extremity Coronal Plane Deformities: Practical Reporting for Orthopedic Surgeons

All Day Location: MK Community, Learning Center

Awards
Cum Laude

Participants
Albert J. Song, MD, Maywood, IL (Presenter) Nothing to Disclose
Kristen Bird, MD, Maywood, IL (Abstract Co-Author) Nothing to Disclose
Laurie M. Lomasney, MD, Oak Park, IL (Abstract Co-Author) Consultant, Reed Elsevier
Mitchell Bernstein, Maywood, IL (Abstract Co-Author) Nothing to Disclose
S R. Rozbruch, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Introduction and brief review of acquired and congenital etiologies of lower extremity deformity. Discuss how the mechanics of lower extremity deformity and limb length inequalities cause altered gait and joint mechanics and can lead to accelerated degeneration of joints in the form of arthritis and pain. Summarize the radiographic screening technique - 51 " hip to ankle standing anteroposterior view of the lower extremities. Step by step evaluation of lower extremity alignment - the mechanical axis and review of normal alignment Deformity assessment - case studies to illustrate identification of the center of rotation of angulation (CORA) and magnitude of coronal deformities. Basic principles for calculation of angularity and bone length contributing to lower extremity deformity and imaging contribution to planning correction will be reviewed.

TABLE OF CONTENTS/OUTLINE
Introduction, etiology and biomechanics Radiographic Technique Evaluation of lower extremity alignment Deformity Assessment Summary
Radiographic Evaluation of Hardware Failure in the Lower Extremity: What Every Radiologist Should Know

All Day Location: MK Community, Learning Center

Participants
Travis E. Meyer, MD, Brooklyn, NY (Presenter) Nothing to Disclose
Ryan Braun, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Srinivas Kolla, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Alex B. Maderazo, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Darren Fitzpatrick, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Scott A. Lehto, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The cornerstone of hardware evaluation has long been, and remains, plain radiography. Advances in CT and MRI have improved the ability to problem solve complications and to improve preoperative planning. However, a strong foundation in basic radiographic principles is still crucial when evaluating orthopedic hardware in both the immediate and extended post-operative periods. This presentation will provide a review of common lower extremity orthopedic hardware complications and their associated radiographic findings with cross-sectional correlation.

TABLE OF CONTENTS/OUTLINE
Many common lower extremity orthopedic hardware complications are presented in quiz format. The cases shown will focus on a range of complications involving hardware of the lower extremity. A discussion of the pertinent radiographic findings with CT/MRI correlation, mechanism of failure and clinical significance/management will accompany each case.
Archenemies of the Foot: Current Concepts of the Pes Cavovarus Deformity for Radiologists

All Day Location: MK Community, Learning Center

Participants
Alvin R. Wyatt II, MD, Seattle, WA (Presenter) Nothing to Disclose
Gregor M. Dunham, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Jack A. Porrino JR, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Hyojeong Mulcahy, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Following review of this exhibit, the reader will have a detailed understanding of the:
1) Pathophysiology and radiographic appearance of the pes cavovarus deformity.
2) Common surgical techniques utilized for correction of this abnormality, their normal imaging appearance, and unexpected post-operative complications.

TABLE OF CONTENTS/OUTLINE
This exhibit details the salient aspects of the pes cavovarus deformity, highlighting the following topics:
1) Normal arch anatomy of the foot.
2) Pathophysiology of arch dysfunction that leads to pes cavovarus deformity.
3) Important radiographic signs in the diagnosis of pes cavovarus.
4) Imaging appearance of common surgical corrective procedures for pes cavovarus.
5) Postoperative complications in pes cavovarus correction.
Magnetic Resonance Neurography for Peripheral Nerve Disorders: A Comprehensive Review

Awards
Certificate of Merit

Participants
Shuji Nagata, MD, Kurume, Japan (Presenter) Nothing to Disclose
Hiroshi Nishimura, MD, Chikushino, Japan (Abstract Co-Author) Nothing to Disclose
Kimberly K. Amrami, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Hideo Arai, Chikushino, Japan (Abstract Co-Author) Nothing to Disclose
Aiko Sumi, MD, Kurume, Japan (Abstract Co-Author) Nothing to Disclose
Ryoji Iwamoto, Kurume, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Nishimura, MD, Chikushino, Japan (Abstract Co-Author) Nothing to Disclose
Kimberly K. Amrami, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Hideo Arai, Chikushino, Japan (Abstract Co-Author) Nothing to Disclose
Ryoji Iwamoto, Kurume, Japan (Abstract Co-Author) Nothing to Disclose
Hideo Arai, Chikushino, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the MR neurography techniques for the evaluation of peripheral nerves. To illustrate normal appearance of the peripheral nerve and the spectrum of peripheral nerve disorders. To discuss the utility of diffusion weighted MR neurography and diffusion tensor MR neurography.

TABLE OF CONTENTS/OUTLINE
MR neurography (MRN) is a rapidly advancing technique and its role is increasing in interpretation of peripheral nerve disorders. This presentation will start with techniques for getting relevant morphological MRN (such as STIR/fat-suppressed T2WI, 3D isotropic T1WI and T2WI) and functional MRN (such as diffusion weighted MRN [DW-MRN] and diffusion tensor MRN [DT-MRN]). We illustrate the normal appearance of the peripheral nerve and many conditions affected the peripheral nervous system, such as peripheral nerve sheath tumor, neural fibrolipoma, perineuroma, metastasis, neural lymphoma, Morton neuroma, traumatic neuroma, intemeural ganglion, amyloidoma, chronic inflammatory demyelination polyneuropathy, and Parsonage-Turner syndrome. We also discuss several pitfalls of MRN in order not to misdiagnose. DW-MRN and DT-MRN have been proposed as valid tools for nerves evaluation because they provide both morphological and physiological information at the same time. We emphasize the usefulness of DW-MRN and DT-MRN.
TEACHING POINTS

Traumatic femoral head fractures are associated with 5-15% of hip dislocations, typically in high-energy trauma. The Pipkin classification system predicts clinical outcome and guides management. Higher grade fractures are associated with poorer outcomes and more complications. Complications include avascular necrosis (AVN), sciatic nerve injury, osteoarthritis, labral tears, transverse ligament and ligamentum teres injury. Sciatic nerve injury and AVN are the most common and serious complications. Other causes of femoral head fractures include; stress/insufficiency, pathologic and non-traumatic AVN-related fractures. Each has unique clinical considerations, management and prognosis.

TABLE OF CONTENTS/OUTLINE

Introduction Distinction between traumatic and non-traumatic femoral head fractures Association between traumatic femoral head fractures and posterior hip dislocation Traumatic femoral head fractures Pipkin classification system Examples of each subtype Management Clinical outcomes Complications of femoral head fractures Other causes of femoral head fractures - stress/insufficiency, pathologic and non-traumatic AVN-related fractures. Clinical context of each subtype Role and features of multimodality imaging Management Conclusion References
High Resolution MRI of Intraarticular Pathology of the Ankle Joints

Awards
Certificate of Merit

Participants
Oscar L. Casado, MD, Galdacano, Spain (Presenter) Nothing to Disclose
Estrella P. Sanchez, Victoria, Spain (Abstract Co-Author) Nothing to Disclose
Jose T. Aurrekoetxea, MD, Galdakao, Spain (Abstract Co-Author) Nothing to Disclose
Maria Jose Ereno Ealo, MD, Galdacano, Spain (Abstract Co-Author) Nothing to Disclose
Gorostiola Lide, Galdakao, Spain (Abstract Co-Author) Nothing to Disclose
Arsenio Diego, Galdakao, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To know potential ways to perform high resolution MRI of the ankle joints.
2. To know the additional information provided by high resolution imaging of the ankle in order to improve clinical decision-making.
3. To review different surgical and imaging classifications of osteochondral lesions of the ankle.
4. To know the potential use of high resolution imaging in cartilage lesions of the distal tibia, posterior subtalar joint, assessment of chondral and osteochondral loose bodies including cartilaginous component of synovial chondromatosis, intraarticular adhesions and synovial changes in ankle impingement syndromes.

TABLE OF CONTENTS/OUTLINE
1. To discuss current types of high resolution MRI techniques.
2. To review different classifications of chondral and osteochondral lesions in the tibiotalar and subtalar joints.
3. To discuss intraarticular findings associated to ankle injuries including chondral and osteochondral disease, intraarticular adhesions and plicae, synovial abnormalities associated to impingement syndromes, synovial osteochondromatosis and loose bodies.
4. To show the usefulness of high resolution techniques in the assessment of intraarticular extension of subchondral bone lesions/tumours.
5. To discuss artefacts and limitations of these techniques.
Differentiating Anterior Glenoid Labral Tears from Normal Variants - A BankART and a Science!

All Day Location: MK Community, Learning Center

Participants
Kathryn J. Stevens, MD, Menlo Park, CA (Presenter) Nothing to Disclose
Mark Sun, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Review anatomy and normal variants of the anterior glenoid labrum using anatomic diagrams and MR images
2) Illustrate common injuries involving the anterior labrum
3) Provide practical tips on how to differentiate labral tears from normal variants
Awards
Certificate of Merit

Participants
Elena Barcina-Garcia, MD, Madrid, Spain (Presenter) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Javier Azpeitia Arman, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Noelia Arevalo, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Miguel Grande, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Maria Carretero Arbona, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- To describe the normal anatomy of the Achilles tendon.
- To review the US study protocol for the evaluation of the Achilles tendon, and the optimized MRI protocols.
- To illustrate the spectrum of lesions involving the Achilles tendon, reviewing sonographic and MRI appearances of the most prevalent pathologic disorders and correlating the findings with clinical presentation.
- To emphasize pitfalls, diagnostic difficulties and differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Both clinical and imaging findings in different entities are presented, highlighting distinguishing features that may aid in detection of lesions, differential diagnosis and recommended diagnostic work-up. We present:
1. Anatomy.
2. Imaging. US Technique and study protocol. MRI protocols.
- Insertional tendinopathy: enthesopathy, retro-calcaneal bursitis/Haglunds´s syndrome.
5. Percutaneous Therapy: Imaging findings after percutaneous interventions with clinical correlation.
TEACHING POINTS
To know detailed normal anatomy of the collateral ligaments, anterolateral ligament and corners (posterolateral and posteromedial).
To know how to describe ligament injuries and understand main associated lesions. To recognize damage to these structures on magnetic resonance imaging (MRI). To detect lesions, such as osseous contusion and ligament tear, and concomitant injuries on MRI. To detect MRI abnormalities in order to predict injury mechanism. To know main features that the orthopedic surgeon needs to know.

TABLE OF CONTENTS/OUTLINE
Ligaments and corners of the knee are anatomic units composed of a complex arrangement of structures. We will study several successive anatomical structures: - anterolateral ligament, - lateral collateral ligament, - posterolateral corner, - medial collateral ligament - posteromedial corner. For each structure, we will describe: - normal anatomy and MRI findings, - overview of specific patterns of injury and associated anomalies, - abnormal MRI patterns.
Ultrasound Imaging of Peripheral Neuropathy: Pictorial Review with MRI Correlation

All Day Location: MK Community, Learning Center

Participants
Oganna K. Nwawka, MD, New York, NY (Presenter) Nothing to Disclose
Satinder S. Rekhi JR, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Yoshimi Endo, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
John A. Carrino, MD, MPH, New York, NY (Abstract Co-Author) Consultant, BioClinica, Inc; Consultant, Pfizer Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc;
Swati Deshmukh, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Darryl B. Sneag, MD, Chestnut Hill, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Ultrasound is highly useful in the evaluation of peripheral neuropathy, and can detect neuritis, mechanical dysfunction (impingement, dislocation) and posttraumatic changes. Understanding the normal sonographic appearance of nerves proves useful in the detection of nerve pathology. Ultrasound and MRI have both overlapping and distinct advantages in the evaluation of peripheral neuropathy.

TABLE OF CONTENTS/OUTLINE
Overview: Peripheral nerve anatomy/histology Normal sonographic appearance of peripheral nerves Ultrasound imaging technique in peripheral neuropathy Ultrasound evaluation of nerve pathology with MRI correlation: Case-based pictorial review Trauma Accidental iatrogenic Inflammation Mechanical dysfunction Impingement Subluxation/Dislocation Ultrasound vs. MRI advantages and disadvantages in nerve imaging Dynamic examination Contralateral evaluation Vascular assessment Ultrasound-guided perineural intervention Summary and conclusion References

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

John A. Carrino, MD, MPH - 2013 Honored Educator
John A. Carrino, MD, MPH - 2015 Honored Educator
TEACHING POINTS

The purpose of this exhibit is: To classify the foot lesions according to incidence (Common, Less common, Rare). To show the age and site distribution about lesions of the foot. To explain the characteristics of each lesion with emphasis on the differentiation from a lesion in other long bones except for the foot.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Background
3. Classification of the incidence about the foot lesions - Common: Lipoma, Simple bone cyst, Osteochondroma - Less common: Ganglion cyst, Aneurysmal bone cyst, Chondroblastoma, Chondrosarcoma, Osteoid osteoma, Osteosarcoma, Ewing sarcoma - Rare: Fibrous dysplasia, Chondromyxoid fibroma, Periosteal chondroma, Rosai-dorfman disease, Melorheostosis
4. Distribution of the bone lesions (about Common and Less common types) - age - site in the foot bone (e.g., talus, calcaneus, phalanges, metatarsal bones, etc.)
5. Image findings of each lesions - with emphasis on differentiation from the occurrence in other long bones except for the foot.
MR Imaging Spectrum of Abnormal Extensor Compartment of Knee in Children and Young Adults

All Day Location: MK Community, Learning Center

Participants
Pankaj Nepal, MD, Doha, Qatar (Presenter) Nothing to Disclose
Devendra Kumar, MBBS, MD, Hamilton, ON (Abstract Co-Author) Nothing to Disclose
Subramaniyan Ramanathan, MD, MBBS, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Habeeba Hena, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Saeed S. Emam Mohammed, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Mahmoud Al Raheem Heidous, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To demonstrate imaging findings in children and young adults who present with persistent knee pain with reference to extensor compartment and emphasis upon the non-traumatic causes.
2) Role of MR imaging in chronic pain is invaluable and causes often labelled idiopathic are illustrated.
3) Radiologists should be aware of common and uncommon causes of knee pain and also about specific causes that affect extensor compartment.
4) Common conditions that affect extensor compartment include patellar tracking problems such as patellar subluxation and patellofemoral pain syndrome, tibial apophysitis, patellar tendinosis or jumpers knee, sinding larsen johansson syndrome and suprapatellar fat pad impingement syndrome.

TABLE OF CONTENTS/OUTLINE
1) Brief overview of extensor MR knee anatomy.
2) Summary of common and uncommon causes with references to clinical features and imaging in specifying the diagnosis.
3) Spectrum of disorders for demonstration: MRI images of trochlear dysplasas, tibial tuberosity lateralization, patella alta and patella baja, suprapatellar fat pad impingement, lateral patellar friction syndrome, Sinding larsen Johansson syndrome, Osgood schlatter disease, bipartite patella and patellar sleeve avulsion fractures.
Pathomechanics of Elbow in the Throwing Athlete; Clinical, Imaging and Arthroscopic Correlation

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Brian S. Martell, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Michael T. Freehill, MD, Winston Salem, NE (Abstract Co-Author) Consultant, Smith & Nephew plc
Leon Lenchik, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Bahram Kiani, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Scott D. Wuertzer, MD, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Maha Torabi, MD, Winston Salem, NC (Presenter) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: 1- Discuss the pathomechanics and mechanisms of elbow injury in the throwing athlete. 2- Present MRI and ultrasound examples of elbow injuries in throwing athletes with clinical and arthroscopic correlation. 3- Demonstrate the importance of medial tension, lateral compression and valgus extension overload injuries. 4- Demonstrate case examples of little league elbow

TABLE OF CONTENTS/OUTLINE
1. Biomechanics of elbow during different phases of throwing.
2. Pathomechanics of medial tension, lateral compression and valgus extension overload injuries.
3. Imaging of throwing athlete injuries.
5. Postoperative imaging findings.
The Significance of Molecular Pathology in Soft Tissue Sarcoma Diagnosis: What a Radiologist Needs to Know?

All Day Location: MK Community, Learning Center

Participants
Naveen Parasu, MBBS, Hamilton, ON (Presenter) Nothing to Disclose
Snezana Popovic, MD, FRCPC, Hamilton, ON (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To understand basic principles of molecular pathology and its applications in soft tissue sarcoma diagnosis.
2. To highlight its clinical relevance to the radiologist as an important sarcoma diagnostic tool.

TABLE OF CONTENTS/OUTLINE
As molecular research identifies the most fundamental causes and markers of disease, clinical testing is moving to the nucleus and its genetic material. Molecular abnormalities (mutations, deletions etc) responsible for genetic diseases, including cancers, are being discovered and used in molecular diagnostic tests. Molecular pathology is a new rapidly evolving field over the last 2 decades which helps in understanding pathogenesis of sarcomas, constituting the basis for the 2013 WHO classification of bone and soft tissue tumors. To radiologists specializing in soft tissue sarcoma imaging, comprehending the basic concepts of molecular pathology would be definitely relevant in current clinical practice. This exhibit will illustrate cases where molecular diagnostics is required for final diagnosis. MR imaging correlation will be provided with relevant teaching points. Examples will include: Differentiating between lipoma and atypical lipomatous tumor Detecting the uncommon dedifferentiated liposarcomas in extremities Differentiating low-grade fibromyxoid sarcoma from myxoma Differentiating synovial sarcoma from other spindle cell sarcomas
Put the "Spring" Back in Your Foot: Adult Acquired Flatfoot Deformity - Imaging Spectrum and Postoperative Appearance

All Day Location: MK Community, Learning Center

Participants
Shefali P. Kothary, MD, New York, NY (Presenter) Nothing to Disclose
Carolyn M. Sofka, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Scott J. Ellis, New York, NY (Abstract Co-Author) Consultant, Integra LifeSciences Holdings Corporation Educator, Integra LifeSciences Holdings Corporation Consultant, OrthoHelix Surgical Designs, Inc
Jonathan T. Deland, MD, New York, NY (Abstract Co-Author) Consultant, Arthrex, Inc; Consultant, Integra, Integra LifeSciences Holdings Corporation; Scientific Advisory Board, Tomier, Inc; Consultant, Tomier, Inc; Royalties, Tomier, Inc; Investor, Tomier, Inc; Consultant, Zimmer Holdings, Inc

TEACHING POINTS
1. To review the imaging findings of adult acquired flatfoot deformity (AAFD). 2. To review the imaging features of complications associated with AAFD, such as, posterior tibial tendon and spring ligament abnormalities, as well as, subfibular and lateral subtalar impingement. 2. To review the treatment options and post-operative appearances of flatfoot reconstructive surgery.

TABLE OF CONTENTS/OUTLINE
1. Review the imaging findings of AAFD using a case-based, multimodality approach with cases ranging in appearance and severity. 2. Discuss the imaging approach for diagnosis of AAFD, including radiographic measurements and advanced cross sectional imaging findings. 3. Illustrate the different pathologies associated with flatfoot deformity, as well as secondary complications that can occur, including osseous, tendinous and ligamentous abnormalities. 4. Discuss the staging and treatment options, including surgical management, for these patients. The postoperative imaging appearance after flatfoot reconstruction will also be depicted.
Role of Compression Elastography in the Diagnosis of Subcutaneous Tumors: Cornerstones, Limitations and Artifacts

All Day Location: MK Community, Learning Center

Participants
Elena A. Gallardo, MD, PhD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Rosa Maria A. Landeras, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Marta Drake Perez, MD, Santander, Spain (Presenter) Nothing to Disclose
Sara Sanchez Bernal, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Elena Lopez Uzquiza, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Rosa De La Puente, Santander, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- To provide a protocol for compression elastography in subcutaneous tumors
- To illustrate the elastography patterns of the most common subcutaneous tumors
- To describe the main artifacts and limitations of the technique

TABLE OF CONTENTS/OUTLINE
A) How to do it? Adequate technique Traffic light-color-coded system Video record
B) Elastography patterns of most frequent tumors: Lipomas and lipomatous lesions Cystic tumors: mucoid cyst, ganglia, epidermoid cyst Hemangiomas and glomus tumors Pilomatrixcomas Superficial fibrosis Malignant tumors
C) Limitations of the technique General limitations Limitations in superficial masses
D) Artefacts
Lighting Up the Spine Tree: A Review of Various Etiologies and Patterns of Spinal Disc and Ligamentous Calcifications

All Day Location: MK Community, Learning Center

Participants
Patrick J. Pan, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Sulabha Masih, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Shahla Modarresi, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Upon completing the review of this educational exhibit, the radiologist should be familiar with: 1) Anatomy of spine. 2) Several common and rare causes spinal calcifications, including their radiographic features, clinical presentation, epidemiology and pathology. 3) Formulating a suitable differential diagnosis based on the pattern of calcifications.

TABLE OF CONTENTS/OUTLINE
Anatomy of the spine
List of common and rare etiologies of soft tissue calcifications of the spine
Different patterns of intervertebral disc calcifications Example: CPPD, annulus fibrosus calcifications
Review of CPPD (crystal deposition): radiographic features, clinical presentation, epidemiology and pathology
Example: alkaptonuric ochronosis, nucleus pulposus calcifications
Review of alkaptonuric ochronosis (pigment deposition)
Different patterns of longitudinal ligament calcifications
Example: DISH, prominent anterior ossifications of contiguous vertebrae without significant intervertebral disc narrowing
Review of DISH
Example: ankylosing spondylitis, symmetric bridging syndesmophytes and fusion of SI joints.
Review of ankylosing spondylitis
Companion cases Reactive arthritis: asymmetric paravertebral ossifications
Traumatic/ degenerative Drug-induced
Pediatric Pelvic Fractures: Review of Imaging, Fracture Classifications and Management

All Day Location: MK Community, Learning Center

Participants
Krishna Patel, MD, Lebanon, NH (Presenter) Nothing to Disclose
James A. Graham, MD, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
Yvonne Y. Cheung, MD, MS, Lebanon, NH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understand the characteristics of the immature pelvis and the triradiate cartilage
Understand the types of pediatric pelvic fractures via the Torode and Zieg classification, including avulsion fractures, iliac wing fractures, simple ring fractures and ring disruption fractures
Identify the common types of avulsion fractures and the muscular attachments that result in the injury on imaging
Identify and describe iliac wing fractures, simple ring fracture and ring disruption fractures on imaging
Understand that ring disruption fractures can result in injury to the triradiate cartilage, though difficult to assess on imaging

TABLE OF CONTENTS/OUTLINE
Characteristics of an immature pelvis and the triradiate cartilage
Classification of pediatric pelvic fractures (Type I-IV)
Type I- Avulsion Imaging of the most common types of pelvic avulsion fractures in relation to muscular attachments
Type II- Iliac wing
Type III- Simple ring (Involving pubic rami or pubic symphysis)
Type IV- Ring disruption
Bilateral pubic rami
Pubic rami or symphysis + posterior elements
Anterior structures + acetabular pelvic ring (Triradiate cartilage injury - Shear vs Crush)
Sample cases of Type I-Type IV fractures
Difficult with imaging of injury to the triradiate cartilage

Summary
Radiation-induced Changes in Musculoskeletal System: Demystifying the X Factor

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Viviane S. Yamachira, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Soo J. Kim, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rafael S. Reche, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hugo P. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Ceci Obara Kurimoto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the early and late radiation-induced changes in bone and soft tissues, including the usual patterns of post-radiation bone marrow, insufficiency bone fracture, osteoradionecrosis, radiation-induced brachial plexopathy and radiation-induced osteosarcoma. 2. To illustrate the imaging findings of radiation-induced changes in musculoskeletal system using cases from our institution. 3. To help recognize and differentiate the characteristic radiation-related findings from recurrent neoplastic disease in oncologic patients.

TABLE OF CONTENTS/OUTLINE
Introduction Imaging findings Discussion Take-home message
Postoperative Evaluation of the Rotator Cuff on MRI: Technique, Normal Appearance and Surgical Complications

All Day Location: MK Community, Learning Center

Participants
Alexandre A. Caland, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Andre Rosenfeld, MD, Recife, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hamilton Guidorizzi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Carlos H. Longo, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, SAO PAULO, Brazil (Abstract Co-Author) Nothing to Disclose
Samia R. Yamashita, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Leonardo M. Sugawara SR, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Role of MRI on the evaluation of the postoperative shoulder
Understanding Surgical Techniques: Decompression Procedures and Tendon Repair
Normal Appearance of the Postoperative Rotator Cuff
Complications Criteria

TABLE OF CONTENTS/OUTLINE
The MRI is the method of choice in the evaluation of the postoperative rotator cuff. A physician, when analysing the postoperative rotator cuff, may have important challenges, such as to recognize the surgical technique, to understand the purpose of the procedure, and the signal and thickness changes of tendons in symptomatic and asymptomatic subjects. As hard as it seems, some parameters are established to define retear or a complication of the surgical procedures, such as changes in patterns compared to a previous exam, large tendon transfixation, liquid in the subacromial-subdeltoid bursa, adhesive capsulitis, broken or displaced fixation device, muscle atrophy, glenohumeral osteoarthritis, superior migration of the humeral head and deltoid dehiscence. This study has the objective of evaluating the postoperative aspects of the rotator cuff on MRI, to describe surgical techniques, and discuss what is established in literature about the normal and pathological aspects of postoperative rotator cuff, pointing out the diagnostic challenges that the radiologist may have.
Peering beneath the Surface: Juxtacortical Tumors of Bone

All Day Location: MK Community, Learning Center

Participants
Ali Gholamrezanezhad, MD, Cleveland, OH (Presenter) Nothing to Disclose
Christos Kosmas, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Salim E. Abboud, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Sasan Partovi, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Mark R. Robbin, MD, Cleveland Hts, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Juxtacortical or surface lesions of bone arise from or adjacent to the cortex. Although their imaging appearance has similarities to their intramedullary counterparts, their location alters their imaging characteristics, creating diagnostic difficulties. Meanwhile nonneoplastic lesions can compound the differential diagnosis. The purpose of this presentation is to: illustrate characteristic radiographic, CT and MR imaging features of various juxtacortical neoplasms, including pathognomonic findings; develop an appropriate differential diagnosis for surface lesions based on imaging findings, lesion location and patient's age; educate on the prognosis and treatment options of juxtacortical tumors.

TABLE OF CONTENTS/OUTLINE
TEACHING POINTS

Lymphoma, leukemia, and myeloma comprise a wide spectrum of malignant conditions, with varying cell type, epidemiology, clinical characteristics, and treatment paradigms. Due to the presence of hematopoietic marrow, hematologic malignancies frequently involve bone. Bone and soft tissue involvement by hematologic malignancy on imaging studies and can provide a diagnostic challenge upon initial presentation.

TABLE OF CONTENTS/OUTLINE

1. Review of hematologic malignancies and epidemiology
   a. Pediatric forms (e.g. T-cell lymphoma, leukemia)
   b. Adult forms (e.g. Hodgkin lymphoma, non-Hodgkin lymphoma, multiple myeloma)
   c. Brief overview of predisposing conditions (e.g. Down syndrome, Sjögren syndrome, HIV/AIDS)
2. Illustrated review of normal bone marrow and pattern of involvement by hematologic malignancy
3. Varied imaging appearances of osseous and soft tissue manifestations of hematologic malignancies and imaging mimics
4. Strategies for successful biopsy and imaging follow-up
5. Treatment paradigms and treatment related issues
Single Source Duel Energy CT in the Evaluation of Gout - Initial Experience

All Day Location: MK Community, Learning Center

Participants
Gandikota Girish, MBBS, FRCR, Ann Arbor, MI (Presenter) Nothing to Disclose
Isaac Wang, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Sung Moon Kim, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (Abstract Co-Author) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ;
David A. Jamadar, MBBS, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Melissa Muck, RT, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1] The learner will know protocol, pitfalls, artifacts and limitations encountered when dealing with single source dual energy CT.2] The learner will be acquainted with challenges faced when initiating and maintaining a DECT service3] The learner will be exposed to the awareness, impressions and expectations of DECT among the rheumatologists.

TABLE OF CONTENTS/OUTLINE

Dual energy CT (DECT) is being increasingly used in the diagnosis of selected patients with gout. Although underlying principles are the same, these are primarily of two types: dual source dual energy CT and a single source dual energy CT with fast kilo voltage switching. Almost all of the published literature comes from the dual source dual energy CT. There are however, many institutions around the world with access to only single source dual energy CT hardware. We would like to share our experiences with single source dual energy CT including how to initiate the DECT service, its feasibility, problems with post processing, the unknowns and potential pitfalls. A systematic review of our initial DECT experience involving 15 cases of gout will be presented. Potential for overcalls and artifacts will be reviewed. Awareness and impression of DECT among the rheumatologists and their expectations will also be discussed.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jon A. Jacobson, MD - 2012 Honored Educator
Participants
Nathan Chaya, MD, Staten Island, NY (Presenter) Nothing to Disclose
Steven Peti, MD, Staten Island, NY (Abstract Co-Author) Nothing to Disclose
Ryan L. Webb, MD, Staten Island, NY (Abstract Co-Author) Nothing to Disclose
Ami Gokli, MD, Staten Island, NY (Abstract Co-Author) Nothing to Disclose
Cheryl H. Lin, MD, Staten Island, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review postoperative imaging evaluation for various orthopedic hardware. 2. To familiarize radiologists with imaging findings of a variety of intraoperative and postoperative hardware complications.

TABLE OF CONTENTS/OUTLINE
1. Radiographic, CT and MR images of normal postoperative orthopedic hardware cases
2. Imaging findings of intraoperative/immediate postoperative complications- Perihardware fracture, Nerve injury, Vascular injury, Malposition/Malalignment
3. Imaging findings of non-immediate postoperative complications- Infection, Mechanical loosening, Peri hardware fracture, Hardware fracture and arthroplasty complications such as dislocation, Particle disease, Metallosis, and Aseptic Lymphocytic Dominant Vasculitis Associated Lesions (ALVAL)
4. Summary
Pudendal Neuralgia: From Diagnosis to Treatment: What the Interventional Radiologist Should Know

All Day Location: MK Community, Learning Center

Participants
Adrian I. Kastler, MD, MSc, Grenoble, France (Presenter) Nothing to Disclose
Julien Puget, Besancon, France (Abstract Co-Author) Nothing to Disclose
Arnaud Attye, MEd, Grenoble, France (Abstract Co-Author) Research Grant, Guerbet SA
Bruno A. Kastler, MD, PhD, Besancon, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Pudendal neuralgia is a debilitating condition with possible high socio-economic impact. Existing treatment options are sparse and patients eventually develop chronic refractory pain.
2. Dual site CT-guided infiltration of the pudendal nerve is a procedure which should be well known by the interventional radiologist, as it has both a diagnostic and therapeutic value.
3. The objective is to describe the prerequisites to perform a successful pudendal nerve infiltration.

TABLE OF CONTENTS/OUTLINE
A. Anatomical background: What is mandatory?
B. Pudendal Neuralgia: what the radiologist must know.
C. Possible Differential diagnosis and Pre-procedure Imaging Assessment: When not to perform pudendal infiltration?
D. Which guiding tool: CT? US? Pros and Cons
E. CT-guided infiltration: 2 infiltration sites: How to do it: Tips and hints: How to increase procedure effectiveness?
F. What to expect of pudendal nerve infiltration in 2015: Results and controversy
F. What about neurolysis?
F. Take home messages
The Radiologist Role as a Soccer National Team Doctor: The World Cup Experience

All Day Location: MK Community, Learning Center

Participants
Alejandro U. Rolon, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Tatiana Piedra Velasco, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Luis Cerezal, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Javier Arnaiz, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Agustín M. Marrero SR, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Damian Couto, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Federico Magdaleno, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:
- To show and emphasize the leading role of a MSK radiologist as part of a National Soccer Team and how Radiology can help to enhance a team’s performance.
- To demonstrate the importance of imaging injured soccer players directly on-site during the last 3 Soccer World Cups to enable immediate diagnosis and fast treatment decisions. Special focus on "on-pitch" ultrasound scanning and MSK interventional radiology.
- To show and describe the imaging findings, (US, MRI, CT, radiography), of the most prevalent lesions affecting professional Soccer players during the last 3 World Cups.

TABLE OF CONTENTS/OUTLINE

- Radiology in elite Soccer with focus on the last 3 World Cups. The Radiologist as part of the Medical Staff of a National Soccer Team.
- Facility organization: creation of an Imaging Department at the training base during World Cup, installation and materials, what to bring: portable and non-portable Ultrasound devices, MRI, materials for interventional procedures.
- How to deal with the Head coach, the players and the Media: effective communication and perfect reports.
- MSK injuries affecting soccer players during elite competition.
- Special focus on muscle imaging, on-site US and MRI for diagnosis.
- Interventional procedures.
- Conclusions.
TEACHING POINTS

The importance of spinal intervention in managing chronic spinal pain has been established on the basis of advances in imaging and the development of injection techniques. Our institution had abundant experiences in cervical and lumbar epidural steroid injection (ESI) and we would like to share our experiences. The major teaching points of this exhibit are: 1. To describe interventional techniques of cervical and lumbar ESI. 2. To understand the good location we should inject correlated with neuroanatomy so that avoid a pitfall.

TABLE OF CONTENTS/OUTLINE

The aim of this study is to evaluate the most frequent findings in examinations of patients with chronic pain in the heel, correlating with the findings in the MRI. MRI is effective in the evaluation of patients with pain in the heel may be obtained sure diagnoses, especially in soft-tissue lesions.

TABLE OF CONTENTS/OUTLINE

Anatomy of the posterior ankle and hind-foot. Causes of chronic heel pain. Evaluate the clinical aspects of the various causes of pain heel. Review of MRI protocols. Review MRI findings with emphasis on those findings that suggest a specific diagnosis.
Schwannomatosis: Review of Clinical and Imaging Features in a Recently Recognized Entity

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Shivani Ahlawat, MD, Baltimore, MD (Presenter) Nothing to Disclose
Jaishri Blakely, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Michael A. Jacobs, PhD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Clinical manifestations of schwannomatosis are diverse with overlapping presentations with other peripheral nerve sheath tumor syndromes. There have been recent changes in the diagnostic criteria of schwannomatosis (SWN) that aid in distinction from NF2 but the diagnosis can be elusive in mosaic presentations and young patients. Whole-body MRI, an emerging tool in diagnosis of SWN, enables detection of tumor burden throughout the body though potential new applications include characterization of neoplasms and assessment of treatment response.

TABLE OF CONTENTS/OUTLINE
Diagnostic criteria: Genetic criteria Clinical criteria Probable schwannomatosis Clinical manifestations of schwannomatosis Imaging work-up of patients with SWN MRI Localized versus whole-body magnetic resonance (WB-MRI) techniques Emerging MRI techniques: Functional imaging with diffusion weighted imaging (DWI) with apparent diffusion coefficient (ADC) mapping Utility in characterization of neoplasms as benign or malignant The role of metabolic imaging with 18F-FDG PET/CT Differential diagnosis of SWN Neurofibromatosis type 2 Other causes of multifocal peripheral nerve thickening - Charcot Marie Tooth Treatment options Surgical Non-surgical
Extra-adrenal Myelolipoma and Extramedullary Hematopoiesis: Imaging Features of Two Similar Benign Fat-Containing Presacral Masses That May Mimic Liposarcoma

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Laurel A. Littrell, MD, Rochester, MN (Presenter) Nothing to Disclose
Doris E. Wenger, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Jodi M. Carter, MD, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Although well-differentiated liposarcoma is the most common fat-containing retroperitoneal tumor, presacral myelolipoma and presacral extramedullary hematopoiesis (EMH) are two benign fat-containing masses that can be mistaken for liposarcoma on imaging. The presacral region is the most common extra-adrenal site for myelolipoma and the 2nd most common site for mass-forming EMH. Both of these masses can present as discrete predominantly fat-containing masses with varying amounts of non-fatty soft tissue components.

TABLE OF CONTENTS/OUTLINE

Purpose
Characterize the imaging characteristics of these masses as well as any associated secondary imaging findings or patient demographics that may assist with the diagnosis
Increase awareness of extra-adrenal myelolipoma and extramedullary hematopoiesis on the differential diagnosis for fatty masses in the presacral region

Introduction
Definition, patient demographics and review of the pathology of extra-adrenal myelolipoma and mass-forming EMH
Imaging features of 8 cases of presacral myelolipoma and 4 cases of presacral EMH will be presented

Conclusions
Extra-adrenal myelolipoma should be considered in the differential diagnosis of a well-defined fat-containing presacral mass
In the clinical setting of severe chronic anemia or marrow replacing/infiltrative disorders, EMH should also be considered
Eponymous-named Fractures: What's in It for Me? A Survival Tool for Junior Residents

Participants
Seyed A. Emamian, MD, PhD, Charlottesville, VA (Presenter) Nothing to Disclose
Cree M. Gaskin, MD, Keswick, VA (Abstract Co-Author) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; ;

TEACHING POINTS
This electronic exhibit demonstrates an easily accessible file for common and uncommon fractures/avulsions bearing a specific name. The name usually signifies a specific constellation of pathophysiology/biomechanics. A radiograph or CT image is provided for each fracture with bullet point information discussing the clinical importance and management issues. Case presented below is an example of what to expect with the format intended to use.

TABLE OF CONTENTS/OUTLINE
The cases will be presented in quiz format. In the response part, few facts or distinguishing characteristics for each fracture are provided including origin of name, pathophysiology/biomechanics, clinical/surgical implication and recommendation for follow up studies or where to look for associated injuries. The fractures intended to discuss are: Upper extremity: Hill-Sachs, Bankert, Monteggia, Essex-Lopresti, Galeazzi, Colles, Smith, Barton, chauffeur's/Hutchinson, Bennett, Rolando, Gamekeeper's/skier's/Stener and boxer's Pelvis: Malgaigne and bucket-handle Lower extremity: Segond, Maisonneuve, Dupuytren, toddler's, triplanar, Tillaux, Shepherd, lover's/don juan, Lisfranc, dancer's/Jones Head/face/spine: Ping-pong, Lefort, NOE, Jefferson, hangman's and Chance.
MK213-ED-X

Terrible Three’s - Culprits in Foot Drop from Head to Toe: A Pictorial Review

All Day Location: MK Community, Learning Center

Participants
Pushpa Bhari Thippeswamy, MD, MBBS, Bangalore, India (Presenter) Nothing to Disclose
Sanjaya Viswamitra, MD, Bengaluru, India (Abstract Co-Author) Nothing to Disclose
Sunitha P Kumaran, MBBS, MD, Bengaluru, India (Abstract Co-Author) Nothing to Disclose
Vinay Hegde, MBBS, MD, Bangalore, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the causes of foot drop from head to toe under 3 broad categories namely, neurogenic, muscular, anatomic. To learn how findings on electrophysiology can be used to protocol MRI study To familiarise the reader about role of MRI neurography in evaluating peripheral nerve pathologies. To describe secondary changes in the leg muscles which predict the non-reversibility of the foot drop.

TABLE OF CONTENTS/OUTLINE
Introduction: Although electrophysiology helps in localizing the site of foot drop, imaging plays important role in identifying and characterizing the lesions. Early diagnosis of the cause of the foot drop is crucial for treatment and reversibility of the foot drop. Methods: 1. 20 cases of foot drop are studied. Depending on the clinical findings and nerve conduction localization, MRI is protocoled. MR neurography is specifically performed for lumbar plexus and peripheral nerves. 2. Further detection, characterization is done by MRI and lesions are categorized under three categories as follows. Neurogenic: Cortical tumors, multiple sclerosis, Spinal cord lesions at L4-S1 level. Lumbar radioculopathy/plexopathy, Sciatic and common peroneal nerve pathologies. Muscular: Direct injury to dorsi flexors. Anatomical: Compressive neuropathies. 3. Imaging findings of non reversibility of foot drop are described.
MRI Pearls in Peripheral Tuberculous Arthritis

All Day Location: MK Community, Learning Center

Participants
Joao Rafael T. Vicentini, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Felipe F. Souza, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To describe MRI signs of non-axial tuberculous arthritis 2. To highlight MRI findings that are usually found in each type of peripheral joint, based on personal experience and literature review

TABLE OF CONTENTS/OUTLINE
1. Literature review of MRI findings of non-axial tuberculous arthritis
2. Examples of laboratory confirmed cases obtained from our Hospital's digital archive to illustrate the most common findings - Synovial thickening - Bone erosion - Abscess formation with smooth margins - Bone fragmentation and intra articular loose bodies - Associated tenosynovitis and bursitis
3. Findings that could help radiologists to consider tuberculous etiology among differential diagnoses when reporting arthritis cases
Pain in the Posterior Ankle and Foot Region: Initial Approach to Diagnosis through Clinical Algorithm

All Day Location: MK Community, Learning Center

Participants
Susana Llorente Galan, MD, Madrid, Spain (Presenter) Nothing to Disclose
Javier Fernandez Jara, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Arturo Alvarez Luque IV, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Marta Guirado Blazquez, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Ignacio Acitores Suz, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Laura Cadenas, MD, San Sebastian De Los Reyes, Spain (Abstract Co-Author) Nothing to Disclose
Juan Romero Coronado, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Sonia Allodi De la Hoz, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Propose a methodology based on clinical questions to achieve an optimal diagnosis approach in posterior ankle and foot region pain.
- Analyze imaging findings of pathologies involved in posterior ankle and foot region pain.

TABLE OF CONTENTS/OUTLINE
Posterior foot and ankle region pain is a very common situation that includes a wide spectrum of diseases. We propose a diagnostic algorithm to classify diagnostic possibilities (corresponding to Table 1 in PDF UPLOAD) based on these key clinical aspects:
- Rheumatological disease history.
- Sports activity.
- Direct trauma.
- Cancer history.
- Pharmacological treatments.
- Chronic disease or immunosuppression.
- Intrinsic factors (toxic habits, old age, obesity).
- Pediatric patient.
- Constitutional factors.
- Absence of relevant backgrounds.
Although the study of each patient is a process that requires an individual management, diagnostic algorithms could support an initial approach to this clinical situation that involve a large number of pathologies. Take home messages. Conclusions.

The term thoracic outlet syndrome (TOS) refers to a heterogeneous group of disorders which have in common the compression of one or more neurovascular elements at some point within the thoracic outlet. The thoracic outlet comprises three compartments: the interscalene triangle and costoclavicular and retropectoral minor spaces by which crosses structures such as the brachial plexus and subclavian artery and vein. TOS includes congenital and acquired abnormalities predisposing to dynamic compression of neurovascular structures triggered by arm elevation. The most common abnormalities include cervical rib, C7 elongated transverse process, development and traumatic anomalies in the first rib and clavicle. Anatomical variations of the scalene muscles, fibrous bands and post-surgical changes are also associated causes. Application of an appropriate MRI investigation protocol is a key factor for this syndrome diagnosis, increasing the sensitivity detection of its compressive causes and allowing the physician to determine an appropriate treatment.

TABLE OF CONTENTS/OUTLINE

Introduction Anatomy review based on illustrations and MRI scans Suggested MRI standard protocol Main differential diagnosis presented as case reviews Conclusion Bibliographic references
Subchondroplasty: A New Minimally Invasive Procedure for Treatment of Knee Pain Associated with Arthritis

All Day Location: MK Community, Learning Center

Participants
Peter Sharkey, MD, Philadelphia, PA (Abstract Co-Author) Zimmer Holdings, Inc.; Knee Creations, Inc.
Steven B. Cohen, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Smith & Nephew plc; Consultant, Zimmer Holdings, Inc
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Johannes B. Roedl, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. The learner will understand the principle and practice of subchondroplasty.
2. The learner will be able to recognize patients with previous subchondroplasty on radiographs and MRI.

TABLE OF CONTENTS/OUTLINE
Degenerative joint disease (DJD) is one of the leading causes of morbidity in the United States. Previous work has suggested that pain from arthritis is primarily related to synovitis and subchondral bone marrow lesions (BMLs) associated with chondrosis. The subchondroplasty procedure has been developed to treat patients with osteoarthritis of the knee, not by treating the cartilage lesion itself, but instead by addressing the BML that may be contributing to pain. Subchondroplasty is much like vertebroplasty; the principle is to inject material into the subchondral bone, specifically within a region of bone marrow edema identified as being associated with painful arthritis or chondrosis. Subchondroplasty can be an option for a population of patients who are between the stages of a focal cartilage lesion and severe arthritis. OUTLINE A. Anatomy and pathophysiology B. Diagnostic Imaging (US, CT) C. Review of Indications, Contraindications D. Initial Treatment E. Follow-up Management F. Outcomes (include complications)
TEACHING POINTS

1. The high frequency of shoulder injuries in the overhead throwing athlete is largely due to the violent stresses placed on the shoulder during the throwing motion. This exhibit will introduce the learner to the phases of throwing and the biomechanics of each of the phases, including the types of forces that act on various structures within the shoulder. This will help the learner understand how and why certain injuries occur. 2. In the course of this discussion we will review the relevant shoulder anatomy and function, including the rotator cuff muscles and glenoid labrum.3. Finally, we will discuss injuries of the rotator cuff, labrum, scapula, and neurovascular bundles, focusing on the types of injuries that are commonly seen with overhead throwing athletes, the proposed mechanisms of these injuries, and the frequently encountered radiologic findings.

TABLE OF CONTENTS/OUTLINE

Background Phases of Throwing/Biomechanics Causes of Shoulder Pain Rotator cuff External impingement (primary and secondary) Internal impingement (primary and secondary) Tensile overload (overuse) Labrum Microinstability and overuse Primary instability Acute traumatic instability Scapula - Scapula dyskinesis and SICK scapula Neurovascular Thoracic outlet Effort thrombosis Quadrilateral space syndrome Suprascapular nerve injury
**Symptomatic Anatomic Variants: From Head to Toe**

All Day Location: MK Community, Learning Center

**Participants**
Nerea Hormaza, MD, Bilbao, Spain (Presenter) Nothing to Disclose
Sandra Baleato Gonzalez, MD, PhD, Santiago, Spain (Abstract Co-Author) Nothing to Disclose
Xavier Tomas-Batlle, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Roque Oca, MD, Vigo, Spain (Abstract Co-Author) Nothing to Disclose
Joan C. Vilanova, MD, PhD, Girona, Spain (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

1) To illustrate several anatomic variants associated with clinical disorders.
2) To discuss normal anatomy and imaging findings of anatomic variants and their differential diagnosis.
3) To review the imaging techniques that allows the final diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Musculoskeletal variants are very common findings in clinical practice and may sometimes present clinical relevance. Radiologist should recognize these conditions, do an accurate diagnose, avoiding misdiagnosis and further unnecessary explorations. We review from head to toe some of them, including Eagle's syndrome, defects of segmentation in the spine, cervical rib causing thoracic outlet syndrome, painful iliac rib, pseudotumor deltoideus, accessory muscles (soleous accessory), supernumerary bones leading to different syndromes such as posterior ancle impingement (Stieda process and os trigonum), other symptomatic osicles (os acromiale, os scaphoideum, partite sesamoid…) among other entities. We discuss normal anatomy of each region and possible normal variants, indicating their demographics, pathophysiological mechanism, potential complications and differential diagnosis. Additionally we review the available imaging techniques that help in the diagnosis, including X-Ray, US, CT and MR.
Dual-Energy Computed Tomography (DECT) Assessing Bone Marrow Edema: How is it Feasible

All Day Location: MK Community, Learning Center

Participants
Rodrigo S. Damasceno, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Eduardo L. Bizetto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Tassia S. Paixao, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Felipe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Denise T. Amaral, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Conrado F. Cavalcanti, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rodrigo Y. Fernandes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Ceci Obara Kurimori, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bondalo-Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Researcher, Guerbet SA
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
DECT allows the evaluation of the chemical composition of structures according to its differential x-ray attenuation at two different energy levels. That said, the main objective of this study is to present and illustrate the feasibility of DECT in identifying bone marrow edema in patients with a trauma context. With this presentation the authors expect that the viewer will be able to:
Recognize the applicability of DECT as a valid tool to assess bone marrow edema in patients with a history of trauma; Identify the imaging findings of DECT compatible with bone marrow edema.

TABLE OF CONTENTS/OUTLINE
In musculoskeletal radiology the DECT was first used to identify the presence of sodium monourate crystals in joints of patients with gout arthropathy. In trauma situations, the demonstration of bone marrow edema through DECT acts as a useful sensitizing factor to identify the presence of other important subtle findings, such as small fractures, that could pass unnoticed in conventional CT scans. That said, it is mostly important that all the radiologists are aware of such method, especially those with particular interest in musculoskeletal radiology.
Accessory Ossicles of the Foot and Ankle: A Case Based Review of Anatomy and Associated Pathology

All Day Location: MK Community, Learning Center

Participants
Amandeep Singh, MD, New Hyde Park, NY (Abstract Co-Author) Nothing to Disclose
Kunal Kothari, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Paul-Michel Dossous, MD, New Hyde Park, NY (Presenter) Nothing to Disclose
John S. O’Donnell, MD, Douglaston, NY (Abstract Co-Author) Nothing to Disclose
Daniel M. Walz, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Michael Brown, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Jarett Burak, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Helise R. Coopersmith, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Ralph A. Millillo, MD, Roslyn, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To provide an anatomic review of the common accessory ossicles in the foot and ankle. 2. To enable learner to appropriately identify pathologic conditions related with such variants and to avoid pitfalls such as misdiagnosis as fractures.

TABLE OF CONTENTS/OUTLINE
Anatomical review of the ossicles of the foot and ankle
Review of painful syndromes associated with accessory ossicles such as os naviculare, os peroneum, accessory cuneiform and os intermetatarsaeum.
Clinical implication of accessory ossicles such as graft failure
Additional pathology related to ossicles such as trauma, infection and degenerative changes
Summary
Extrapleural Soft-tissue Solitary Fibrous Tumor: Imaging-Pathologic Correlation

TEACHING POINTS

Although extrapleural soft-tissue SFT are rare, it can be suspected in patients with a deep soft-tissue mass, isointense on T1-WI, heterogeneous on T2-WI, and hypervascular on Gd-enhanced T1-WI. Increased power doppler tumoral signal on US, marked contrast-enhanced on CT, intralesional flow voids on MRI and identification collateral feeding vessels are imaging signs that can suggest this diagnosis. Histologically, SFT are composed of patternless distributions of closely packed spindle cells with varying degrees of fibrosis and interspersed branching staghorn-shaped vessels, features which explain most of their imaging appearance. Some SFTs that were initially classified as benign on the basis of their histopathologic features were found to have metastases, a finding that necessitates long-term follow-up even in cases of histologically benign tumors.

TABLE OF CONTENTS/OUTLINE

1- Clinical presentation
2- Pathologic definition of SFT according the new WHO classification of soft-tissue tumors, which now includes Hemangiopericytoma
3- Pathologic features
4- Imaging characteristics: a) X-ray b) Ultrasound c) CT d) MR imaging findings e) PET-CT
5- Imaging-pathologic correlation
6- Imaging and pathological considerations about malignant soft-tissue SFT
7- Radiological differential diagnosis
8- Treatment and follow-up strategies
Participants
Christopher J. Burke, MBChB, New York, NY (Presenter) Nothing to Disclose
Jenny T. Bencardino, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ronald S. Adler, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

TABLE OF CONTENTS/OUTLINE

We outline our experience using this novel platform that fuses MRI with real-time ultrasound imaging allowing for increased accuracy and safety in interventional musculoskeletal procedures.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jenny T. Bencardino, MD - 2014 Honored Educator
Sonographic Evaluation of Ankle/Hindfoot Pain

All Day Location: MK Community, Learning Center

Participants
Seema M. Meraj, MD, Lindenhurst, NY (Presenter) Nothing to Disclose
Cono W. Gallo, MD, Dix Hills, NY (Abstract Co-Author) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Aurora, CO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The ankle/hindfoot is a common source of pain for many patients. Because of its relatively low cost, short exam time and ability for dynamic/targeted evaluation, sonography is increasingly becoming the imaging test of choice following initial radiographs, especially in whom MR is contraindicated. Knowledge of the complex anatomy, differential diagnosis, secondary imaging findings and clinical presentation in concert with the ability to formulate a systematic approach in narrowing the differential based on location are of paramount importance. This educational exhibit will provide a sonographic pictorial review of the various causes of ankle/hindfoot pain. Focus will be drawn to the unique imaging characteristics and ancillary findings of each to help guide diagnosis with clinical/MR/pathologic correlation.

TABLE OF CONTENTS/OUTLINE

TEACHING POINTS

1. Common causes of lytic lesions around arthroplasties include particle disease and infection. Soft tissue masses (pseudotumors) are also frequently encountered.
2. In the general population, it is exceedingly rare for periprosthetic lysis or a soft tissue mass to represent malignancy.
3. Careful consideration is always warranted in patients with a tumor prosthesis, as recurrence at or near the prosthesis is a preeminent consideration. Additionally, in patients with a history of known malignancy elsewhere, metastatic disease and myeloma may also present as periprosthetic lesions.
4. Despite the presence of hardware, imaging with CT and MRI is valuable for detecting these abnormalities.

TABLE OF CONTENTS/OUTLINE

We present an original case series and literature review to discuss the causes and imaging features of periprosthetic lytic lesions and soft tissue masses. Cases are presented in quiz format.

1. OVERVIEW: a. Types of arthroplasties, including tumor prosthesis
   b. Imaging techniques
2. NON-MALIGNANT PERIPROSTHETIC LESIONS: a. Bone b. Soft tissue
4. SUMMARY AND CONCLUSIONS
Giant Cell Containing Lesions of the Musculoskeletal System: Beyond Giant Cell Tumor of Bone

All Day Location: MK Community, Learning Center

Participants
Marit Asadoorian, MD, Glendale, CA (Presenter) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Alexander Fedenko, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Eric A. White, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Aaron Schein, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Sulabha Masih, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
There are many musculoskeletal lesions that contain giant cells. As a result, histopathology can be confusing in establishing the final diagnosis. Radiology becomes an indispensable part of the evaluation of giant cell containing lesions. The purpose of this presentation is to review the numerous musculoskeletal lesions that contain giant cells, present the learner with the radiological appearances, differentiating features, and the pathologic correlates.

TABLE OF CONTENTS/OUTLINE
Musculoskeletal lesions containing giant cells
Benign bone lesions (e.g. giant cell tumor, non-ossifying fibroma, Brown tumor, aneurysmal bone cyst, chondroblastoma, fibrous dysplasia, and giant cell granuloma)
Malignant bone tumors (e.g. malignant giant cell tumor, giant cell rich osteosarcoma, and malignant fibrous histiocytoma)
Soft tissue and joint lesions (pigmented villonodular synovitis, giant cell tumor of tendon sheath, foreign body granuloma, granulomatous infections, and fibrohistiocytic tumors)
Demographics and epidemiology
Common imaging features
Pathologic correlation
Imaging of Patellofemoral Joint Instability: A Review of Joint Mechanics and Radiographic Features of the Unstable Joint

All Day Location: MK Community, Learning Center

TEACHING POINTS

Review function of the patella as the anchor of the extensor apparatus. Overview of patellofemoral anatomy including joint morphology and soft tissue constraint. Be able to describe joint biomechanics and its role in joint stability. Review normal radiographic and MRI appearance of the patellofemoral joint. Review of radiographic and MRI appearance of joint alignment and morphology. Overview of conservative and surgical management. Discuss current concepts and rationale of various surgical techniques including medial patellofemoral ligament reconstruction and tibial tubercle transfer osteotomy. Review normal post surgical imaging of these techniques.

TABLE OF CONTENTS/OUTLINE

Background/introduction Joint anatomy Joint mechanics Radiographic Technique Radiographic and MRI appearance, including patellar tendon length, features of trochlear dysplasia, and TT-TG Non-surgical management Surgical management and postoperative imaging Summary
Awards
Certificate of Merit

Participants
Christine M. Rehwald, MD, Seattle, WA (Presenter) Nothing to Disclose
Linda E. Chen, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Felix S. Chew, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Alice S. Ha, MD, Seattle, WA (Abstract Co-Author) Grant, General Electric Company

TEACHING POINTS
After reviewing this exhibit, readers will learn about the various methods of recreational drug delivery and how it affects the musculoskeletal (MSK) system. Specifically, the reader will appreciate the unique MSK consequences produced by 1) intravenous, intramuscular, and subcutaneous injection, 2) inhalation, and 3) ingestion.

TABLE OF CONTENTS/OUTLINE
We will discuss the background, details of preparation and administration of recreational drugs, and the MSK ramifications and their associated radiologic findings. Specifically, we will discuss the following: Intravenous drug administration: can result in superficial and deep infections, ranging from cellulitis to septic joints. Thrombophlebitis is another common complication. Inadvertent intra-arterial injection can cause tissue ischemia. Inhalational drug administration: marijuana-laced PCP can lead to severe rhabdomyolysis with widespread systemic effects. Subcutaneous/Intramuscular drug administration: poses a higher risk of infection, especially abscess formation and deeper infections involving the muscle and bone, as well as necrotizing soft tissue infections, retained foreign bodies, and compartment syndrome. IM anabolic steroid injection can lead to gynecomastia and premature epiphyseal closure. Drug Ingestion: toxic ingestion can lead to avascular necrosis.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Felix S. Chew, MD - 2012 Honored Educator
Using Our Gadgets to Look at Paget's: A Review of Paget's Disease of Bone and Its Radiologic Findings on Selected Modalities

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
John G. Whaley, MD, San Diego, CA (Presenter) Nothing to Disclose
Mark D. Stanley, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Michael S. Gibson, MD, Rockville, MD (Abstract Co-Author) Nothing to Disclose
Pierre A. Pelletier, MD, Coronado, CA (Abstract Co-Author) Nothing to Disclose
Brenda Nelson, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:
1. To review the pathophysiology of Paget's disease of bone.
2. To emphasize the characteristic and some unusual locations and findings of Paget's disease using various imaging modalities, to include: radiographs, computed tomography (CT), magnetic resonance imaging (MRI), and nuclear medicine bone scans.
3. To discuss potential complications of and current treatment strategies for Paget's disease.

TABLE OF CONTENTS/OUTLINE

• Pathophysiology of Paget's disease
• Review of Imaging Findings Characteristic and unusual locations affected Modalities: Radiographs, CT, MRI, Bone scan Mimics/Differential
• Sample Cases
• Complications and Treatment
Understanding Biodegradable Orthopedic Implants and Their Complications: An Imaging Perspective

All Day Location: MK Community, Learning Center

Participants
Kimia K. Kani, MD, Palmdale, CA (Presenter) Nothing to Disclose
Hyojeong Mulcahy, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Jack A. Porrino JR, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Felix S. Chew, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Become familiar with properties of biodegradable implants
- Describe the common applications of biodegradable implants
- Recognize orthopedic applications of biodegradable implants
- Explain the advantages and disadvantages of temporary biodegradable implants, versus permanent metallic implants
- Identify the imaging spectrum of normal and complicated biodegradable implants

TABLE OF CONTENTS/OUTLINE
- Background and rationale for use of biodegradable implants
- Common orthopedic applications
- Materials and designs of bioabsorbable implants
- Bioabsorbable versus metallic implants
- Imaging spectrum of normal and complicated bioabsorbable implants
- Specific complications: Foreign body response; Premature degradation; Late implant resorption; Incomplete osseous replacement of resorbed implant

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Felix S. Chew, MD - 2012 Honored Educator
Practical Guideline for US-guided Core Needle Biopsy of Soft Tissue Tumors: Transformation from Beginner to Specialist

Awards
Certificate of Merit

Participants
Tack Sun Oh, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Hye Won Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jong-Seok Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Min Hee Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Hoon Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung Jin Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. US-guided core needle biopsy of soft tissue tumors is very important for differentiating malignancy from benignancy. But there is no practical guideline for inexperienced radiologist using detailed images and descriptions. 2. By using this practical guideline with several specific cases, radiologists could perform core needle biopsies of soft tissue tumors successfully without complication.

TABLE OF CONTENTS/OUTLINE
Our exhibition will be composed of 4 parts: Selection of the biopsy target for accurate biopsy result Correlation between US findings and various imaging findings on MR and PET-CT to find solid and representative region or malignant component of tumor Selection of the biopsy route for avoiding unintended wide excision or local tumor recurrence Understanding of the orthopedic surgeon's perspective Watch out for critical anatomic structures Principles and tips of biopsy techniques Selection of proper biopsy needle and adequate number of specimen Tips for difficult biopsy cases such as movable or very painful mass Discrepancy between radiological diagnosis and biopsy result
**Sickle Cell Disease: Effects on the Musculoskeletal System**

All Day Location: MK Community, Learning Center

**Participants**
Sasan Partovi, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Christos Kosmas, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Ali Gholamrezanezhad, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD, Cleveland Heights, OH (*Abstract Co-Author*) Nothing to Disclose
Salim E. Abboud, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Mark R. Robbin, MD, Cleveland Hts, OH (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

Sickle cell disease is a hemoglobinopathy with significant manifestations on bones and muscles. This includes chronic anemia with the resultant marrow hyperplasia and osseous vasoocclusive crises that result in osteonecrosis and significant pain. The purpose of this presentation is to: Describe the musculoskeletal manifestations of sickle cell disease Illustrate the imaging findings of these effects on different modalities Assist the radiologist in early detection of common musculoskeletal effects of sickle cell disease

**TABLE OF CONTENTS/OUTLINE**

Musculoskeletal manifestations of Sickle Cell disease Hematopoietic Marrow Hyperplasia Extramedullary Hematopoiesis Bone expansion Pathologic fractures Osteonecrosis Avascular Necrosis Bone Infarcts Growth effects H-shaped vertebrae Dactylitis (Hand-foot syndrome) Infection Osteomyelitis Septic arthritis Muscle involvement Muscle necrosis Soft tissue hematomas Abscesses
Rotator Cuff Interval Imaging: Anatomy and Pathology

All Day Location: MK Community, Learning Center

Participants
Eduardo L. Bizetto, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Pedro Panizza, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rodrigo S. Damasceno, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Felippe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Conrado F. Cavalcanti, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Denise T. Amaral, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rodrigo Y. Fernandes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hugo P. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Guilherme E. Nasser, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Ceci Obara Kurimori, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The rotator interval corresponds to a well-defined portion of the anterior shoulder region, located between the supraspinatus and subscapularis tendons. This space contains the coracohumeral and superior glenohumeral ligaments, the biceps tendon and anterior capsule joint. Rotator interval changes are directly related to shoulder stability, adhesive capsulitis and long head biceps changes. Abnormalities of the rotator interval are underdiagnosed in clinical practice, due to its complex anatomy and the difficulty in visualizing structures in both imaging studies and arthroscopy. The characterization of the pathologies of the rotator interval may be a key factor for the diagnosis and treatment of joint pain.

TABLE OF CONTENTS/OUTLINE

Introduction Anatomy review based on illustrations correlated to MRI scans Rotator cuff ultrasound evaluation Pathology: biceps pulley lesion, biceps tendinopathy and adhesive capsulitis. Bibliographic references
Atypical Femoral Fractures and Their Precursor Lesions: Radiographic Diagnosis and Imaging Findings

All Day Location: MK Community, Learning Center

Participants
Meng-Ai Png, MBBS, Singapore, Singapore (Presenter) Nothing to Disclose
Tet-Sen Howe, MBBS, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Joyce S. Koh, Singapore, Singapore (Abstract Co-Author) Faculty, Zimmer Holdings, Inc; Faculty, Stryker Corporation; Research support, Tenex Health Inc; Research support, Johnson & Johnson
P Chandra Mohan, MBBS, FRCR, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Highlight the characteristic radiographic features of atypical femoral fractures (AFF) which distinguish them from ordinary osteoporotic femoral fractures Describe the radiographic features of their precursor lesion: femoral cortical stress lesion Illustrate the imaging findings of femoral cortical stress lesion

TABLE OF CONTENTS/OUTLINE
A brief introduction to AFF: background, incidence and its association with chronic bisphosphonate use. American Society for Bone and Mineral Research case definition of AFF (Table 1). Explain the importance of making a correct diagnosis and the implications on subsequent management of the patient. Radiographic features of AFF precursor stress lesions, their differential diagnosis and feature/s that suggest impending fracture. Describe the role of imaging in femoral cortical stress lesions and the spectrum of imaging findings on CT, MRI and bone scan.
Role of Chemical Shift Imaging in Musculoskeletal Radiology

All Day Location: MK Community, Learning Center

Participants
Parham Pezeshk, MD, Dallas, TX (Presenter) Nothing to Disclose
Lulu Tenorio, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Stephen Fisher, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
William Robertson, MD, Dallas, TX (Abstract Co-Author) Consultant, CONMED Corporation
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Research Consultant, Siemens AG; Consultant, ICON plc

TEACHING POINTS
1. Learn basic physics of the chemical shift imaging (CSI) techniques including Dixon imaging.
2. Learn the role of CSI in tissue characterization, e.g. fat, hemorrhage products, fibrosis and trabecular fracture.
3. Demonstrate the utility of CSI in musculoskeletal (MSK) imaging with relevant case examples.

TABLE OF CONTENTS/OUTLINE
1. Discuss the basics of various fat suppression techniques. 2. Learn technical considerations of CSI among different techniques including Dixon imaging and differences among different scanner strengths. 3. Discuss role of CSI in tissue characterization, e.g. fat, hemorrhage products, fibrosis and trabecular fracture. 4. Discuss the role of chemical shift imaging in differentiation of specific pathologies in musculoskeletal imaging, e.g. infections, trabecular fractures, benign, untreated and treated marrow lesions, PVNS, and intra-articular hemorrhage, etc. 5. Case presentation of selected examples of pathologies showing incremental value of CSI over conventional imaging techniques.
TEACHING POINTS

1. Understanding and interpreting color elastograms and shear wave (SW) velocities requires knowledge of basic ultrasound (US) physics of shear wave elastography (SWE).
2. SWE imaging findings may be used to evaluate differences between normal and traumatic/various pathologic conditions of musculoskeletal (MSK) soft tissues including the tendons, muscles, nerves, joint capsules and bursae.
3. Application of SWE may complement the diagnosis obtained by gray scale (B mode) and power/color Doppler US imaging by quantifying mechanical and elastic tissue properties.

TABLE OF CONTENTS/OUTLINE

1. Basic technical principles of SWE including application of acoustic radiation force (ARFI), tissue deformation, generation and propagation of SW, tracking the SW, and reconstruction of the shear/Young modulus (tissue displacement maps, calculate SW speed).
2. Show SWE findings (mechanical and elastic properties) of the normal MSK soft tissues on color elastograms and SW velocity (m/s) in correlation with gray scale and power/color Doppler US imaging.
3. Show SWE findings (elastic properties) of various MSK soft tissue injuries and diseases on color elastograms and SW speed (m/s) in correlation with gray scale and power/color Doppler US imaging.
4. Discuss added value and limitations of SWE in MSK US imaging.
**Iliopsoas Muscle: Anatomy, Traumatic Injuries, Snapping and Impacts**

All Day Location: MK Community, Learning Center

**Participants**

Eduardo L. Bizetto, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

Rodrigo S. Damasceno, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Denise T. Amaral, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Marcos Felipe P. Correa, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Pedro Panizza, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Rodrigo Y. Fernandes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Conrado F. Cavalcanti, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Denise T. Amaral, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Paulo Victor P. Helito, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Guilherme E. Nasser, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Guilherme E. Nasser, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Hugo P. Costa, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Marcos Felipe P. Correa, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Ceci Obara Kurimori, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Giovanni G. Cerri, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

The iliopsoas compartment corresponds to the retroperitoneal space that contains the psoas major, minor and iliopsoas. Several pathologies can affect this compartment including inflammatory, hemorrhagic, traumatic, mechanical or post-hip replacement complications. When considering pathologies of the long muscle belly along the paraspinal compartment, we emphasize the importance of coronal T2 fat sat / STIR protocol in lumbar spine routine for proper evaluation of conditions such as extraforaminal hernias, discitis and paraspinal abscesses. At myotendinous plan, peritendinous edema on MRI may infer iliopsoas internal snapping, therefore dynamic ultrasonography should complement patient workup. Post-hip replacement complications, cases of traumatic injuries and iliopsoas bursitis are also described. Finally we demonstrate the role of the iliopsoas tendon in anterior acetabular labrum lesions, currently described as central impact.

**TABLE OF CONTENTS/OUTLINE**

Introduction Anatomy review based on illustrations and its correlation to MRI scans. Ultrasound evaluation of the iliopsoas tendon

Pathologies: Psoitis, myotendinous attrition, muscular strain, tears , ossifying miositis, central impact and iliopsoas snapping.

Bibliographic references.
Pattern Approach for Redundant Nerve Roots in the Central Stenosis

All Day Location: MK Community, Learning Center

Participants
Young Wook Jeon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung Jin Shin, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Hye Won Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Min Hee Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Hoon Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jisue Shim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Cauda equina redundancy is frequently and variously demonstrated on the magnetic resonance images of spinal stenosis patients. In clinical practice, this finding sometimes mimics other pathology such as intradural tumor or vascular lesion. Systematic approach by categorizing this finding will help the radiologists to understand pathophysiology of central stenosis and prevent misdiagnosis.
2. This educational exhibition will categorize various morphologic changes of spinal stenosis, and correlate with the possible physiologic changes in the spinal canal by reviewing the serial follow-up MR studies.

TABLE OF CONTENTS/OUTLINE

Our exhibition will be composed of three parts: 1. Literature review of the physiologic flow of cerebrospinal fluid and the movement of cauda equina in the normal spinal canal and the stenotic canal. 2. Pattern approach for the morphologic features of cauda equina on MR study of central stenosis patient. (1) Redundant in upper and kinked in lower segment of the central stenosis (2) Redundant in lower segment of the central stenosis (3) Redundant in upper and lower segment of the central stenosis. 3. Pathophysiologic correlation in each pattern of cauda equina morphologic change.
Participants
Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (Presenter) Consultant, Medical Metrics, Inc
Alice S. Ha, MD, Seattle, WA (Abstract Co-Author) Grant, General Electric Company

TEACHING POINTS
Describe many of the orthopedic hardware that are more commonly used or newly introduced over the past 5 years Understand the mechanical purpose of the devices Recognize normal post-operative imaging appearances Demonstrate examples of complications as detected by imaging

TABLE OF CONTENTS/OUTLINE
Optimal Reporting of Acetabular Fractures on Trauma CT Examinations: What the Orthopedic Surgeon Wants to Know

All Day Location: MK Community, Learning Center

TEACHING POINTS

Learn four key questions that help with accurate classification of acetabular fractures on CT examinations. Understand the Judet and Letournel classification of acetabular fractures. Avoid common mistakes when describing acetabular fractures. Recognize how fracture classification helps with operative planning.

TABLE OF CONTENTS/OUTLINE

Background: Classification systems for describing acetabular fractures may be intimidating. Purpose: To provide an approach for acetabular fractures on trauma CT examinations and to describe some interpretative pitfalls. Normal CT Anatomy: Evaluation using true axials, sagittal and coronal reformats, and volume-rendered 3D reformats without the femoral head. Judet and Letournel Classification Made Simple: Diagram Key Questions: Are the rami fractured? Yes: More likely column than wall; No: More likely wall than column. Is the iliac wing fractured? Yes: More likely column; No: More likely wall. With iliac wing fracture, is there continuity between SI joint and acetabulum (sciatic buttress intact)? Yes: More likely posterior column; No: More likely both column. At the level of acetabular roof, the main fracture line is: Coronal: More likely column; Sagittal: More likely transverse; Oblique: More likely wall. Case Examples Discussion of Common Pitfalls Operative Planning Summary References
TEACHING POINTS

1) 3D printing is a reasonably easy and user-friendly technique that adds valuable information to routine 2D and 3D diagnostic imaging. It is useful in patients with trauma, especially in complex anatomic areas such as the pelvis, elbow, and craniofacial region.

2) It is also useful in patients with scoliosis, developmental dysplasia of the hip, and non-traumatic complex cranio-facial anomalies.

3) 3D printed models give surgeons the ability to hold the part in their hands, to understand the anatomy better, to conceptualize the pathology more accurately, to practice the surgery in advance, and to then better plan treatment.

4) 3D printing can be easily assimilated into a routine radiology practice to create bone models within 24 hours as part of a routine 3DCT report.

TABLE OF CONTENTS/OUTLINE

1) Introduction to 3D printing
2) Description of the technique of 3D printing as a daily routine
3) Role of 3D printing and the advantages offered in clinical practice with special reference to trauma and congenital anomalies
4) Sample cases
5) Comparison of accuracy of 3D models with intraoperative findings
6) Limitations
Look Under the (Knee) Cap: Patellofemoral Dysplasia-A Frequently Overlooked Condition on Imaging

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Dane G. Mackey, MD, New Orleans, LA (Presenter) Nothing to Disclose
Raman Danrad, MD, New Orleans, LA (Abstract Co-Author) Nothing to Disclose
Michael L. Manstany, MD, New Orleans, LA (Abstract Co-Author) Nothing to Disclose
Eric Wallace JR, MD, Metairie, LA (Abstract Co-Author) Nothing to Disclose
Bradley M. Spieler, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
After reviewing the exhibit the learner should be able to a). Discuss the pathophysiology and various components of patellofemoral dysplasia. b) Recognize major imaging features of patellofemoral dysplasia on plain radiographs and MRI. c) Understand the appropriate method to measure various components of patellofemoral dysplasia to aid in management.

TABLE OF CONTENTS/OUTLINE
1. Epidemiology and spectrum of disease. 2. Osseous anatomy and variants of patella and femoral condyles: Wiberg classification of patella and Dejour classification of distal femoral condyles. 3. Relationship of patellofemoral soft tissue structures - extensor mechanism, patellar tracking, medial and lateral soft tissue restraints. 4. Techniques of measurement of sulcus angle, congruence angle, patellar tilt, lateral patellofemoral angle, Q-angle, Insall-Salvatti index, Caton-Deschamps index, tibial tubercle to trochlear groove distance. 5. Brief discussion of treatment options for patellofemoral dysplasia.
Whole Leg Radiographs for Lower Extremity Alignment: What Do I Need to Measure and Why?

All Day Location: MK Community, Learning Center

Participants
David Melville, MD, Tucson, AZ (Presenter) Nothing to Disclose
Daniel Latt, MD, PhD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Lana H. Gimber, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Michael D. Miller, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Miha S. Taljanovic, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Whole leg radiographs (WLR) are the gold standard for determining axial lower extremity alignment in pre-operative assessment for high tibial osteotomy and total knee arthroplasty. Familiarity with common mechanical axis (MA) measurements enables the radiologist to provide useful quantitative information to the orthopedist. Knowledge of conditions frequently undergoing assessment with WLR assists the radiologist in providing additional qualitative information, which may further guide surgical planning. Awareness of the indications and imaging appearances of frequently performed corrective procedure allows the radiologist to assess for successful intervention.

TABLE OF CONTENTS/OUTLINE

1. Introduction to WLR - technique and positioning
2. Measurements - including how to measure and normal ranges
   - Mechanical axis
   - Anatomic axis MA angle
   - Lateral distal femoral angle
   - Medial proximal tibial angle
   - Lateral distal tibial angle
   - Proximal femoral and distal tibial anatomic angles
   - Posterior tibial slope
3. Conditions
   - Developmental varus/valgus deformity
   - Congenital and Metabolic conditions
   - Post-traumatic deformity
4. Surgical Correction - procedures with expected post-operative WLR measurement ranges
   - High tibial osteotomy
   - Distal femoral osteotomy
   - Unicompartmental arthroplasty
   - Total knee arthroplasty
   - Knee Arthrodesis
Soft Tissue Infections from Cellulitis to Necrotizing Fasciitis

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Mohammadreza Hayeri, MD, San Diego, CA (Presenter) Nothing to Disclose
Pouya Ziai, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Monda L. Shehata, MD, King of Prussia, PA (Abstract Co-Author) Nothing to Disclose
Oleg Teytelboym, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Soft tissue infection is a clinical diagnosis, however imaging is used to distinguish between disease entities, evaluate extent and severity of the disease and identify possible complications. The definitions and classifications of soft tissue infections are frequently ambiguous in the literature with different authors using different terms to describe same entities. Systematic approach to assess soft tissue infections, as illustrated in the presentation, is essential in guiding patient management. Recognition of common infection mimics helps to avoid overdiagnosis.

TABLE OF CONTENTS/OUTLINE

Definition Classification Diagnosis Diagnosis and treatment Role of imaging Imaging findings: Multimodality pictorial assay of different types of soft tissue infections and complications, including Infectious cellulitis Non necrotizing fasciitis Eosinophilic Paraneoplastic Inflammatory (lupus myofascitis, etc) Necrotizing infections Myositis Pyomyositis/soft tissue abscess Myonecrosis Inflammatory myopathy Compartment syndrome Septic bursitis Tenosynovitis 6. Differential diagnoses of soft tissue infections and discriminating imaging findings 7. Imaging pearls and pitfalls in evaluating soft tissue infections 8. What clinicians want to know and what information should the radiology report contains
Hip, Hop and Beyond - Review of Common and Rare Manifestations of Osteonecrosis

All Day Location: MK Community, Learning Center

Participants
Preethi Ratakonda, MD, Augusta, GA (Presenter) Nothing to Disclose
Norman B. Thomson III, MD, MBA, Augusta, GA (Abstract Co-Author) Stockholder, Nuance Communications, Inc
Yulia Melenevsky, MD, Augusta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
After viewing of this exhibit, the learner will be able to: Discuss etiology and predisposing factors of osteonecrosis Apply commonly used staging and classification systems and their implications for the patient management and prognosis Describe the spectrum of imaging findings in osteonecrosis using a multimodality approach Recognize manifestations of osteonecrosis in uncommon locations

TABLE OF CONTENTS/OUTLINE
Numerous pathways lead to osteonecrosis. Osteonecrosis is a multifactorial entity which occurs in multiple locations of the bony skeleton. Based on the site and the stage of disease, treatment can span from conservative symptomatic management to joint replacement. Radiologists must know the appearance, locations, and staging of osteonecrosis, and understand the factors influencing treatment. The goal of this exhibit is to provide radiologists with a concise high yield overview of this complex topic, utilizing the following outline: Definitions, etiology, and pathophysiology of osteonecrosis Imaging appearance(s): radiographs, CT, MR, bone scintigraphy, PET/CT Grading and classification Differential diagnosis Overview of osteonecrosis manifestations by location
Review of the Anatomy and Major Traumatic Injuries of the Flexor Mechanism of the Hand and Wrist: A Pictorial Essay

All Day Location: MK Community, Learning Center

Participants
Rodrigo S. Damasceno, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Danilo S. Duque, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo L. Bizetto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Pedro Panizza, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Felipe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Denise T. Amaral, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Conrado F. Cavalcanti, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bondalo-Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Researcher, Guerbet SA
Giovanni G. Cerri, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The flexor mechanism is a tendinous complex involved in the flexion of the hand and wrist, being commonly injured in upper limb trauma. MRI plays a key role in the diagnosis of these pathologies. Knowledge of tendon anatomy in MRI is crucial to perform the correct diagnosis of these lesions, which if not adequately treated, can lead to severe functional loss. With this presentation one may be able to: Review the anatomy of the flexor mechanism of the hand and wrist in MRI; Understand the trauma contexts involved in trauma of the flexor mechanism of the hand and wrist; Recognize the main MRI findings in lesions involving the flexor mechanism of the hand and wrist.

TABLE OF CONTENTS/OUTLINE
There are two flexor tendons to each finger, except the thumb, which has only one. The short flexors are located in the hand, and the long flexors are located in the forearm, connecting to bones by long tendons. Injuries to the flexor mechanism occur due to a contusion or penetrating wound. The shallowness of these tendons and the small amount of subcutaneous tissue overlying the volar aspect of the hand and wrist predisposes these lesions. Recognizing the anatomy and major traumatic injuries of the flexor mechanism of the hand and wrist oughta be mastered by all radiologists, especially those with particular interest in musculoskeletal imaging.
Advanced MRI Techniques in Diabetic Foot Evaluation: Differentiation between Neuropathic Arthropathy and Osteomyelitis

All Day Location: MK Community, Learning Center

Participants
Teodoro Martin, MD, Jaen, Spain (Presenter) Nothing to Disclose
Fernando Caro Mateo, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Marta Gomez Cabrera, MD, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Maria Jose Romero Rivera, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Joan C. Vilanova, MD, PhD, Girona, Spain (Abstract Co-Author) Nothing to Disclose
Jordi Broncano, MD, Cordoba, Spain (Abstract Co-Author) Nothing to Disclose
Pilar Caro Mateo, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Luna, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the technical adjustments necessary to perform, in the diabetic foot, functional sequences such as DWI (mono and biexponential analysis), DCE-MRI, DWI and DTI-based neurography, DIXON sequence and 3D and 4D angiography.
2. Analyze the advantages of a MRI protocol integrating morphological and functional sequences.
3. Show the utility of all these new techniques in the differentiation between diabetic neuropathic arthropathy and osteomyelitis.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Technical basis and adjustments of advanced MRI sequences in the foot
   a. DWI: monoexponential and biexponential quantification
   b. DCE-MRI
   c. MR neurography: DWI and DTI
   d. MRI angiography: 3D, 4D
   e. DIXON acquisition
3. Diabetic foot evaluation with functional MRI techniques
   a. Morphological MRI: limitations
   b. Bone marrow edema pattern
   c. Soft tissue involvement
   d. Joint involvement
   e. Vascular assessment
4. Conclusions
Magnetic Resonance Neurography of Sciatic Nerve and Piriformis Muscle Variants: Simplified Classification

All Day Location: MK Community, Learning Center

Participants
Jason P. Eastlack, MD, Dallas, TX (Presenter) Nothing to Disclose
Lulu Tenorio, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Kelly Scott, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Adam Starr, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Research Consultant, Siemens AG; Consultant, ICON plc

TEACHING POINTS
Gain knowledge of traditional Beaton and Anson classification system for sciatic nerve and piriformis muscle variants. Learn MR neurography techniques for best demonstration of sciatic nerve and its variants. Review a proposed, simplified classification system for common sciatic neuromuscular variants as identified on MR neurography. Learn sciatic nerve and piriformis muscle variants with relevant case examples on anatomic and diffusion imaging. Gain knowledge of imaging findings of piriformis syndrome with relevant surgical correlations and image guided procedure interventions.

TABLE OF CONTENTS/OUTLINE
Discuss various classification systems of sciatic nerve and piriformis muscle variants from existing literature including most comprehensive Beaton and Anson classification from cadaveric work. Technical considerations for best anatomic and diffusion demonstration of sciatic neuromuscular variants. Review a proposed, simplified classification system for common sciatic neuromuscular variants as identified on MR neurography. Demonstrate sciatic neuromuscular variants with relevant case examples on anatomic and diffusion imaging. Selected case examples of piriformis syndrome with demonstration of various neuromuscular abnormalities on anatomic and diffusion imaging with relevant surgical correlations and image guided procedure interventions.
Be Pain Free: CT Guided Perineural Injections for Pelvic Pain

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Vibhor Wadhwa, MBBS, Little Rock, AR (Presenter) Nothing to Disclose
Paul T. Weatherall, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Lulu Tenorio, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Hythem A. Omar, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Parham Pezeshk, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Research Consultant, Siemens AG; Consultant, ICON plc

TEACHING POINTS

Learn the normal CT imaging anatomy of various pelvic nerves including genitofemoral nerve, ilioinguinal, iliohypogastric, pudendal nerve, inferior hemorroidal nerve, sciatic, lateral femoral cutaneous and posterior femoral cutaneous nerves with corresponding MR neurography (MRN) imaging examples. Learn the CT guided technique of perineural injections. Demonstrate with relevant case examples, the use of this technique in the diagnosis and therapy of chronic pelvic pain. Gain knowledge of potential pitfalls.

TABLE OF CONTENTS/OUTLINE

CT anatomy of pelvic nerves with corresponding MRN examples, CT guided technique of perineural injections and criteria for negative and positive blocks. MRN examples of anterior, posterior and deep pelvic neuropathies and corresponding CT injections for diagnostic and therapeutic blocks. Gain knowledge of potential pitfalls. Discussion of advantages and Disadvantages of CT guided injections over MR guided interventions.
Review of the Anatomy and Major Traumatic Injuries of the Extensor Mechanism of the Hand and Wrist: A Pictorial Essay

All Day Location: MK Community, Learning Center

Participants
Rodrigo S. Damasceno, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Eduardo L. Bizetto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Pedro Panizza, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Felippe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Denise T. Amaral, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Conrado F. Cavalcanti, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Bordalo-Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Researcher, Guerbet SA
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Danilo S. Duque, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The extensor mechanism is compound by the most complex anatomical structures of the hands, being commonly injured in upper limb trauma. MRI plays a key role in the diagnosis of these pathologies. Knowledge of tendon anatomy in MRI is crucial to perform the correct diagnosis of these lesions, which if not adequately treated, can lead to severe functional loss. With this presentation one may be able to: Review the anatomy of the extensor mechanism of the hand and wrist in MRI; Understand the trauma contexts involving the extensor mechanism of the hand and wrist; Recognize the main MRI findings in lesions involving the extensor mechanism of the hand and wrist.

TABLE OF CONTENTS/OUTLINE

The extensor muscles are divided into extrinsic and intrinsic. The intrinsic are located in the hand, while the extrinsic are located in the forearm and connect to the hand's bones through long tendons. There is also the interosseous-lumbrical complex. The lumbrical muscles contribute to the extension of the interphalangeal joints. Injuries to the extensor mechanism are common, mainly because of its superficial location and reduced amount of overlying subcutaneous tissue. Recognizing the anatomy and traumatic injuries of the extensor mechanism of the hand and wrist oughta be mastered by all radiologists, especially those interested in musculoskeletal imaging.
Subtle Pelvic Lesions: The Importance of Lines
All Day Location: MK Community, Learning Center

Participants
Chase Campbell, MD, Los Angeles, CA (Presenter) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Sulabha Masih, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Aaron Schein, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Anderanik Tomasian, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Eric A. White, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to educate the radiologist about the importance of observing the various radiographic lines and arcs in the pelvis as it relates to subtle pelvic lesions. Each of the important lines, rings, arcs, and trabecular patterns evaluated on routine adult and pediatric pelvic radiographs will be reviewed and correlated with their anatomic landmarks. This will be followed with several cases of subtle pelvic lesions, detectable by disruption of the aforementioned radiographic landmarks.

TABLE OF CONTENTS/OUTLINE
Pictorial and imaging anatomy of the bony pelvis. Illustrations and imaging of radiographic lines, rings, arcs, and trabecular patterns in both the adult and pediatric pelvis, specifically highlighting their anatomic correlates. Adult: iliac crest, iliopectineal, ilioischial, and sacral arcuate lines; acetabular teardrop, acetabular roof, and anterior and posterior acetabular walls; pelvic and obturator rings. Pediatric: Hilgenreiner, Perkin, Shenton and Klein lines. Imaging and discussion of several cases in which subtle pelvic fractures or destructive lesions are identifiable by a careful review of aforementioned radiographic lines, rings, arcs and trabecular patterns.
Functional MRI in Infectious Conditions of the Musculoskeletal System: Friend or Foe for Radiologist?

All Day Location: MK Community, Learning Center

Participants
Teodoro Martin, MD, Jaen, Spain (Presenter) Nothing to Disclose
Maria Jose Romero Rivera, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Joan C. Vilanova, MD, PhD, Girona, Spain (Abstract Co-Author) Nothing to Disclose
Marta Gomez Cabrera, MD, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Fernando Caro Mateo, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Pilar Caro Mateo, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Luna, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Describe the role and limitations of conventional radiological exams (x-ray plain film, ultrasound and computed tomography) and morphological MRI sequences in the evaluation of infectious conditions of musculoskeletal system.
2. Review the technical adjustments necessary to perform, in musculoskeletal system, functional sequences.
3. Analyze the role of these techniques, and potential pitfalls, in the evaluation of infectious conditions of bone and soft tissue.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Role of morphological imaging in the evaluation of MSK infection
   a. Osteomyelitis
   b. Soft tissue infection: cellulitis, abscess, pyomyositis
   c. Infectious arthritis
3. Technical basis and adjustments of functional MRI sequences for MSK system
   a. Dixon sequence
   b. DWI
   c. DCE-MRI
   d. Spectroscopy
4. Clinical applications of functional MRI
   a. Bone edema and osteomyelitis
   b. Soft tissue pathology (included subcutaneous tissue, muscle and tendons)
   c. Infectious arthritis
   d. Differentiating infection from malignancies with multiparametric MRI
5. Conclusions
Sonoelastography: A New Found Kin of B-mode Ultrasonography: Musculoskeletal Applications

All Day Location: MK Community, Learning Center

Participants
Nishant Singla, MBBS, Mumbai, India (Presenter) Nothing to Disclose

TEACHING POINTS

Sonoelastography (SEL) is a non-invasive method to assess the biomechanical property of a tissue. It gives some insight regarding the underlying disease process by following a simple dictum 'Soft is benign and Hard is malignant'. We intend to demonstrate the utility of this dictum in musculoskeletal system. The purpose of this exhibit is: Pictorial demonstration of the various musculoskeletal pathologies evaluated with sonoelastography, at our institute. Discuss various types of SEL, techniques and associated pitfalls. Brief discussion of the disease process evaluated by SEL.

TABLE OF CONTENTS/OUTLINE

Principles and types of SEL Technique and pitfalls Applications Rotator cuff Ankle joint (Achilles tendon) Knee Wrist Elbow Soft tissue (muscles and subcutaneous tissue) Superficial tumors and tumor like masses. Diagnostic dilemmas Further studies
TEACHING POINTS

The combination of optimized turbo spin echo and FDA-approved MAVRIC SL and SEMAC MRI allow for good to excellent metal artifact reduction and evaluation of host bone, bone-implant interface and surrounding soft tissues. The MRI characterization of periprosthetic fractures, osteolysis, infection, synovitis, hemarthrosis, tendon tears and neuropathies can contribute information for prognosis, risk stratification and surgical planning. Agency recommendations and international society guidelines often recommended MRI for work-up and surveillance of suspected adverse local tissue reactions in patients with metal-on-metal hip arthroplasty implants.

TABLE OF CONTENTS/OUTLINE

Update on published recommendations and guidelines for the use of MARS MRI Update on adverse local tissue reactions in the setting of metal-on-metal hip arthroplasty designs Common modes of failure of hip, knee and shoulder arthroplasty systems

Techniques and protocols for MARS MRI of hip, knee and shoulder following arthroplasty including patient positioning, coil selection, optimized turbo spin echo MRI, MAVRIC, SEMAC, intravenous contrast administration MRI appearances of periprosthetic fractures, osteolysis, infection, types of synovitis, hemarthrosis, arthrofibrosis, tendon tears, ligamentous insufficiency, and neuropathies
Hardware Complications: Open Reduction and Internal Fixation

All Day Location: MK Community, Learning Center

Participants
Connie Y. Chang, MD, Boston, MA (Presenter) Nothing to Disclose
Santiago Lozano Calderon, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ambrose J. Huang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Knowing the normal appearance of open reduction and internal fixation hardware is essential for detecting abnormalities and complications.
2. When evaluating hardware, remember MING: Metal (hardware), Bone-hardware Interface, Native bone, Bone Graft.
3. The Metal (hardware) can bend, break, and move.
4. Bone-hardware Interface lucency has a differential diagnosis, the most worrisome of which is infection, but mechanical loosening and foreign body reaction can have a similar appearance.
5. Bone can fracture, especially immediately proximal or distal to the hardware.
6. Bone graft can fracture, dislocate, resorb, and subside.
7. Many of these complications are concurrent.

TABLE OF CONTENTS/OUTLINE
1. Expected post-operative appearance of open reduction and internal fixation hardware.
2. Immediate post-operative complications.

All Day Location: MK Community, Learning Center

Participants
Eric Tarkowski, MD, Chicago, IL (Presenter) Nothing to Disclose
Imran M. Omar, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Kevin J. Blount, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Jonathan D. Samet, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Thomas H. Grant, DO, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: 1. Discuss techniques to optimally evaluate peripheral nerves in the upper extremity during an ultrasound examination. 2. Review brachial plexus and upper extremity peripheral nerve anatomy. 3. Provide a guide on how to consistently and confidently identify less commonly observed peripheral nerves with ultrasound. Many of these peripheral nerves are known to cause clinical symptoms and may be difficult to assess with MR imaging. 4. Review upper extremity peripheral nerve conditions and their sonographic presentation utilizing real case examples.

TABLE OF CONTENTS/OUTLINE
Discussion of the ultrasound exam of peripheral nerves Approach Equipment Technique/optimization of nerve imaging Review upper extremity nerve anatomy Areas of concentration - including discussion and illustration of methods for identification, normal nerve appearance, and examples of clinical conditions Brachial plexus Lateral antebrachial cutaneous n. Median nerve branches Anterior interosseous n. Palmar cutaneous branch Recurrent branch of median n. Ulnar nerve branches Dorsal branch Ulnar digital nerve of the thumb (Bowler's thumb) Radial nerve branches Superficial branch (wartenberg's syndrome) Posterior interosseous neuropathy (PINS) and radial tunnel syndrome (RTS)
All about Lumbar Facet Arthrogram: Imaging Spectrum and Technical Tips

All Day Location: MK Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Boreum Yoo, MD, Seongnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon Woo Lee, MD, PhD, Sungnamsi, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eugene Lee, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Huncheol Lim, MD, Seongnaum, Korea, Republic Of (Presenter) Nothing to Disclose
Yusuhn Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joong Mo Ahn, MD, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) to review the anatomy and the basic technique for lumbar facet joint injection, 2) to show various patterns of the facet arthrogram 3) to adduce technical tips for successful intra-articular injection in challenging cases.

TABLE OF CONTENTS/OUTLINE
1. Anatomy of Lumbar Facet Joint
2. Injection Technique for Lumbar Facet Joint
4. "False" facet arthrogram- Soft tissue staining- Muscular staining- Vascular staining
5. Challenging cases- Osteoporosis- Severe degenerative change of facet joint- Excessive coronal orientation : L5-S1 facet joint, scoliosis- Adjacent iatrogenic implants : Post-instrumentation, vertebroplasty
Ultrasound for the Evaluation of Rheumatologic Conditions

All Day Location: MK Community, Learning Center

Awards
Magna Cum Laude

Participants
Netanel Berko, MD, Bronx, NY (Presenter) Nothing to Disclose
Shlomit Goldberg-Stein, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Shari Friedman, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Malka B. Finkelstein, MD, New Rochelle, NY (Abstract Co-Author) Nothing to Disclose
Beverly A. Thornhill, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Ultrasound is well-suited to evaluate various rheumatologic conditions, including osteoarthritis, inflammatory arthritis, gout, and CPPD arthropathy. Ultrasound can be used to assess abnormalities in bone, cartilage, joints and soft tissues. Use of color Doppler increases sensitivity in the detection of disease processes. Ultrasound is more sensitive than radiography for the detection of early disease findings and for the evaluation of active disease. Correct performance of ultrasound examinations, and knowledge of pitfalls and artifacts, is crucial for accurate diagnosis.

TABLE OF CONTENTS/OUTLINE

Indications for ultrasound in rheumatologic conditions and comparison with other imaging modalities Ultrasound technique Pathology Bone Erosions Osteophytes Cartilage Cartilage loss Chondrocalcinosis Crystal deposition Joint Synovitis Effusion Differentiation between complex effusion and synovitis Tendon Tenosynovitis Tendinosis Soft tissues Bursitis Artifacts and pitfalls Anisotropy Excess transducer pressure eliminating vascularity Metacarpal head pseudoerosion Wrist extensor retinaculum simulating tenosynovitis
Musculoskeletal Tumors and Pseudotumors with Restricted Diffusion in DW-MRI

Awards
Certificate of Merit

Participants
Juliana P. Andrade, MD, Rio de Janeiro, Brazil (Presenter) Nothing to Disclose
Flavia M. Costa, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Silvana M. Mendonca, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Augusto G. Altoe, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

How to recognize the main differential diagnosis of musculoskeletal tumors and pseudotumors with restricted diffusion in diffusion-weighted MR imaging, and how to apply DWI sequence in diagnosis and post treatment follow-up of some of these lesions.

TABLE OF CONTENTS/OUTLINE

A. To explain Diffusion-weighted MR imaging (DWI) sequence; B. To illustrate with conventional MR and DW images the differential diagnosis of musculoskeletal tumors and pseudotumors with restricted diffusion (sarcomas, abscesses, hematomas, Giant cell tumors, lymphoma, angiofibrolipoma, granular cell tumor). C. To correlate DWI-MRI and conventional images with radiologic and histopathologic findings. D. To illustrate the differential diagnosis of these tumors with DWI-MRI and conventional images. E. The usefulness of diffusion in follow-up treatment management of these tumors.
What’s in a Name? - A General Radiologist’s Guide to Eponymous Fractures

All Day Location: MK Community, Learning Center

Participants
Christine Azzopardi, MD, Birkirkara, Malta (Abstract Co-Author) Nothing to Disclose
Christine J. Cannataci, MD, Msida, Malta (Abstract Co-Author) Nothing to Disclose
Gabriel Galea, MD, Msida, Malta (Abstract Co-Author) Nothing to Disclose
Reuben Grech, MD, FRCR, Msida, Malta (Presenter) Nothing to Disclose
Sandro Galea-Soler, MD, FRCR, Msida, Malta (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To demonstrate findings of eponymous fractures on different imaging modalities To illustrate and recognise patterns, associations and complications of eponymous fractures

TABLE OF CONTENTS/OUTLINE
Traumatic bone injuries and their sequelae may incur significant morbidity and mortality to patients - the importance of early recognition and accurate description is well-recognised. This pictorial review aims to illustrate the radiological assessment of important eponymous fractures in various parts of the skeleton and outline key imaging findings ensuring these fractures are correctly identified with the physicians who so affectionately named them. The indications for cross-sectional imaging and the appearances of these fractures, their associations and complications will be discussed. The classification of these injuries, which gives an indication of stability and which may aid in planning management and predicting long-term functional outcome will be described and illustrated.
Participants
Idan Genah, MD, Paris, France (Presenter) Nothing to Disclose
Jean-Denis Laredo, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Elodie Sibleau, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Caroline Parlier, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Valerie Bousson, Paris, France (Abstract Co-Author) Nothing to Disclose
Jean-Michael Sverzut, MD, Saint Denis, France (Abstract Co-Author) Nothing to Disclose
David Petrover, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Sebastien Touraine, MD, Paris, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the anatomy and functional anatomy of the TFCC
To review the pathophysiology, the imaging and the clinical repercussions of the different TFCC tears. To understand the therapeutic strategy

TABLE OF CONTENTS/OUTLINE
The triangular fibrocartilage complex of carp (TFCC) is a complex structure of the ulnar side ensuring stability of the distal radio-ulnaire joint (DRUJ) and amortization of stress on the ulnar side. TFCC tears are traumatic or, more often, degenerative. It is favored by a positive ulnar variance. The treatment of tears of the TFCC is essentially based on the anatomical location of these lesions and impact on the stability of the distal radio-ulnaire joint. Imaging is essential. In addition to plain radiographs, MR orthography or CT arthrography are the most appropriate imaging examinations for these lesions: They allow to objectify the TFCC lesion and specify its location and extent, and provide a good analysis of the associated ligament and cartilage injuries. Articular disc tears, with no impact on the stability of the DRUJ, are distinguished from tears of the stabilizing structures such as radioulnar ligaments. Moreover, tears of the radial side are differentiated from the ulnar side where the TFCC is better vascularized, allowing to consider restorative surgery with greater potential for healing.
I am Losing My Arch and It Hurts: Posterior Tibial Tendon Dysfunction and Acquired Flat Foot Deformity

All Day Location: MK Community, Learning Center

Participants
Riza Selc, Brooklyn, NY (Presenter) Nothing to Disclose
Jinel A. Scott, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Srinivas Kolla, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Samuel A. Osei-Bonsu, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Scott A. Lehto, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jaime Uribe, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the anatomy of the plantar arch and posterior tibial tendon.
2. Understand the posterior tibial tendon dysfunction and its association with adult acquired flat foot deformity.
3. Review the biomechanics of the continuum of posterior tibial tendon dysfunction.
4. Understand the most commonly used staging system for posterior tibial tendon dysfunction utilizing radiographs and MRI imaging.
5. Review and demonstrate treatment options for each stage of posterior tibial tendon dysfunction.

TABLE OF CONTENTS/OUTLINE
1. Illustration of the anatomy of the plantar arch and posterior tibial tendon.
2. Biomechanics of posterior tibial tendon dysfunction.
3. Key anatomical relationships on radiographic and MRI imaging of the adult acquired flatfoot.
4. Description and illustrations of the widely used staging system of PTTD based on condition of the tendon, hindfoot position and flexibility of the acquired foot deformity.
5. Radiographic and MRI illustration of the stages of PTTD pre and post surgical correction.
Updated and Novel Imaging of Acetabular Fractures
All Day Location: MK Community, Learning Center

Participants
Rollin Yu, BSC, Burnaby, BC (Presenter) Nothing to Disclose
Teresa I. Liang, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (Abstract Co-Author) Institutional research agreement, Siemens AG

TEACHING POINTS
To discuss pathophysiology and the clinical presentation of acetabular fractures To discuss the imaging modalities and spectrum of imaging findings used for diagnosis of acetabular fractures To review the Judet-Letournel classification system of acetabular injuries and its impact on management

TABLE OF CONTENTS/OUTLINE
Pathophysiology/epidemiology/anatomy/clinical presentation/complications of acetabular fractures Utility and limitations of imaging modalities for diagnosis and follow up (ie. radiographs and MDCT) Sample cases and imaging examples Key measurements and findings requested by orthopedic surgeons Review of the Judet-Letournel imaging classification system Imaging-based algorithm for evaluation and management of acetabular fractures Cases of associated imaging pitfalls and artifacts New imaging techniques applicable for imaging of acetabular fractures Iterative Reconstruction Dual-energy CT Summary
Participants
Kavi K. Devulapalli, MD, MPH, San Francisco, CA (Presenter) Nothing to Disclose
Daria Motamedi, MD, Washington DC, DC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review of relevant anatomy including the compartments of the lower extremity with emphasis on fascia. Demonstrate key-imaging characteristics of lower extremity fascia injuries including Morel-Lavallée lesions, muscle hemiation injuries, compartment syndrome and injuries related to the fascia lata including iliotibial band syndrome. Review management options of the above entities.

TABLE OF CONTENTS/OUTLINE
Name That AVN: A Guide to Eponymous Avascular Necroses
All Day Location: MK Community, Learning Center

Participants
Vivek Patel, MD, New Haven, CT (Presenter) Nothing to Disclose
Aditi Vyas, MD, Norwalk, CT (Abstract Co-Author) Nothing to Disclose
Andrew W. Lischuk, MD, Newtown, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to review the historical information, incidence, imaging findings, causes, treatments, outcomes, and teaching points of eponymous avascular necroses.

TABLE OF CONTENTS/OUTLINE
A radiograph and brief history will be initially presented and the viewer will be asked to "Name that AVN." Next, annotated multimodality images will be presented with a discussion. The AVN's to be discussed: Ahlback - medial femoral condyle Brailsford - radial head Buchman - iliac crest Burns - distal ulna Caffey - intercondylar spines of tibia Chandler - adult femoral head Dias - trochlear of the talus Dietrich - metacarpal heads Freiberg - head of the second metatarsal Friedrich - medial clavicle Hass - humeral head Iselin - base of the fifth metatarsal Keinbock - lunate Kohler - pediatric patella or navicular Kummel - vertebral body Legg-Calve-Perthes - pediatric femoral head Liffert-Arkin - distal tibia Mandl - greater trochanter Mauclaire - metacarpal heads Milch - ischial apophysis Mueller-Weiss - adult navicular Osgood-Schlatter - tibial tubercle Panner - capitellum of humerus Pierson - symphysis pubis Preiser - scaphoid Renander - tibial sesamoid Sever - calcaneal epiphysis Sinfind-Larsen-Johansson - patella Thiemann - base of phalanges Trevers - fibular sesamoid Van Neck-Odelberg - ischiopubic synchondrosis
Bloated Bones: A Review of Intraosseous Gas

All Day Location: MK Community, Learning Center

Participants
Vivek Patel, MD, New Haven, CT (Presenter) Nothing to Disclose
Aditi Vyas, MD, Norwalk, CT (Abstract Co-Author) Nothing to Disclose
Andrew W. Lischuk, MD, Newtown, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The goal of this exhibit is to review the different causes, imaging findings, prevalence, treatments, and outcomes of etiologies presenting with intraosseous gas. Detailed pathophysiology, biomechanics, and physics of how intraosseous gas forms and its sources will be highlighted.

TABLE OF CONTENTS/OUTLINE
Each case will be first presented with a brief history and CT imaging and the viewer will be asked “what is the cause of this intraosseous gas?” The viewer will then analyze the image and create a differential diagnosis. This will be followed by annotated CT images, multimodality imaging correlation, review of associated findings, and a discussion. The discussion will contain relevant information about prevalence, causes, pathophysiology, treatments, and outcomes of each entity. Separate slides with information about the pathophysiology related to the intraosseous gas will be presented. The pathologies to be discussed are: Bone biopsy Compression/insufficiency fracture Degenerative disease Fistula Intraosseous abscess Neoplasm Osteomyelitis Osteonecrosis Pneumatocyst Schmorl's node Surgery Traumatic fracture
You Cannot Lose Your Roots. Don´t Miss the Radiographic Film Tips for Systemic Diseases

All Day Location: MK Community, Learning Center

Participants
Felipe B. Franco, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Affonso C. Neto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Sergio Brasil Tufik, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Dalton L. Ferreira, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marco de Andrade Bianchi, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
(1) Review the aspects of important systemic diseases that can be properly diagnosed with the correct interpretation of musculoskeletal radiography. (2) Emphasize the more frequent and pathognomonic findings in each disease, that narrow differential diagnosis. (3) Illustrate the disease course with the follow up of severe cases and lately diagnosed patients. (4) Point the main aspects that can drive the correct diagnostic workflow with cases in which radiography played a crucial role.

TABLE OF CONTENTS/OUTLINE
(1) Basic anatomic review, pointing the main affected structures and the pathophysiologic course of each disease. (2) Typical findings of the following diseases, illustrated by our own cases: Sickle Cell Disease, Thalassemia, Tuberous Sclerosis, Hyperparathyroidism, Osteopetrosis, Gorham Stout Disease, Scleroderma (CREST Syndrome), Ankylosing Spondylitis, Reactive Arthritis, Enteropathic Spondylitis, Psoriatic Arthritis and Juvenile Idiopathic Arthritis. (3) Point the most common pitfalls in the interpretation of these diseases. (4) Review the current clinic diagnostic workflow for each disease.
General Positioning Sonography: GPS of the Carpal Bones

All Day Location: MK Community, Learning Center

Participants
Guillermo A. Azulay, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Ignacio Rossi, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Carlos Cadenas, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Patrick Omoumi, MD, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review a practical ultrasonographic approach to identify normal and pathologic findings of carpal bones, taking in consideration different anatomic references, dynamic maneuvers and cortical bone contours.

TABLE OF CONTENTS/OUTLINE
Participants
Jason Rothschild, MD, Orange, CA (Presenter) Nothing to Disclose
Joseph E. Burns, MD, PhD, Orange, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Using three-dimensional modeling with cine, create an epidemiologically-based intuitive conceptual geometric picture of the pathoanatomy of acetabular fractures in both the young and elderly. 2. Review the most common classification and reporting system in use by orthopedic surgeons for acetabular fractures. 3. Discuss reporting of imaging findings which are important help guide patient management decisions for orthopedic surgeons.

TABLE OF CONTENTS/OUTLINE
1. Review of acetabular and peri-acetabular anatomy. Describe the normal radiographic acetabular anatomy. 2. Using 3-dimensional reconstructs and animations, demonstrate the bimodal mechanisms of injury and pathophysiology in young and elderly patients. 3. Illustrate the Judet and Letournel classification system used by orthopedic surgeons for acetabular fractures with radiologic examples, and discuss how this factors into patient management decision trees. 4. Discuss important features on follow-up imaging. Review the most common complications associated with these types of injuries.
Shoulder Injuries in the Overhead Athlete

All Day Location: MK Community, Learning Center

Participants
Dana Lin, MD, New York, NY (Presenter) Nothing to Disclose
Tony T. Wong, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jonathan K. Kazam, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The thrower's paradox illustrates the delicate balance between shoulder mobility and shoulder stability. Altered dynamics from repetitive throwing can result in internal impingement and glenohumeral internal rotation deficit, both factors predisposing to rotator cuff tears and SLAP lesions, especially along the posterosuperior glenohumeral joint. In the throwing athlete, the most common type and site of cuff tears are partial-thickness articular surface tears of the posterior supraspinatus and/or anterior infraspinatus tendons. Proximal humeral epiphysiolysis and lesser tuberosity avulsion fractures are common injuries unique to adolescent overhead athletes due to incomplete or recent fusion of the physes.

TABLE OF CONTENTS/OUTLINE

1. Pre-test
2. Pitching mechanics Pertinent anatomy Kinetic chain Phases of pitching Thrower's paradox
3. Mechanisms of injury and imaging findings in adult pitchers Internal impingement Glenohumeral internal rotation deficit (GIRD) Posterior glenoid exostosis (Bennett's lesion) Superior labrum anterior-posterior (SLAP) lesions Partial thickness articular-sided rotator cuff tears
4. Injuries unique to adolescent pitchers Proximal humeral epiphysiolysis (Little League shoulder) Lesser tuberosity avulsion fractures and stress reaction
5. Post-test
Participants
Andrew L. Chiang, MD, Maywood, IL (Presenter) Nothing to Disclose

TEACHING POINTS
Understand normal anatomy of the clavicle including normal variants and associated soft tissues and articulations Recognize the spectrum of traumatic, neoplastic, inflammatory, infectious, metabolic, and congenital disease states that can affect the clavicle Identify imaging features on conventional radiographs, CT, and MRI that allow accurate diagnosis of specific disease states, as illustrated by representative cases from our institution Understand treatment options for common disease states involving the clavicle

TABLE OF CONTENTS/OUTLINE
Normal anatomy of the clavicle and normal variants Review of disease states affecting the clavicle Traumatic, neoplastic, infectious, inflammatory, metabolic, and congenital Basic treatment options Imaging techniques Radiographs, CT, MRI, nuclear medicine Sample cases Summary
Shoulder Muscle Denervation: An Imaging Review with Cadaveric Correlation

All Day Location: MK Community, Learning Center

Participants
Robert J. Ward, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ramsay C. Ishak, MD, Boston, MA (Presenter) Nothing to Disclose
Khaled Hammoud, MD, Cambridge, MA (Abstract Co-Author) Nothing to Disclose
Kristin England, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Joshua T. Kyle, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Marios Loukas, MD, PhD, Saint George, Grenada (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The learner will be able to identify leading causes of common denervation syndromes about the shoulder. The learner will understand the innervation of the shoulder muscles from the level of the brachial plexus. The learner will review uncommon denervation patterns about the shoulder.

TABLE OF CONTENTS/OUTLINE
I. Common denervation patterns about the shoulder
A. Supraspinatus
1. Etiology/Common Causes
2. Brachial Plexus Correlation
3. Cadaveric Correlation
B. Infraspinatus
1. Etiology/Common Causes
2. Brachial Plexus Correlation
3. Cadaveric Correlation
C. Teres Minor
1. Etiologies
2. Brachial Plexus Correlation
3. Cadaveric Correlation
II. Uncommon denervation patterns about the shoulder
A. Subscapularis
1. Etiology
2. Brachial Plexus Correlation
3. Cadaveric Correlation
B. Teres Major Correlation
1. Etiology
2. Brachial Plexus Correlation
3. Cadaveric Correlation
III. Multiple Nerve Denervation Patterns
1. Etiology
2. Brachial Plexus Correlation
3. Cadaveric Correlation
Participants
Tae Seong Im, Seongnam, Korea, Republic Of (Presenter) Nothing to Disclose
Eugene Lee, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon Woo Lee, MD, PhD, Sungnamsi, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The major teaching point of this exhibit is to illustrate spinal intervention procedures which is related with cerebrospinal fluid management such as CSF tapping, lumbar drainage catheter insertion or epidural blood patch, through reviewing anatomy, protocols, typical images and technical failures of each procedures. We expect that this exhibit, as a concise reference, can help radiologists to perform those spinal intervention procedures.

TABLE OF CONTENTS/OUTLINE
TEACHING POINTS

Fluid-fluid levels were initially described as a feature of ABC. Additional studies reported it in a wide range of bone and soft-tissue tumors, both benign and malignant. The purpose is to review different characteristics of fluid-fluid level containing bone and soft tissue tumors, using conventional and advanced MRI techniques as dynamic contrast-enhanced perfusion MR imaging, SWI, in and out phase and DWI. To correlate these findings with X-ray, computer tomography and histopathologic analysis.

TABLE OF CONTENTS/OUTLINE

-To illustrate and differentiate, using conventional MRI (extent and signal characteristics on T2, many cases of fluid-fluid level containing bone and soft-tissue tumors: Benign: Giant Cells Tumor, chondroblastoma, fibrous dysplasia, simple bone cyst, Primary and secondary ABC; Brown tumor; synovial haemangioma; Malignant lesions: Telangiectasic osteosarcoma; metastasis; synovial sarcoma; myositis ossificans; adamantinoma. -To discuss and illustrate the characteristics of each advanced MRI sequence in the differential diagnosis of these tumors. -To correlate these MRI techniques with X-ray, computer tomography and histopathological findings. -To illustrate the usefulness of dynamic contrast-enhanced perfusion MR imaging to indentify the solid part of the lesion and to guide the biopsy site.
Interposition Injuries in Orthopaedics: MRI Features and Clinical Significance

All Day Location: MK Community, Learning Center

Awards
Magna Cum Laude

Participants
Robert D. Boutin, MD, Sacramento, CA (Presenter) Nothing to Disclose
Russell C. Fritz, MD, Mill Valley, CA (Abstract Co-Author) Nothing to Disclose
Tal Laor, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Lawrence Yao, MD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose
Mini N. Pathria, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Interposition injuries are caused most commonly by trauma, especially transient subluxations, dislocations and fractures. Although the Stener lesion is a well-known phenomenon in the thumb, analogous circumstances can occur at all of the other major joints in the extremities. In addition to displacement of a torn ligament away from bone (allowing for interposition of another structure that inhibits normal healing), a wide array of important structures can be displaced into ectopic locations, including into a joint, bone (fracture), tendon tear or ligament tear. Important structures that are displaced include: ligament, tendon, muscle, nerve, cartilage, bone and periosteum. Interposition injuries often require management with operative intervention in order to restore anatomic relationships and optimize clinical outcomes. MRI is helpful in identifying appropriate surgical candidates and planning surgical correction

TABLE OF CONTENTS/OUTLINE
Cases are presented in a quiz format. MRI of interposition injuries are organized anatomically for the upper and lower extremities, and includes both adult and pediatric patients: Hand (Stener lesion); Elbow (LCL, annular ligament); Shoulder (osteocondral fracture, biceps) Foot (plantar plate, peroneal tendons); knee (MCL; quad, patellar, popliteal tendons; peroneal nerve, periosteum); hip (labrum, ligamentum teres)
Do We Really Need Open or Upright MRI Scanner? Our Technique for Imaging the Wrist in Obese and Claustrophobic Patients Using a Standard MRI Scanner

All Day Location: MK Community, Learning Center

Participants
Yogesh Kumar, MD, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose  
Daichi Hayashi, MBBS, PhD, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose  
Brian Rapillo, RT, Trumbull, CT (Abstract Co-Author) Nothing to Disclose  
Kusum Hooda, MBBS, Stratford, CT (Abstract Co-Author) Nothing to Disclose  
Salil Sharma, MD, Bridgeport, CT (Presenter) Nothing to Disclose  
Ian G. Karol, MD, Westport, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. It is challenging to image obese and claustrophobic patients using a standard, non-open, magnetic resonance imaging scanner.  
2. Installing an additional upright or open MRI scanner may not be cost effective for most practices.  
3. Our technique with a patient in sitting or standing position behind the standard MRI scanner with the wrist imaged using a standard wrist coil may be helpful in MR examination of these patients.

TABLE OF CONTENTS/OUTLINE
• Standard patient positioning for routine MRI of wrist using a non-open standard MRI scanner  
• Our technique with the patient sitting/standing outside the standard MRI scanner for imaging obese and claustrophobic patients  
• Comparison of image quality for diagnostic information between standard technique and our technique  
• Sample cases - triquetral fracture; degenerative changes of radiocarpal joint; triangular fibrocartilage complex tear  
• Conclusion - our technique enables wrist imaging of obese and claustrophobic patients who cannot otherwise be imaged using a standard MRI scanner without compromising image quality that is essential for making diagnosis
Participants
Huncheol Lim, MD, Seongnaum, Korea, Republic Of (Presenter) Nothing to Disclose
Euddeum Shim, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yusuhn Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joong Mo Ahn, MD, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Many advanced surgical procedures are being performed for the treatment of osteoarthritis (OA) of knee and the precise interpretation of postoperative imaging is important as much as the correct preoperative diagnosis. The purpose of this exhibit are:
1. To introduce surgical techniques and successful postoperative image findings for knee OA.
2. To describe abnormal image findings associated with surgical failure or complications which may be related with residual or recurrent symptoms.

TABLE OF CONTENTS/OUTLINE
1. Overview of the OA of knee: image findings, stage (Kellgren-Lawrence grade, International Knee Documentation Committee grade)
2. Surgical techniques and normal postoperative image findings A. arthroscopic lavage and debridement B. cartilage repair techniques: bone marrow stimulation, osteochondral transplantation, autologous chondrocyte implantation C. osteotomies D. arthroplasty: unicompartmental / total knee arthroplasty
3. Abnormal postoperative imaging on follow-up
4. Summary and Take-home message
High-Resolution 3T MR Neurography

All Day Location: MK Community, Learning Center

Participants
Pedro H. Martins, MD, Rio de Janeiro, Brazil (Presenter) Nothing to Disclose
Flavia M. Costa, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Evandro Miguelote, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Bruno Baptista H. Mendes SR, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Marcio Bernardes, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to review the 3T MR Neurography (MRN) techniques and to explain how advances in MR imaging, including functional sequences such as diffusion-weighted imaging (DWI) and diffusion-tensor imaging (DTI), could improve peripheral nerve system assessment in disorders as nerve injury, entrapment, and neoplasm.

TABLE OF CONTENTS/OUTLINE
- To demonstrate the MRN technique used in our institution
- To explain the physical principles of DWI and DTI and their application in assessing peripheral nerves
- To illustrate the normal appearance and the spectrum of disorders that can affect the peripheral nervous system
- Potential future application
TEACHING POINTS

Whole-body imaging is generally performed by using skeletal survey, scintigraphy and positron emission tomography (PET), the latter also combined with computed tomography (CT). The use of whole-body magnetic resonance imaging (WBMRI), including diffusion-weighted imaging (DWI), has been studied as an alternative method, specially for tumor staging and assessment of treatment response, that has the benefits of wholebody coverage and lack of ionizing radiation. The purpose of this exhibit is to review whole body MRI protocols and how DWI could improve this technique, and illustrate with practical examples.

TABLE OF CONTENTS/OUTLINE

- To demonstrate the Whole-Body MRI (WBMRI) technique used in our institution
- To explain the physical principles of DWI and its application on WBMRI
- To discuss and illustrate the usefulness of WBDWI associated with conventional sequences in the context of diffuse bone disease
- The usefulness of these techniques in assessment follow-up and therapeutic management
- To discuss the limitations of WBDWI and potential future application
An Overview of the Types of Orthopedic Hardware Used in the Hip and Proximal Femur and Their Associated Complications

All Day Location: MK Community, Learning Center

Participants
George Athanasatos, MD, Winston Salem, NC (Presenter) Nothing to Disclose
Katryana M. Hanley-Knutson, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Scott D. Wuertz, MD, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Pushpender Gupta, MBBS, Winston-Salem, NC (Abstract Co-Author) Author, Reed Elsevier
Maha Torabi, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review types of orthopedic hardware used in the hip and proximal femur
Present complications associated with the different types of orthopedic hardware
Review the orthopedic hardware and their associated complications through case examples

TABLE OF CONTENTS/OUTLINE
Introduction
Orthopedic Hardware
Total arthroplasty
Hard on hard
Hard on soft
Hemiarthroplasty
Unipolar
Bipolar
Resurfacing arthroplasty
Screws
Cannulated screw
Derotational screw
Dynamic hip screw
Interlocking screw
Intramedullary rod
Plates
Greater tuberosity humeral buttress plate
Reconstruction plate
Angled blade plate
Nails
Cerclage wires
Gruen Zones
Complications
Periosteal reaction
Stress shielding
Calcar resorption
Particle disease and osteolysis
Bony remodeling
Metallic debris, polyethylene wear, and reaction to metal
Heterotopic ossification
Implant migration and subsidence
Hardware loosening
Infection
Mechanical impingement
Screw migration
Periprosthetic fracture
Dislocation
Transient High Vertebral Bony Enhancement Caused by Basivertebral Engorgement Syndrome Mimicking Sclerotic Osseous Metastases

All Day Location: MK Community, Learning Center

Participants
Ron I. Benjamin, MD, Newark, DE (Presenter) Nothing to Disclose
Assaf Graif, MD, Newark, DE (Abstract Co-Author) Nothing to Disclose
Howard M. Levy, MD, Bryn Mawr, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review the etiologies leading to development of vertebral body venous collaterals, discussing normal venous drainage pathways and the pathophysiology of abnormal venous plexus anastomoses. 2. Discuss the key imaging factors including timing of the acquisition, and rate of injection of contrast causing transient high density vertebral bone enhancement. 3. Compare key imaging characteristics which help to distinguish between transient high density vertebral bone enhancement and true sclerotic boney metastases.

TABLE OF CONTENTS/OUTLINE
A. Short review of the anatomy of normal vertebral body venous drainage
B. Discussion of etiologies for formation of collaterals of the venous drainage pathway a. Superior Vena Cava Obstruction b. Left Brachiocephalic vein thrombosis
C. Pathophysiology of the four different collateral pathways within the chest, while focusing on the vertebral drainage pathway
D. Pictorial overview of pathological development of the vertebral drainage pathway leading to a dilated venous plexus, and subsequent enhancement with contrast which mimics sclerotic osseous metastases
E. Imaging parameters leading to vertebral body contrast enhancement: a. Timing of the acquisition b. Rate of injection of contrast
F. How to discern transient high density vertebral bone enhancement from osseous metastases utilizing various imaging modalities
TEACHING POINTS

1. CT guided bone biopsy performed with a battery powered mechanical drill is an effective method for biopsy of dense sclerotic lesions, lesions with long biopsy tracks, lesions in bone with a curved surface, small lesions that require careful repositioning of the biopsy needle, and bone marrow aspiration procedures.  
2. The mechanical drill system is safe and easy to use for bone biopsy procedures. The recent introduction of a coaxial system is an added benefit for many biopsy approaches.  
3. The mechanical drill offers distinct advantages over traditional manual biopsy needles. 

TABLE OF CONTENTS/OUTLINE

A. Description of the mechanical drill device  
B. How to use the drill using animations and illustrations, with single needle and coaxial technique  
C. Indications for the mechanical drill with example cases  
D. Advantages of the mechanical drill over the manual device  
   - Shorter procedure time  
   - Less pain experienced by the patient  
   - Decreased strain on operator  
   - Drilling through dense bone or reaching bone lesions that may be otherwise difficult to access  
   - Increased biopsy sample size  
E. Literature review with focus on comparison of a powered biopsy device versus manual technique  
F. Potential future improvements in the drill system
MRI Guided Biopsies of Soft Tissue Tumors

All Day Location: MK Community, Learning Center

Participants
Guenther K. Schneider, MD, PhD, Homburg, Germany (Presenter) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group; Jonas Stroeder, MD, Homburg, Germany (Abstract Co-Author) Nothing to Disclose
Philippe Jagoda, MD, Homburg/saar, Germany (Abstract Co-Author) Nothing to Disclose
Peter Fries, MD, Homburg, Germany (Abstract Co-Author) Nothing to Disclose
Arno Buecker, MD, Homburg, Germany (Abstract Co-Author) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG

TEACHING POINTS
Frequently soft tissue tumors are insufficiently displayed on CT or US especially regarding internal lesion morphology. With the advent of large bore MR-systems routine biopsies of soft tissue tumors are nowadays possible. Due to the better tissue contrast, MRI allows for sufficient depiction of lesions even on unenhanced images. Furthermore MRI using DWI, PWI and contrast enhanced imaging allows for identification of internal tissue morphology of tumors e.g. necrosis, cystic areas, dedifferentiated tissue areas and so allows for identification of optimal tumor regions for tissue sampling thus decreasing the sampling error. The aim of this poster is to demonstrate the potential of MRI guided biopsies in a routine setting. Materials, sequences and cases of different tumors in different locations will be demonstrated. All presented cases are confirmed by histology and a comparison between predicted and final histology post resection is given.

TABLE OF CONTENTS/OUTLINE
A Materials, Patient preparation and sequences available for MR guided interventions B Review of compartmental anatomy C The right access for biopsy D Case presentations with depiction of the different techniques used in different locations and tumors, demonstration of biopsy planning and use of semiautomatic and automatic systems, final and predicted histology of presented cases
How to Approach and Classify Intra-articular Hip Injuries Based on MR Arthrography with Leg Traction with Arthroscopic Correlation

All Day Location: MK Community, Learning Center

Participants
Luis Cerezal, MD, Santander, Spain (Presenter) Nothing to Disclose
Moises Fernandez Hernando, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Luis P. Carro, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Eva Llopis, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Alejandro U. Rolon, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Ana Canga, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Update on the diagnosis and treatment of intra-articular hip pathology.
2. To correlate MR arthrography with axial traction findings with arthroscopy.
3. To discuss the different existing classifications and establish which of them allow an effective communication with our arthroscopists and preoperative planning.

TABLE OF CONTENTS/OUTLINE
1. We will review the role of imaging techniques in the diagnosis of intra-articular hip pathology, with emphasis on MR arthrography with axial traction.
2. We will discuss the main intra-articular pathologies (femoroacetabular impingement, adult hip dysplasia, ligamentum teres injuries, hip instability, and traumatic injuries) showing demonstrative examples with arthroscopy correlation.
3. To improve communication with clinicians is essential to use the same classifications, we will review the main classifications used in the literature and their clinical implications.
   a. Labrum: Mahorn. Clock face system of extension of labral injuries.
   b. Cartilage: ICRS classification. ALAD. Geographic zone method.
   c. Ligamentum teres: Botser’s classification.
   d. Hip instability: Mahorn. Our objective is to conclude which of these classifications allow a better correlation with arthroscopy and should be part of our radiology report for an effective communication with arthroscopic surgeons.
3D CT Analysis of the Femoral Head and Acetabulum in Hip Impingement Syndromes: What the Surgeon Wants to Know

All Day Location: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Vivek Kalia, MD, MPH, Burlington, VT (Presenter) Nothing to Disclose
Russell E. Meyer, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Douglas N. Mintz, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
John A. Carrino, MD, MPH, New York, NY (Abstract Co-Author) Consultant, BioClinica, Inc; Consultant, Pfizer Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc; Eric A. Bogner, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Thin-section CT with multiplanar and 3D reformations allow for precise measurements of key bony landmarks and relationships. 2) Detailed measurements allow for objective evaluation of structural hip pathology implicated in hip impingement syndromes and allows for optimal surgical planning.

TABLE OF CONTENTS/OUTLINE
I. Backgrounda. Advances in imaging technique and post-processing utilization of images and measurements have progressed in tandem.II. Imaging of Hip Impingementa. Radiographs offer an excellent general survey of bony anatomy.b. MRI is superior for associated articular cartilage and labral pathology.c. Thin-section CT has superior spatial resolution and allows for precise measurements of bony landmarks and relationships.i. Sample measurements: alpha and modified beta angles, description of extent of loss of head neck offset, center edge angles, Tönnis angle, femoral neck shaft angle, acetabular and femoral version, offsetii. Qualitative evaluation of bony anatomy and extra-articular impingementiii. Ability to create dynamic 3D CT modelsIII. Surgical treatment of hip impingementsIV. Postoperative imaging examplesV. Significancea. The information obtained from multiplanar and 3D CT allows for quantitative and qualitative assessment of the hip impingement syndromes and improves preoperative planning.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

John A. Carrino, MD, MPH - 2013 Honored Educator
John A. Carrino, MD, MPH - 2015 Honored Educator
Ankle Injuries: An Algorithmic Approach to Lauge-Hansen Classification

All Day Location: MK Community, Learning Center

Participants
Meagan Uzee, MD, Temple, TX (Presenter) Nothing to Disclose
Kuang-Wei Chang, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Ricardo D. Garza-Gongora, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Linda M. Parmán, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Utilize an interactive platform including a question and answer format to identify common radiographic findings associated with ankle injuries.
2. Explain the mechanisms of ankle injury utilizing the Lauge-Hansen system to guide classification.
3. Learn an effective strategy to promptly classify ankle fractures according to the Lauge-Hansen system using an algorithmic approach.

TABLE OF CONTENTS/OUTLINE
- Review basic ankle anatomy
- Describe the Lauge-Hansen classification system of ankle injuries
- Demonstrate the various mechanisms of ankle injury
- Present an algorithm for correctly classifying ankle injuries according to this system
- Show radiographic and diagram examples of each type of injury while using the algorithm for classification
- Use a question and answer format with multiple 'unknown' ankle radiographs to test the learner's knowledge
**Femoroacetabular Impingement: From Diagnosis to Postoperative Assessment**

All Day Location: MK Community, Learning Center

**Participants**
- Eser Sanverdi, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
- Seray Akcalar, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
- Evsen Polattas Solak, MD, Ankara, Turkey (Presenter) Nothing to Disclose
- Mustafa E. Turkoz, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
- Mehmet Ali Gurses, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
- Asim Kayaalp, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
- Reha Tandogan, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

Femoroacetabular impingement (FAI) comprises a broad spectrum of hip dismorphology. Although "cam" and "pincer" abnormalities are the well known classical forms of FAI, isolated posterior acetabular hyperplasia and acetabular version abnormalities are also included in the FAI etiology. However, hip dismorphology that causes to FAI other than classical forms have not been clarified yet. Detailed evaluation of hip morphology in the preoperative term is the most important responsibility of a radiologist. On the other hand, different surgical techniques that are chosen depend on type of FAI must be known for correct postoperative assessment.

**TABLE OF CONTENTS/OUTLINE**

In this educational exhibit, we present different causative dismorphology of FAI with pre- and postoperative computerized tomography and magnetic resonance imaging findings.
Ulnar-side Wrist Pain: Anatomy and Differential Diagnosis

All Day Location: MK Community, Learning Center

Participants
Marcelo Bordalo-Rodrigues, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Marcos Felipe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hugo P. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Denise T. Amaral, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo R. Rezende, PhD, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1- Illustrate the complex anatomy of the ulnar side of the wrist.
2- Discuss differential diagnosis of ulnar-side wrist pain.
3- Review imaging aspects and the usefulness of each method in the diagnosis of this condition.

TABLE OF CONTENTS/OUTLINE
1- Illustrate the normal anatomy of the ulnar side of the wrist, including bones, articulations, tendons, nerves, vessels and, especially, the triangular fibrocartilage complex (TFCC).
2- TFCC lesions and classification with MR-arthroscopic correlation.
3- Impingement syndromes (ulnar, ulnocarpal abutment, hamatolunate).
4- Bone fractures: ulnar stiloid process, hamate and triquetrum.
5- Extensor carpi ulnaris tendon abnormalities, including tendinopathies and tears, with emphasis on subluxation and the subsheath role in this condition.
6- Flexor carpi ulnaris abnormalities, especially calcific tendinitis.
7- Ulnar nerve compression syndrome: US and MR diagnosis.
Overview of Myonecrosis and Compartment Type Syndromes in MSK Imaging with Radiologic, Clinical and Pathologic Correlation

All Day Location: MK Community, Learning Center

Participants
Ajay R. Goud, MD, Boston, MA (Presenter) Nothing to Disclose
Luis E. Diaz, MD, Needham, MA (Abstract Co-Author) Nothing to Disclose
William F. Arndt III, MD, Littleton, MA (Abstract Co-Author) Nothing to Disclose
Nipa Goud, MD, Jamaica Plain, MA (Abstract Co-Author) Nothing to Disclose
Stacy E. Smith, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review advanced imaging appearance and clinical features and common terminology of myonecrosis and compartment syndromes.
2. Understand most common etiologies including diabetic, post traumatic, and pressure induced myonecrosis.
3. Understand the role and appropriateness for advanced imaging in cases of myonecrosis and compartment type syndromes.

TABLE OF CONTENTS/OUTLINE
1. Normal imaging features of muscle on advanced imaging, with special emphasis on MR imaging.
2. Overview of terminology and clinical review of myonecrosis/compartment type syndromes, including diabetic, post traumatic, and pressure induced myonecrosis.
3. Imaging case depictions of myonecrosis and compartment syndromes with advanced imaging.
4. Imaging Checklist for the Radiologist: Key imaging features of myonecrosis and compartment syndromes.
**Spectrum of Hip Impingement**

All Day Location: MK Community, Learning Center

**Participants**
Evens Polattas Solak, MD, Ankara, Turkey *(Presenter)* Nothing to Disclose  
Eser Sanverdi, MD, Ankara, Turkey *(Abstract Co-Author)* Nothing to Disclose  
Seray Akcalar, MD, Ankara, Turkey *(Abstract Co-Author)* Nothing to Disclose  
Mustafa E. Turkoz, Ankara, Turkey *(Abstract Co-Author)* Nothing to Disclose  
Mehmet Ali Gurses, MD, Ankara, Turkey *(Abstract Co-Author)* Nothing to Disclose  
Reha Tandogan, MD, Ankara, Turkey *(Abstract Co-Author)* Nothing to Disclose  
Asim Kayaalp, MD, Ankara, Turkey *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**

Hip impingement is a common orthopedic disease causing pain and degeneration of labrum and articular cartilage in the nondysplastic hip joint. The classical description of FAI consists of a ‘cam’ type (presence of a ‘bump’ in the head and neck junction of femur), a ‘pincer’ type (overcoverage of acetabulum over the femoral head) and a mixed type (combination of both) hip impingement. In comparison to classical FAI, impingement between femoral head - neck junction and adjacent anatomical structures such as psoas tendon (iliopsoas impingement) and anterior - inferior iliac spine (subspine impingement), ischiofemoral impingement, or impingement associated with abnormal femoral version, abnormal pelvic and acetabular tilt, and extreme hip motion are much less common. Bony abnormalities causing abnormal contact of hip joint elements such as labrum and femur, and impingement of related soft tissue constituents during hip motions may subsequently cause early degeneration of the hip and may require surgical treatment.

**TABLE OF CONTENTS/OUTLINE**

Although a significant amount of data on the classical form of FAI has been published, extraarticular hip impingement syndromes are rare and have been described recently. In this educational exhibit, we present a variety of hip impingement syndromes with an emphasis of clinical aspect.
Role of Conventional and Novel Imaging for Osteoarthritis in Young Patients: What Every Radiologist Needs to Know

All Day Location: MK Community, Learning Center

FDA

Discussions may include off-label uses.

Participants
Nima Hafezi Nejad, MD, MPH, Baltimore, MD (Presenter) Nothing to Disclose
Gaurav K. Thawait, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Bashir Zikria, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
John A. Carrino, MD, MPH, New York, NY (Abstract Co-Author) Consultant, BioClinica, Inc; Consultant, Pfizer Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc; ;
Jeffrey H. Siewerdsen, PhD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Consultant, Siemens AG; Research Grant, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Elekta AB; ;
Shadpour Demehri, MD, Baltimore, MD (Abstract Co-Author) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation

TEACHING POINTS
The purpose of this educational exhibit is: 1. To elucidate the role of conventional and advanced imaging modalities in osteoarthritis (OA) diagnosis, management and outcome prediction in young patients. 2. To explain “when” to perform advanced imaging (CT and MRI) and “what” to look for, in subjects with OA. Modalities including plain radiography (qualitative and semi-quantitative assessments), CT (multidetector CT (MDCT), cone-beam CT (CBCT) and four-dimensional CT (4DCT)), MRI (semi-quantitative, quantitative and compositional) and their applications are reviewed.

TABLE OF CONTENTS/OUTLINE
Overview of Imaging examinations in OA-Diagnosis and gradingTherapeutic assessmentOutcome predictionPlain radiographyJoint Space Narrowing (JSN)Kellgren and Lawrence (KL) scoringConventional Multi-Detector CT (MDCT)Advanced evaluation of subchondral osseous structuresCone Beam CT (CBCT)Comparing weight bearing with non-weight bearingMeniscal extrusion and joint space morphologyFour Dimensional (4D) CTDetection and characterization of patellofemoral instability (PI)Analysis of static and kinematic data to predict OA development in patients with PI Magnetic Resonance Imaging (MRI):MR imaging techniques: morphologic or compositional evaluationQuantitative MRI assessments

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

John A. Carrino, MD, MPH - 2013 Honored Educator
John A. Carrino, MD, MPH - 2015 Honored Educator
Ultrasonography of Median, Ulnar and Radial Nerves from Wrist to Fingertip: A Finger Trap?

All Day Location: MK Community, Learning Center

Participants
Catherine Phan, MD, Paris, France (Presenter) Nothing to Disclose
Anne Miquel, Paris, France (Abstract Co-Author) Nothing to Disclose
Clement Pradel, Paris, France (Abstract Co-Author) Nothing to Disclose
Celine Quach, Paris, France (Abstract Co-Author) Nothing to Disclose
Mona Kara, Paris, France (Abstract Co-Author) Nothing to Disclose
Yves M. Menu, MD, Paris, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the normal anatomical course of the median, ulnar and radial nerves from wrist to fingers. To list helpful sonographic and superficial landmarks to aid their identification. To present an atlas of correlation between MR and ultrasound images. How to diagnose the most common pathologies of the median, ulnar and radial nerves from wrist to fingertip.

TABLE OF CONTENTS/OUTLINE
1. The anatomy and relationship between the median, ulnar, radial nerve and surrounding structures
2. Tips for probe positioning allowing demonstration of the nerves
3. Normal echotexture of the nerve / normal MR-aspect of the nerve
4. Overview of common pathologic findings for each nerve:
   - Median nerve: Pre- and post-operative sonographic findings for carpal syndrome (criteria); bifid median nerve; post-traumatic nerve injuries of terminal branches
   - Ulnar nerve: Guyon’s canal; injury of superficial or deep branch of the ulnar nerve
   - Radial nerve: Wartenberg syndrome and its differential diagnoses
   - Peripheral nerve tumors (neuroma, schwannoma, neurofibroma, malignant tumor): pathophysiology, imaging findings.
TEACHING POINTS

The purposes of this exhibit are: 1. To illustrate the applicability of the slice encoding technique for metal artifact correction (SEMAC) in the reduction of magnetic susceptibility artifacts. 2. To comparatively demonstrate imaging studies acquired by 1.5T field resonance scanner, with and without the use of SEMAC, exposing clinical situations experienced at our institution in which the application of the technique allowed diagnostic elucidation by the substantial correction of spatial distortion artifacts.

TABLE OF CONTENTS/OUTLINE

In the postoperative period clinical and radiological follow-up is essential to rule out complications, mainly related to infection and periprosthetic osteolysis. The SEMAC allows metal artifact reduction for being a two-dimensional (2D) view angle tilting (VAT)-spin echo sequence, acquiring information from the periprosthetic regions with minimization of inhomogeneities of the field induced by metal, within a feasible scan time. It is possible to significantly improve accessing bone and soft tissue in the vicinity of metallic prosthesis and produce diagnostic images with the use of MRI coupled with modern artifacts correction methods.
Intra Muscular Hemangioma: A Diagnostic Challenge

Awards
Cum Laude

Participants
Annouck Bisdorff Bresson, Paris, France (Presenter) Nothing to Disclose
Caroline Parlier, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Michel Wassef, Paris, France (Abstract Co-Author) Stockholder, OCCLUGEL SAS; Stockholder, Archimmed; Stockholder, XPrem
Claude Laurian, Paris, France (Abstract Co-Author) Nothing to Disclose
Benoit Faucon, Paris, France (Abstract Co-Author) Nothing to Disclose
Emmanuel Houdart, Paris, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To provide a pictorial review of the intramuscular hemangioma (IMH) based on MRI to differentiate and avoid misdiagnosis with common intramuscular venous malformation (IVM) To emphasize the use of ultrasound to differentiate IMH from IVM To discuss the differential diagnoses: sarcoma, nodular fasciitis ...

TABLE OF CONTENTS/OUTLINE
1/ Histopathological findings
2/ MRI findings: IMH: Well delineated and well limited tissular lesion iso T1 to the muscle and hyper T2 with strong and homogeneous gadolinium enhancement. Central flow voids due to arterial vasculariation. IVM: lobulated hyper T2 intramuscular lesion, hypo T1, gadolinium enhancement on the venous phase, signal void due to phleboliths.
4/ Differential diagnoses: sarcoma, nodular fasciitis ...
5/ Treatment options: surgical excision has to be performed in IMH and IMVM whereas sclerotherapy can only be suggested in IMVM
"Ouch! My Bones Hurt"- Osseous Manifestations of Sickle Cell Disease: Imaging Patterns and Predictors

All Day Location: MK Community, Learning Center

Participants
Sameer B. Raniga, FRCR, MD, Muscat, Oman (Presenter) Nothing to Disclose
Humoud H. Al Dhuhli, MD, FRCPC, Muscat, Oman (Abstract Co-Author) Nothing to Disclose
Salaam Al Kindi, MD, MRCP, MUSCAT, Oman (Abstract Co-Author) Nothing to Disclose
Sultan Al Maskary, MD, MS, Muscat, Oman (Abstract Co-Author) Nothing to Disclose
Matthew R. Skalski, DC, Whittier, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. "Pattern Approach" to the imaging manifestation of the osseous complications of sickle cell disease and how to use it. 2. Multimodality pictorial review of the imaging spectrum of various acute and chronic osseous complications of sickle cell disease using the "Pattern" based approach. 3. Predictors of imaging findings differentiating the acute vaso-occlusive crisis from acute osteomyelitis.

TABLE OF CONTENTS/OUTLINE
1. Spectrum of osseous manifestation of acute and chronic complications of sickle cell anemia (SCA) - including marrow hyperplasia-fibrosis-sclerosis, vaso-occlusive crisis- avascular necrosis- medullary infarction and osteomyelitis. 2. Role of different imaging modalities in evaluation of osseous complications of SCA with emphasis on role of MRI. 3. Lesions are approached on radiographs and MRI as easily remembered "Patterns" and differential diagnosis of each pattern is presented. 4. Four Radiographic/CT patterns include- Coarse trabecular pattern, multifocal sclerotic pattern, diffuse increase in bone density pattern and Aggressive pattern. 5. Six MRI patterns include- Black marrow, Gray marrow, Diffuse White marrow, Multifocal white matter, Geographic and Aggressive pattern. 6. Correlations of the imaging patterns with pathoanatomical changes are presented.
Awards
Certificate of Merit

Participants
Riza Seitz, Brooklyn, NY (Presenter) Nothing to Disclose
Samuel A. Osei-Bonsu, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Scott A. Lehto, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Stephen A. Waite, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Srinivas Kolla, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Causes of deposition of calcification in soft tissues
2. Patterns of calcifications seen on imaging
3. Examples of infrequent causes soft tissue calcification in quiz format

TABLE OF CONTENTS/OUTLINE
Introduction: Deposition of calcifications in the soft tissues is fairly common in the musculoskeletal system. Radiology plays a central role in diagnosis. Examples of atypical causes of soft tissue calcifications: iatrogenic infectious metabolic neoplastic
Recognizing the pattern, morphology and volume can lead to a meaningful diagnosis and alter management. Recognition and classification of unusual soft tissue calcifications is crucial for patient care.

Awards
Certificate of Merit

Participants
Rubens C. Santos Neto, MD, San Diego, CA (Presenter) Nothing to Disclose
Bruno R. Ogata, Curitiba, Brazil (Abstract Co-Author) Nothing to Disclose
Dyan Christine V. Flores, MD, Antipolo, Philippines (Abstract Co-Author) Nothing to Disclose
Edward Smitaman, MD, West Hartford, CT (Abstract Co-Author) Nothing to Disclose
Mini N. Pathria, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Briefly review hip anatomy, including osseous, capsular ligaments, and surrounding fascia. Use a multimodality approach to increase awareness of various uncommon, but important, intra- and extra-articular hip pathologies. Thereby, limiting diagnostic delays and pitfalls.

TABLE OF CONTENTS/OUTLINE
Brief review of the hip anatomy, including osseous, capsular ligaments and surrounding fascia
Cadaveric anatomy and multimodality imaging features of intra- and extra-articular hip pathologies:
- Traumatic posterior hip subluxation, focusing on capsular injuries
- Injury to the gluteal aponeurotic fascia and proximal iliotibial band injuries
- "Isolated" greater trochanteric fracture
- Calcium hydroxyapatite deposition
Diagnostic delays and pitfalls in these hip lesions
Dedicated Imaging of Inguinofemoral and Lower Abdominal Wall Hernias

All Day Location: MK Community, Learning Center

Participants
Roy S. Dwarkasing, MD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Rob Boxhoorn, MD, Rotterdam, Netherlands (Presenter) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
Casper H. van Eijck, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To illustrate the appearance of the relevant anatomy of the inguinofemoral region on ultrasound, CT and MRI. To illustrate and demonstrate the power of ultrasound for diagnosis and classification of clinically occult cases, including tips for dynamic sonographic examination (defy symptoms). To illustrate and describe the added value of CT and MRI in initial unclear or complicated lesions. To describe and illustrate potential post-surgery findings on imaging which may be responsible for persistent complaints.

TABLE OF CONTENTS/OUTLINE
Introduction Anatomy of the inguinofemoral region on imaging Classification and illustration of clinically occult inguinofemoral hernias Unclear or complicated cases using multimodality imaging for proper diagnosis Postoperative evaluation Pitfalls References Summary While clinically overt inguinal hernias may be readily diagnosed without the need for imaging, ultrasound examination provides a dynamic diagnostic tool for identifying and classifying clinically occult inguinofemoral and lower abdominal wall hernias. In this exhibit we demonstrate the power of dedicated ultrasound for diagnosis and multimodality approach in unclear or complicated cases.
Participants
William F. Conway, MD, PhD, Charleston, SC (Presenter) Nothing to Disclose
Russell W. Chapin, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Robert H. Hazelrigg, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Thomas Britt, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Nathaniel Jones, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Kevin G. Garrett, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew R. Gillott, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew P. Brill, DO, Oklahoma City, OK (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.
**SSA13**

**Musculoskeletal (Interventional)**

**Sunday, Nov. 29 10:45AM - 12:15PM Location: E451B**

**MK CT IR MR**

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

**FDA** Discussions may include off-label uses.

**Participants**

Michael G. Fox, MD, Charlottesville, VA (Moderator) Stockholder, Pfizer Inc;
Mary Kristen Jesse, MD, Denver, CO (Moderator) Nothing to Disclose

**Sub-Events**

**SSA13-01 Fluoroscopic Guided Sacroiliac Joint Injections - Comparison of Intra-articular and Peri-articular Injections on Immediate and Short-term Pain Relief**

**Sunday, Nov. 29 10:45AM - 10:55AM Location: E451B**

**Participants**

Nicholas C. Nacey, MD, Charlottesville, VA (Presenter) Nothing to Disclose
James Patrie, MS, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Michael G. Fox, MD, Charlottesville, VA (Abstract Co-Author) Stockholder, Pfizer Inc;

**PURPOSE**

To determine if intra-articular sacroiliac (SI) joint injections provide greater immediate and short-term pain relief compared to peri-articular SI joint injections.

**METHOD AND MATERIALS**

All fluoroscopic guided SI joint injections targeting the inferior 1 cm of the SI joint, performed over a 4-year period, were identified. All patients were injected with 2.5 mL of Bupivacaine and 20 mg (0.5 mL) of triamcinalone. Patients were excluded if another triamcinalone dose or a different steroid/anesthetic combination was used, or if either the pre-injection, immediate (5-10 minute) post-injection, or 1-week post-injection pain score was not recorded. Two MSK radiologists with 2 and 13 years post-fellowship experience independently retrospectively reviewed the fluoroscopic images to determine intra-articular or peri-articular placement. Univariate and multivariate statistical analysis was performed.

**RESULTS**

169 patients (114F:55M; mean age 60.9 years) met the inclusion criteria with 88 intra-articular and 81 periarticular injections. Pre, immediate and 1-week post-injection pain scores for the intra-articular and periarticular injections were 6.2/2.0/4.1 and 6.0/2.3/4.2, respectively. Immediate and 1-week post-injection pain reduction was statistically significant in both groups (p=0.030). After adjusting for age, gender, pre-pain level, time of year, and reason for exam there was no significant difference in the pre-injection to immediate post-injection change in pain between intra-articular and periarticular injections (mean change 0.35, p=0.30) or in the pre-injection to 1-week postinjection change in pain (mean change 0.03, p=0.92). Geometric mean fluoro time was 27 sec for intra-articular injections and 42 sec for periarticular injections (p<0.001).

**CONCLUSION**

Both intra-articular and periarticular SI joint injections provide statistically significant immediate and 1-week post-injection pain relief. However, there was no significant difference in the degree of pain relief provided by intra-articular and peri-articular injections.

**CLINICAL RELEVANCE/APPLICATION**

Since similar pain relief was provided with intra-articular and periarticular SI joint injections, fluoroscopy is an adequate method for performing most SI joint injections.

**SSA13-02 Ten Years' Experience in Combined Intradiscal and Periradicular Injection of Medical Ozone and Periradicular Administration of Steroids and Anesthetic for the Treatment of Lumbar Disk Herniation: Effects on Disk Size and Lumbar Radiculopathy in 437 Patients**

**Sunday, Nov. 29 10:55AM - 11:05AM Location: E451B**

**Participants**

Thomas Lehnert, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Josef Matthias Kerl, MD, Frankfurt, Germany (Abstract Co-Author) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Ralf W. Bauer, MD, Frankfurt, Germany (Abstract Co-Author) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Martin Beeres, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the therapeutic benefit and morphologic changes in herniated lumbar disk after CT-guided intradiscal and periradicular ozone-oxygen injection combined with a periradicular administration of steroids and anesthetic.

**METHOD AND MATERIALS**

All fluoroscopically guided SI joint injections targeting the inferior 1 cm of the SI joint, performed over a 4-year period, were identified. All patients were injected with 2.5 mL of Bupivacaine and 20 mg (0.5 mL) of triamcinalone. Patients were excluded if another triamcinalone dose or a different steroid/anesthetic combination was used, or if either the pre-injection, immediate (5-10 minute) post-injection, or 1-week post-injection pain score was not recorded. Two MSK radiologists with 2 and 13 years post-fellowship experience independently retrospectively reviewed the fluoroscopic images to determine intra-articular or peri-articular placement. Univariate and multivariate statistical analysis was performed.

**RESULTS**

169 patients (114F:55M; mean age 60.9 years) met the inclusion criteria with 88 intra-articular and 81 periarticular injections. Pre, immediate and 1-week post-injection pain scores for the intra-articular and periarticular injections were 6.2/2.0/4.1 and 6.0/2.3/4.2, respectively. Immediate and 1-week post-injection pain reduction was statistically significant in both groups (p=0.030). After adjusting for age, gender, pre-pain level, time of year, and reason for exam there was no significant difference in the pre-injection to immediate post-injection change in pain between intra-articular and periarticular injections (mean change 0.35, p=0.30) or in the pre-injection to 1-week postinjection change in pain (mean change 0.03, p=0.92). Geometric mean fluoro time was 27 sec for intra-articular injections and 42 sec for periarticular injections (p<0.001).

**CONCLUSION**

Both intra-articular and periarticular SI joint injections provide statistically significant immediate and 1-week post-injection pain relief. However, there was no significant difference in the degree of pain relief provided by intra-articular and peri-articular injections.

**CLINICAL RELEVANCE/APPLICATION**

Since similar pain relief was provided with intra-articular and periarticular SI joint injections, fluoroscopy is an adequate method for performing most SI joint injections.
437 patients with lumbar radiculopathy received an intradiscal (3 mL) and periradicular (7 mL) injection of an ozone-oxygen mixture (ratio 3:97), followed by a periradicular injection of corticosteroid (1 mL of Celestan®Depot) and anesthetic (2 mL of Carbostesin® 0.25%) in the same session. Under CT guidance, intradiscal and periradicular injection was administered by means of an extraspinal lateral approach, using a 22-gauge 17.8-cm spinal needle. 6 months after treatment, clinical outcome was assessed by applying the modified MacNab method. The effects on disk matrix and disk volume were evaluated by MRI.

RESULTS

Treatment was successful in 316 patients (72.3%). In the remaining 121 patients (27.7%), treatment was considered to have failed. Among the patients whose treatment was a success, outcome was excellent in 153 patients (48.4%) and good in 163 patients (51.6%). Among the patients whose treatment was a failure, this was poor in 87 patients (71.9%) and poor with recourse to surgery in 34 patients (28.1%). Initial disk volume was 8.06-29.15 cm³ (mean, 18.29 cm³). 6 months after treatment, in patients with excellent outcome disk volume reduction was 5.67-22.11% (mean, 12.11%), in patients with good outcome 2.61-16.11% (mean, 7.29%) and in patients with poor outcome 0.33-8.21% (mean, 2.46%).

CONCLUSION

Our study shows that the combined intradiscal and periradicular injection of medical ozone and periradicular injection of steroids affects both the mechanical and the inflammatory components of pain caused by disk herniation. For this reason, this is a therapy option for treating lumbar disk herniation that has failed to respond to conservative management, before recourse to surgery or when surgery is not possible.

CLINICAL RELEVANCE/APPLICATION

CT-guided combined intradiscal and periradicular injection of ozone-oxygen represents a therapeutic alternative for lumbar radiculopathy with promising results. The ease of execution and non-invasiveness of this therapy permit the successful outpatient treatment of lumbar sciatic pain.

SSA13-03 Computed Tomography (CT) Guided O2-O3 Discolysis: Critical Review of Indications According to Our Experience

Sunday, Nov. 29 11:05AM - 11:15AM Location: E451B

Participants

Marco Perri, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Marco Varrassi, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Claudia Marsecano, MD, Fiuggi, Italy (Abstract Co-Author) Nothing to Disclose
Alessandra Splendiani, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Massimo Gallicci, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

The aim of this study was to clarify the O2-O3 discolysis indications and outcomes depending on the type of disc disease.

METHOD AND MATERIALS

Medical Ethical Committee approval was obtained for prospective double-blind trial. A total of 517 patients gave informed consent and were randomly assigned to two groups. Control group of 159 men and 101 women with age range 25-89 years, underwent percutaneous steroid treatment while Study Group of 163 men and 94 women with age range 22-92 years underwent the same treatment with the addiction of oxygen-ozone discolysis. Procedures were performed under computed tomographic guidance. Visual Analog Scale Questionnaire was administered before treatment and at intervals, the last at 6-month follow-up. Results were compared with the X2 and t-test.

RESULTS

After 6 months, O2-O3 discolysis was successful in 106 Study Group patients (41.24% with extrusions) compared with 9 Control Group patients (3.5%) with the same disco vertebral pathology (P <.001). Moreover in 89 (34.6%) Study Group patients with protrusions success rate was statistically significant (P<.001) compared with 5 Control Group patients( 1.9%) with the same pathology. Furthermore statistically significant difference (P<.001) was detected in the presence of Grade I, II, III of Degenerated Disc in 185 of Study Group patients (68.4%) compared with 4 Control Group patients (1.5%).

CONCLUSION

O2-O3 discolysis is more effective at 6 months than steroid and anesthetic injection near intraforaminal sites especially in cases of sciatica due to herniated or protruded disc and with a Grade of Disc Degeneration from mild to moderate range.

CLINICAL RELEVANCE/APPLICATION

Our approach leads to relief in sciatica symptoms and obtains the best results in case of extrusions, protrusions and in presence of discal degenerative aspects from mild to moderate grade.

SSA13-06 Magnetic Resonance Guided Focused Ultrasound Surgery (MRgFUS) for Totally Non-Invasive Treatment of Osteoid Osteoma: A Prospective Development Study

Sunday, Nov. 29 11:35AM - 11:45AM Location: E451B

Participants

Maurizio Del Monte, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Gaia Cartocci, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (Presenter) Nothing to Disclose
Valeria De Soccio, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Boni, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate mid-to long-term efficacy of MRgFUS in the treatment of symptomatic ostoid osteomas

METHOD AND MATERIALS

This prospective study involved 29 consecutive patients with clinical and imaging diagnosis of Ostoid Osteoma; all patients underwent MRgFUS ablation (ExAblate, InSightec; 3T MR). Lesions located in vertebral body were excluded; prior RFA or surgery was not considered an exclusion criteria. Patients received therapy using MRgFUS, delivered toward the nidus, identified on MRI and/or CT. Primary endpoints were adverse events (serious and otherwise) and pain relief assessed using Quality of Life questionnaires in patients with bone pain (FACT-BP), Visual Analog Pain Score (VAS) and daily intake of Non-steroidal drugs (NSAID). Patients’ follow-up, including clinical and imaging examinations, was established at 1, 12 and 24 months. As secondary endpoint, imaging examinations (CT and dynamic CE-MRI, Gd-BOPTA, Bracco) were used to evaluate inflammatory status after treatment and bone remodeling.

RESULTS

29 patients (4 female; 25 male; mean age 23.4 yo) were recruited for totally non-invasive MRgFUS treatment. The treatment was well tolerated by all patients and no adverse events were recorded. A mean number of 5.6 sonication with mean energy of 894 ± 209 J was necessary to complete the treatment. Complete clinical response was found in 27/29 patients. There was a significant (p=0.001) improvement in quality of life, according to FACT-BP (mean values: 33.7 at baseline and 54.7 at follow-up). A statistically significant difference (p=0.001) was noted between pre- and post-treatment VAS scores (8.4 vs 0.6, respectively).

Imaging evaluation with CE-MRI demonstrated edema and hyperemia decrease in lesions associated with complete response. At CT, bone remodeling was evident in all complete responders (27/29 patients, 93%); in 15/29 (51%), nidus fading was demonstrated and in 10/29 (34%) restitution-ad-integrum of bone abnormality was depicted.

CONCLUSION

MRgFUS can be safety and effectively adopted for the treatment of Ostoid Osteoma. This application is totally non-invasive, carried out in a single session and with pain relief attainable since the very following day after treatment. Our results also indicated a positive trend to bone restoration especially in younger patients.

CLINICAL RELEVANCE/APPLICATION

MRgFUS allows single session, totally non-invasive treatment of ostoid osteoma.

SSA13-07  Minimally Invasive Screw Fixation of Fractures in the Cervical and Thoracic Spine: CT-controlled Pre-surgical Guidewire Implantation in Clinical Routine

Sunday, Nov. 29 11:45AM - 12:05PM Location: E451B

Participants

Sebastian Fischer, MD, Frankfurt, Germany (Presenter) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Maximilian Kreising, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Ingo Marzi, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Martin G. Mack, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Katrin Echler, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

Purpose of our retrospective study is to evaluate the feasibility and accuracy of minimally invasive, transpedicular screw placement in cervicothoracic fractures with the help of CT-controlled guidewires.

METHOD AND MATERIALS

293 guidewires were inserted in 35 patients (42.9 ± 21.2 years) under CT fluoroscopy (286 thoracic, 7 cervical). There were 28 traumatic cases, 3 pathologic fractures, 3 fractures due to infectious infiltrations and 1 osteoporotic fracture. In 151 pedicles the screwing was directly performed and controlled in the CT-room. CT-images were reviewed regarding accuracy and cortical violations using the popular 2 mm increment deviation classification by Gertzbein and Robbins.

RESULTS

The guidewire implantation resulted in 28 cortical contacts. Minor affections of the pedicle wall by the inserted screws occurred in 39.1% (59 of 151), respectively 23.8% if taking unavoidable encroachments into account (30 of 59). The width of the pedicular isthmus correlated to the number of cortical guidewire-contacts (r=0.449; p=0.077) and pedicle violations (all graded “A”) by the inserted screws (r=0.581; p=0.049). Total procedural duration was 138.6 ± 44.2 min, representing 14.5 ± 11.6 min for each pedicle.

CONCLUSION

The treatment of vertebral fractures with a guidewire-based insertion technique for pedicle screws results in a very high accuracy and a low complication rate if performed under CT-imaging.

CLINICAL RELEVANCE/APPLICATION

Guidewires help in precise placement of cervical and thoracic screws for vertebral osteosynthesis. Special attention should be taken in the mid-thoracic levels due to a smaller width of the pedicle isthmus.

SSA13-08  Feasibility of CT Guided Needle Biopsy in Harvesting Chondrocytes for Autologous Chondroctye Implantation: An Initial Experience on Human Cadavers

Sunday, Nov. 29 11:55AM - 12:05PM Location: E451B

Participants

Nima Hafezi Nejad, MD, MPH, Baltimore, MD (Presenter) Nothing to Disclose
PURPOSE
To evaluate the timing, accuracy and technical feasibility of CT guided chondrocyte retrieval from superior medial and lateral non weight-bearing margins of the trochlea.

METHOD AND MATERIALS
As an initial experience, 10 human knee cadavers were selected as samples. Osteosite bone biopsy needle (G13761 - Murphy M1M - 11G/10cm) was used for the purpose of chondrocyte retrieval. Two operators, one musculoskeletal radiologist and one orthopedic surgeon performed the chondrocyte retrieval procedures. Each performed one sampling from the medial and one sampling from the lateral margins of the trochlea. In the first planning phase, operators selected the proper target for chondrocyte retrieval, in the CT examination. Time (seconds), accuracy (mm distance from the target) and needle readjustment attempts were recorded during chondrocyte retrieval.

RESULTS
All samplings resulted in eventual tissue retrieval. Samplings from the lateral margin were performed faster (Operator 1: 74 ± 34 sec vs. 106 ± 36 sec; P value: 0.056 - Operator 2: 72 ± 30 sec vs. 111 ± 35 sec; P value: 0.014) and more accurate (Target error: Operator 1: 1.32 ± 1.01 mm vs. 3.23 ± 1.72 mm; P value: 0.007 - Operator 2: 1.17 ± 0.57 mm vs. 2.81 ± 1.36 mm; P value: 0.040) than samplings from the medial margin. There was no significant difference in the mean number of needle adjustment rates (ranging from 1.50 ± 0.71 to 1.10 ± 0.74 readjustment attempts); neither between the operators, nor between lateral and medial margins.

CONCLUSION
This preliminary results supports the hypothesis that CT guided needle biopsy may be a feasible and accurate method for chondrocyte retrieval from non weight-bearing margins of the trochlea. Sampling from the lateral margin may be relatively advantageous in terms of procedure time and accuracy.

CLINICAL RELEVANCE/APPLICATION
Feasibility of CT-guided chondrocyte retrieval for autologous chondrocyte implantation may obviate one arthroscopic surgery; and therefore, reduce the cost, morbidity and complication.
**SSA14**

**ISP: Musculoskeletal (Bone Tumor)**

Sunday, Nov. 29 10:45AM - 12:15PM Location: E451A

**AMA PRA Category 1 Credits ™**: 1.50

**ARRT Category A+ Credits**: 1.50

---

**Participants**

Craig W. Walker, MD, Omaha, NE (Moderator) Nothing to Disclose

Corrie M. Yablon, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

---

**Sub-Events**

**SSA14-01**  
**Musculoskeletal Keynote Speaker: Bone Tumor**

Sunday, Nov. 29 10:45AM - 11:05AM Location: E451A

**Participants**

Mark J. Kransdorf, MD, Phoenix, AZ (Presenter) Nothing to Disclose

---

**SSA14-03**  
**Distinguishing Untreated Osteoblastic Metastases from Enostoses Using CT Density Measurements**

Sunday, Nov. 29 11:05AM - 11:15AM Location: E451A

**Participants**

Adam C. Ulano, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Miriam A. Bredella, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Patrick J. Burke, MBCh, Madison, WI (Abstract Co-Author) Nothing to Disclose

Ivan Chebib, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Frank J. Simeone, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Ambrose J. Huang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Martin Torriani, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Connie Y. Chang, MD, Boston, MA (Presenter) Nothing to Disclose

---

**PURPOSE**

Differentiating osteoblastic metastases from benign enostoses on CT can be challenging. The purpose of our study was to determine if CT density thresholds of osteoblastic bone lesions can be used to distinguish untreated osteoblastic metastases from benign enostoses.

**METHOD AND MATERIALS**

Our study was IRB approved and complied with HIPAA guidelines. The study group comprised 62 patients (mean age 62± 20 y, 35 f, 27m) with sclerotic bone lesions found on CT. Etiology of sclerotic lesions was assessed by biopsy (n=17) or clinical and imaging follow-up (n=45). None of the patients had prior treatment for metastases. CT density of all lesions was measured by a MSK and an abdominal imaging fellow. If multiple lesions were present, the largest lesion was evaluated. The average and maximum densities in Hounsfield Units (HU) were measured. ROC analysis was performed to determine sensitivity and specificity, area under the ROC (AUC), and confidence intervals (CI), as well as cutoff values of CT densities to differentiate metastases from enostoses. Interreader reproducibility was assessed using intraclass correlation coefficient (ICC) with 95% CI.

**RESULTS**

A total of 37 enostoses and 25 untreated osteoblastic metastases were evaluated (primary tumors: breast cancer n=12, prostate cancer n=11, ovarian cancer n=1, transitional cell carcinoma n=1). Mean and maximum CT densities of enostoses were 1190 HU and 1323 HU, respectively and of osteoblastic metastases were 654 HU and 787 HU, respectively. Using a cut-off of 885 HU for average density, the AUC was 0.982, sensitivity was 94.6%, and specificity was 96%. Using a cut-off of 1058 HU for maximum CT density, the AUC was 0.976, the sensitivity was 94.6%, and specificity was 96%. ICC for mean density was 0.987 for enostoses and metastases. ICC for maximum density was 0.814 for enostoses and 0.980 for metastases.

**CONCLUSION**

Density measurements using CT can be used to distinguish untreated osteoblastic metastases from enostoses.

**CLINICAL RELEVANCE/APPLICATION**

An average density of 885 HU and a maximum density of 1058 HU provide reliable thresholds below which a metastatic lesion is the favored diagnosis.

---

**SSA14-04**  
**Multiparametric Approach with Diffusion Weighted Imaging (DWI) and Dynamic Contrast Enhanced (DCE) Magnetic Resonance Imaging (MRI): A Comparison Study in Differentiation between Benign and Malignant Bone Lesions**

Sunday, Nov. 29 11:15AM - 11:25AM Location: E451A

**Participants**

Young Cheol Yoon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Eunsun Oh, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

---

**PURPOSE**

To evaluate and compare the diagnostic performance of quantitative parameters derived from DWI and DCE-MRI in differentiating...
Whole Body MRI Assessment of Bone Involvement in Prostate Cancer and Multiple Myeloma: Diagnostic Accuracy of Different Sequences

Participants
Ahmed Larbi, MD, Nimes, France (Presenter) Nothing to Disclose
Patrick Omouni, MD, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Vasiliki Pasogliou, MD, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
Bertrand Tomba, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
Catherine Cypeval, MD, Montpellier, France (Abstract Co-Author) Nothing to Disclose
Frederic E. Lecouvet, MD, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the diagnostic accuracy of the different sequences obtained in whole-body MRI (WB-MRI/DWI) in detecting bone involvement in patients with prostate cancer (PCa) and multiple myeloma (MM).

METHOD AND MATERIALS
Two musculoskeletal radiologists reviewed WB-MRI studies in 50 patients with PCa at high risk for metastasis and in 47 patients with suspicion of MM. WB-MRI examinations included anatomical coronal T1- and STIR-weighted sequences, and functional diffusion-weighted (DWI) sequences. The readers successively assessed individual sequences (T1, STIR, DWIBS), then pairs of sequences (T1/DWIBS, T1/STIR, STIR/DWIBS), and finally all sequences together (T1 / STIR / DWIBS) to detect bone involvement. The gold standard was established on the basis of a panel review of all sequences.

RESULTS
Inter-observer agreement was good to excellent with similar kappa in both groups (.71 to .96). In the ‘PCa’ group, the study demonstrated the superiority of T1-weighted (Se 100%, Sp 92%) and DWI (Se 97%, Sp 92%) sequences, and of the pair T1 / DWIBS (Se 100%, Sp 100%) for the detection of patients with bone involvement. Isolated reading of STIR sequences lacked accuracy (Se 91%, Sp 92%) for detecting bone metastases. In the “MM” group, the study demonstrated the insufficiency of individual sequences (Se 83-93%, Sp 70%) to detect bone involvement. The best diagnostic accuracy was achieved by the combined reading of all sequences T1 / STIR / DWIBS (Se 93%, Sp 88%).

CONCLUSION
To detect bone involvement, the combined reading of T1- and DWI-weighted sequences appears sufficient in PCa, whereas the combined reading of all sequences is necessary in MM.

CLINICAL RELEVANCE/APPLICATION
Diagnostic accuracy of the different sequences obtained in whole-body MRI (WB-MRI/DWI) are unknown. The combined reading of T1- and DWI-weighted sequences appears sufficient in PCa, whereas the combined reading of all sequences is necessary in MM.
To retrospectively investigate whether intravoxel incoherent motion (IVIM) diffusion-weighted imaging (DWI) parameters correlate with dynamic contrast-enhanced (DCE) magnetic resonance imaging (MRI) perfusion parameters in patients with bone metastasis from non-small cell lung cancer (NSCLC) at 3.0 T.

**METHOD AND MATERIALS**

The institutional review board approved this retrospective study and informed consent was waived. Thirty-two patients (16 men, 16 women, mean age 61 years, range 46-89) with 37 treatment naive bone metastases from NSCLC underwent 3T MRI including IVIM DWI with nine b values (0-800 sec/mm²) and DCE-MRI. Following IVIM parameters including apparent diffusion coefficient (ADC), true diffusion coefficient (Dslow), pseudodiffusion coefficient (Dfast), and perfusion fraction (f), DCE MRI perfusion parameters including volume transfer constant (Ktrans), rate constant (Kep), extracellular extracellular volume fraction (Ve), and initial area under the time-signal intensity curve at 60 seconds (IAUC) were calculated. The Spearman rank correlation was performed for statistical analysis.

**RESULTS**

Median Ktrans, Kep, Ve, and IAUC were 138 (107-213) 10⁻³/min, 506 (319-647) 10⁻³/min, 334 (236-513) 10⁻³/cm²/min, and 16 (11-27) 10⁻³/cm²/min, respectively. Median ADC, Dslow, Dfast, and f were 973 (849-1198) μm²/sec, 898 (786-1128) μm²/sec, 274 (224-311) μm²/sec, and 98 (59-118), respectively. Ktrans demonstrated a significant inverse correlation with Dslow (r = -0.405, P=.013). Kep revealed a significant inverse correlation with ADC and Dslow (r = -0.370, P = .024; r = -0.352, P = .033, respectively). There was a significant inverse correlation of IAUC with ADC and Dslow (r = -0.434, P = .007; r = -0.486, P = .002, respectively). However, there was no significant correlation between Ve and IVIM parameters.

**CONCLUSION**

Ktrans inversely correlates with Dslow, while Kep and IAUC inversely correlate with ADC and Dslow in patients with bone metastasis from NSCLC at 3.0 T.

**CLINICAL RELEVANCE/APPLICATION**

IVIM DWI could help assume tumor perfusion in bone metastasis from NSCLC, particularly when DCE MRI cannot be performed.

### Whole-Body MRI: Value in Chronic Recurrent Multifocal Osteomyelitis (CRMO) and Synovitis, Acne, Pustulosis, Hyperostosis, and Osteitis (SAPHO)

**SSA14-08**

**Participants**

Joyce Veld, BSc, Boston, MA (Presenter) Nothing to Disclose

Elizabeth K. O'Donnell, Boston, MA (Abstract Co-Author) Nothing to Disclose

Andrew J. Yee, Boston, MA (Abstract Co-Author) Nothing to Disclose

Martin Torriani, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

Miriam A. Bredella, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Recent studies have suggested that abdominal adiposity may be risk factor of progression from monoclonal gammopathy of undetermined significance (MGUS) to multiple myeloma (MM). The purpose of our study was to determine abdominal body composition parameters on PET/CT that may serve as predictors of progression of MGUS to MM. We hypothesized that patients with MM had higher abdominal adiposity and higher fat metabolic activity compared to subjects with MGUS.

**METHOD AND MATERIALS**

Our study was IRB approved and complied with HIPAA guidelines. The study group comprised 38 patients (mean age 63±12 y, 20 m, 18 f) with MGUS and 31 patients (mean age 61±11 y, 14 m, 17 f) with recently diagnosed MM (mean time from diagnosis to PET/CT: 4.7±6.7 mo). All patients underwent whole body PET/CT. Total abdominal adipose tissue (TAT), abdominal subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT) cross sectional areas (CSA) (cm²) and metabolic activity (SUV) were assessed at the level of L4 on the unenhanced PET/CT. Date and type of therapy were recorded. None of the patients had active malignancy other than MM at the time of PET/CT. Variables were tested for normality of distribution using the Shapiro-Wilk test. Variables that were not normally distributed were log transformed. Groups were compared by ANOVA.

**RESULTS**

Results: Patients with recently diagnosed MM had higher TAT and SAT CSA (p=0.03 and p=0.04) and higher TAT and VAT metabolic activity (p<0.0001). Seventeen patients with MM had not undergone MM therapy prior to PET/CT. There were no differences in body composition between MM patients with or without treatment at time of PET/CT (p > 0.5).

**CONCLUSION**

Patients who were recently diagnosed with MM had higher TAT and SAT CSA and higher fat metabolic activity compared to patients with MGUS, suggesting that these parameters may be serve as novel biomarkers of disease progression in MM. Larger longitudinal studies are necessary to test this hypothesis.

**CLINICAL RELEVANCE/APPLICATION**

Abdominal adiposity and fat metabolic activity may serve as novel biomarkers for disease progression from MGUS to MM.
SSA14-09 Assessment of Therapeutic Response in Ewing’s Sarcoma Based on One-, Two-, and Three-dimensional Tumor Size Measurements

Participants
Maryam Aghighi, MD, Menlo Park, CA (Presenter) Nothing to Disclose
Joshua T. Lee, BS, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Justin Boe, MD, Edmond, OK (Abstract Co-Author) Nothing to Disclose
Rie von Eyben, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Rakhee S. Gawande, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Philippe Petit, MD, Marseille, France (Abstract Co-Author) Nothing to Disclose
Tarsheen Sethi, MBBS, Daly City, CA (Abstract Co-Author) Nothing to Disclose
Solomon Messing, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Jeremy Sharib, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Neyssa Marina, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Steven G. DuBois, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Heike E. Daldrup-Link, MD, Palo Alto, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The Children's Oncology Group (COG) established criteria to assess therapeutic response in Ewing sarcoma based on three-dimensional tumor size measurements. The purpose of our study was to compare COG criteria with one-dimensional Response Evaluation Criteria in Solid Tumors (RECIST) and two-dimensional tumor measurements defined by the World Health Organization (WHO) and to determine which method correlates best with clinical outcomes.

METHOD AND MATERIALS
Seventy-four patients (mean age of 14.5±6.5 years) with newly diagnosed Ewing sarcoma treated at three medical centers were evaluated. Primary tumor size was assessed on pre- and post-treatment Magnetic Resonance (MR) scans according to COG, RECIST, and WHO criteria. Effective tumor volume (Using OSIRIX software) served as the standard of reference. The agreement of each criterion with the standard of reference was assessed using Cohen kappa coefficient analysis. Tumor therapy responses based on changes in tumor length, area or volume, were compared with patient survival using the Log-rank test and Kaplan-Meier plots.

RESULTS
Based on Cohen's kappa coefficient, the agreement with the standard of reference was very good for COG (κ=0.89) while it was fair for RECIST (κ=0.39) and moderate for WHO (κ=0.55). COG criteria had significantly greater sensitivity to predict responders (92%) compared to RECIST (54%) and WHO (66%). Only COG demonstrated a significant difference in survival between responders and non-responders (p<0.003) compared to RECIST (p=0.41) and WHO (p=0.48).

CONCLUSION
Three-dimensional tumor measurements according to COG criteria are better predictors of therapeutic response of Ewing sarcoma than RECIST or WHO. These results could motivate more aggressive treatment for patients identified as non-responders by COG criteria.
CLINICAL RELEVANCE/APPLICATION

In clinical practice, a high sensitivity of response assessments is warranted in order to avoid ineffective therapies and stratify non-responders to other therapies at a time point when interventions can still impact prognosis. Our data in EFST showed that volumetric tumor measurements are substantially more sensitive for detection of tumor non-response than unidimensional measurements.
MK318-SD-SUA1

**T2* Mapping of the Subchondral Tissue using Ultra Short TE MRI: Comparison to the International Cartilage Repair Society (ICRS) Grade by Arthroscopy in Sports Trauma Patients**

**Station #1**

**Participants**

Michael G. Fox, MD, Charlottesville, VA (Moderator) Stockholder, Pfizer Inc;

**Sub-Events**

**T2* Mapping of the Subchondral Tissue using Ultra Short TE MRI: Comparison to the International Cartilage Repair Society (ICRS) Grade by Arthroscopy in Sports Trauma Patients**

**PURPOSE**

To investigate the microenvironment change of subchondral tissue using ultra short TE -T2* (UTE-T2*) mapping. Microenvironment changes of extracellular matrix (ECM) by traumatic injury can lead to abrupt alteration in physical tissue properties and may increase the future risk of osteoarthritis (OA).

**METHOD AND MATERIALS**

This study was performed under an IRB approved protocol. T2* value of the subchondral tissue in fifteen patients (age range 20-47 years), scheduled for arthroscopic reconstruction surgery of the anterior cruciate ligament (ACL) and/or meniscal repair was measured preoperatively, and they were classified according to the International Cartilage Repair Society (ICRS) grade (0-4) postoperatively. MRI was performed using prototype UTE sequence on a 3T clinical scanner (Siemens MAGNETOM Skyra). Each images (TE: 0.4, 0.6, 0.8, 1.0 ms) of four echo time were collected with section thickness of 0.78 mm isotropic voxel. Region of interests (ROI) were set on the subchondral regions of medial and lateral center of femoral condyle (cMF, cLF), medial and lateral center of tibia (MT, LT), patella and trochlea (excluded any injury area) for T2* measurement.

**RESULTS**

Mean T2* of cMF with ICRS grade 0 (n=6), grade 1(n=4), grade 2 (n=3) andgrade 3 (n=2) were 0.86±0.46 ms, 1.16±0.68 ms, 1.29±1.10 ms and 1.70±0.17 ms, respectively. Similarly, mean T2* of cLF with ICRS grade 0, 1, 2 and 3 were 0.71±0.17, 0.81±0.4, 0.96±0.45 and 1.17±0.49. T2* value was increased following the ICRS grading, and damaged region indicated the highest T2* value. However, especially at cMF and patella, higher T2 * values were confirmed in regardless of the grade.

**CONCLUSION**

In general, ICRS grade and T2* value indicated parallel increase, however, did not necessarily correlate for all of the ROIs. Instead of the arthroscopy, evaluating the surface of the cartilage, T2 *mapping of the subchondral tissue can predict the potential internal change toward the OA.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative assessment of subchondral tissue by UTE-T2* will be helpful for risk of OA in future.

MK319-SD-SUA2

**Hypodermal Adipose Tissue Sonoelastography for Monitoring Treatment Response in Patients with Plaque Psoriasis**

**Station #2**

**Participants**

Takako Aoki, PhD, Iruma-Gun, Japan (Presenter) Nothing to Disclose
Mamoru Niitsu, MD, Saitama, Japan (Abstract Co-Author) Nothing to Disclose
Yomei Tachibana, MD, PhD, Kawagoe, Japan (Abstract Co-Author) Nothing to Disclose
Naoki Sugita, MD, Iruma-Gun, Japan (Abstract Co-Author) Nothing to Disclose
Takashi Ushimi, MD, PhD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Imai, MS, RT, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Improving ultrasonographic assessment with Sonoelastography was successful in evaluating chronic inflammation in different organs. The purpose of our study is to evaluate hypodermal adipose tissue inflammation underneath psoriasis plaques quantifying tissue elasticity with sonoelastography before and after treatment with topical therapy, systemic therapy with DMARDS or biologic drugs.
METHOD AND MATERIALS
From September 2014 to March 2015, we enrolled 60 patients with plaque psoriasis with a PASI (5-10). On the basis of clinical examination they were divided in 3 groups of treatment depending on the prescribed drug: topic therapy (Group A), sistemic therapy with DMARDS (Group B) and biologic drugs therapy (Group C). A baseline (T0) ultrasound examination with sonoelastography was performed before the beginning of drugs assumption. At this time the mean strain ratio (muscle to hypodermal adipose tissue), resulting from the averaging of three measurement, underneath the chosen psoriasis plaque was recorded and compared with the one obtained by analysing the same tissues underneath normal surrounding skin. A follow up clinical and ultrasonographic examination (T1) was performed after one month of treatment to evaluate therapy response. At this time a comparison was made between T0 and T1 obtained mean strain parameters and overall clinical response.

RESULTS
At T0 lesional mean strain ratio (muscle to hypodermal adipose tissue) was significantly higher than non-lesional one; thus documenting an high grade of stiffness of the hypodermal fat underneath psoriasis evaluated plaques. The strain ratio showed no statistically significant difference according to gender (p=0.59). T1 examination data obtained from the 3 selected groups of patients documented a significant decrease in stiffness when comparing group B and C together with group A and group C with both group A and B. Mean strain ratio decrease correlated with clinical PASI improvement in all the responder patients in the considered groups. Non-responders demonstrated a persistent high tissutal stiffness.

CONCLUSION
Sonoelastography is able to identify hypodermal adipose tissue involvement in plaque psoriasis and it represents a valid method to assess early therapy response in patient with plaque psoriasis.

CLINICAL RELEVANCE/APPLICATION
Hypodermal adipose tissue involvement in plaque psoriasis can be quantified with sonoelastography and could be used as marker of treatment response.

MK320-SD- SUA3 Sonographic Evaluation of Morton's Neuroma Prior to and Following Laser Therapy

Participants
David Melville, MD, Tucson, AZ (Presenter) Nothing to Disclose
Matthew P. Del Giudice, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Darin A. Bocian, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Lana H. Girber, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Elizabeth A. Krupinski, PhD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Miha S. Taljanovic, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose

PURPOSE
To retrospectively assess for differences in imaging appearances of Morton's neumomas prior to and following laser therapy using ultrasound (US).

METHOD AND MATERIALS
Following IRB approval, a retrospective review was performed identifying 42 patients who underwent US to evaluate for Morton's neuroma prior to laser therapy. Sonographic and MRI reports and images were reviewed in correlation with clinical history. The final study group consisted of 21 patients, who underwent US of 24 feet prior to laser therapy followed by post-treatment US. A retrospective consensus review of the US from patients with treated Morton's neumomas was then carried out to characterize the appearances of these lesions prior to and following therapy. Data was then evaluated to identify US variables associated with laser therapy. When available, comparison of US to MR images was performed to assess lesion visibility.

RESULTS
Of 42 patients undergoing Morton's neuroma evaluation by US, 21 underwent treatment of a total of 32 Morton' neuromas. Retrospective US review of the pre-treatment lesion showed heterogeneously, hypoechoic masses with well-defined borders with associated pain on transducer pressure in 97% (31/32). An associated bursa (3/28) was identified in a minority of cases. Following treatment the lesions remained heterogeneously hypoechoic but most demonstrated ill-defined borders (23/31) with significantly decreased or absent pain with transducer pressure (p<0.0001), as well as the presence of an associated intermetatarsal bursa (p<0.05), which resolved following treatment, but not size. Finally, all neumomas were determined to be better visualized on US compared to MRI.

CONCLUSION
US is an excellent imaging technique for assessment of Morton's neumomas and may be used to identify post-treatment changes following laser therapy for Morton's neuroma, which include ill-defined lesion borders, resolution of bursae and improved/absent pain with transducer pressure, and these criteria may be applied in future clinical studies evaluating the efficacy of laser therapy for this condition.

CLINICAL RELEVANCE/APPLICATION
Post-treatment US changes following laser therapy for Morton's neumomas include ill-defined lesion borders, resolution of intermetatarsal bursal fluid and improved/absent pain with transducer pressure.

MK321-SD- SUA4 Spinal Osteoid Osteoma: Long-term Results after Radiofrequency Ablation

Participants
Giancarlo Faccinini, Bologna, Italy (Presenter) Nothing to Disclose
Paolo Spinnato, MD, Bologna, Italy (Abstract Co-Author) Nothing to Disclose
Eugenio Rimondi, MD, Bologna, Italy (Abstract Co-Author) Nothing to Disclose
Alberto Bazzocchi, MD, Bologna, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Gasbarrini, Bologna, Italy (Abstract Co-Author) Nothing to Disclose
Ugo Albisinni, MD, Bologna, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
The aim of this study was to evaluate efficacy and complications of CT guided radiofrequency ablation (RFA) of spinal osteoid osteoma (OO).

METHOD AND MATERIALS
Between 2002 and 2012, 61 patients (46 males and 15 females - mean age 26.4±12.7 yo) were submitted to RFA for spinal OO. The diagnosis of OO was made after a period of pain and symptoms of 20.6±14.4 months. RFA was performed under conscious sedation and local analgesia. Clinical symptoms were evaluated at 3-6-12 months, and at the end of the time of the present investigation. Mean follow-up was 41.5±7.1 months.

RESULTS
The primary efficacy of RFA, complete regression of symptoms was obtained in 57/61 (93.4%) patients. Four of 61 (6.5%) patients showed a relapse of OO (after 3 months); 2/4 were submitted to a second RFA, the others were submitted to surgery. Complications accounted for a disc herniation and lower limb formication for 30 days after the ablation.

CONCLUSION
CT-guided RFA is an excellent treatment for spinal OO. Our data suggest that this procedure should be considered for the first step therapy of this disease.

CLINICAL RELEVANCE/APPLICATION
The safety and effectiveness of CT-guided RFA in the treatment of spinal OO suggest that this minimally invasive procedure can replace spine surgery.

MK322-SD-SUA5
Whole-Body MRI: Value in Chronic Recurrent Multifocal Osteomyelitis (CRMO) and Synovitis, Acne, Pustulosis, Hyperostosis, and Osteitis (SAPHO)

Participants
Roxanne Giggens, MBBS, Oxford, United Kingdom (Presenter) Nothing to Disclose
Karen J. Partington, MBChB, MRCS, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose

PURPOSE
CRMO and SAPHO are characterised by multifocal non-infective osteomyelitis. Lesions are often asymptomatic and therefore, if suspected, whole-body screening is useful to determine multifocality. We aim to evaluate the role of whole-body MRI in the diagnosis, exclusion, and follow-up of CRMO and SAPHO.

METHOD AND MATERIALS
We retrospectively reviewed 22 whole-body MRI examinations performed in 19 patients (12 females, 7 males; age range 10-54 years) for suspected, or known CRMO or SAPHO between May 2012 and February 2015. The protocol consisted of coronal T1-weighted and STIR sequences. The number and location of osseous lesions were evaluated and compared with previous radiological examinations.

RESULTS
14 scans were performed for suspected diagnosis of CRMO or SAPHO; 5/14 (36%) showed a single site of disease and 9/14 (64%) showed multifocal disease. In the multifocal group, 19 previously undetected lesions were visualised in 6/9 (67%) patients. MR findings were used to guide biopsy location in 5 patients. 8 scans were performed to assess disease severity in patients with known multi-focal CRMO or SAPHO; 6/8 (75%) showed a change in disease burden compared to previous imaging, with 4 new or worsening lesions, and 12 lesions showing improvement or resolution.

CONCLUSION
Whole-body MRI can demonstrate multifocal disease, including asymptomatic lesions, in CRMO and SAPHO without exposure to ionising radiation. In our series we have shown that whole-body MRI is useful for establishing a diagnosis, visualising occult lesions, providing a baseline of disease distribution, guiding treatment and allowing follow-up to evaluate progression and resolution.

CLINICAL RELEVANCE/APPLICATION
In patients with suspected or confirmed CRMO or SAPHO, whole-body MRI is an ideal initial, and follow-up, diagnostic tool that does not involve ionising radiation.

MK105-ED-SUA6
Sonographic and MR Evaluation of Pectoralis Major Injury

Participants
Yauk Lee, MD, San Jose, CA (Presenter) Nothing to Disclose
Eric A. White, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Anderanik Tomasian, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Diane Phan, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
George R. Matcuk Jr, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Aaron Schein, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
TEACHING POINTS
This exhibit will provide an instructive guide to the sonographic and MR evaluation of pectoralis major injuries with an emphasis on imaging protocol, findings, and classification.

TABLE OF CONTENTS/OUTLINE
- Pictorial and imaging cases illustrating the chest wall and pectoralis major: anatomic variations, origin, course, and insertion.
- Presentation, pathophysiology, and management considerations in different clinical settings of pectoralis major injury.
- Sonographic protocol for evaluating suspected pectoralis major injury with step-by-step instructive guide to performing the exam: anatomic landmarks and appearance of normal structures.
- MR protocol for evaluating suspected pectoralis major injury: technical parameters, anatomic landmarks, and injury findings.
- Pictorial and imaging cases illustrating injury classification as well as key features of operative and non-operative injury types based on degree and location of tear.

MK149-ED-SUA7 Reimbursement for Musculoskeletal Imaging and Procedures: Understanding the Critical Role of the Relative Value Unit

Participants
Yuri E. Peterkin, MD, Mineola, NY (Presenter) Nothing to Disclose
Amanjit S. Baadh, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Joseph P. Mazzie, DO, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Jason C. Hoffmann, MD, Mineola, NY (Abstract Co-Author) Consultant, Merit Medical Systems, Inc; Speakers Bureau, Merit Medical Systems, Inc
Melanie Wegener, Garden City, NY (Abstract Co-Author) Nothing to Disclose
Michael K. Brooks, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. An understanding of the Relative Value Unit (RVU) is essential to the musculoskeletal radiologist, as this is what determines reimbursement. 2. The total payment for a musculoskeletal procedure or imaging study is calculated by multiplying the total RVU by a conversion factor. This conversion factor is updated annually. 3. Musculoskeletal radiologists must be aware of current issues regarding reimbursement and potential future payment models.

TABLE OF CONTENTS/OUTLINE
Review the history of medical reimbursement in the United States. Detail the development of the currently used RVU system, focusing on musculoskeletal imaging and procedures. The Omnibus Budget Reconciliation Act—Explanation of the RVU components and their calculation—Define the role of the RUC (Relative Value Scale Update Committee). Provide examples of RVU calculations for MSK studies and procedures, including (but not limited to): x-ray—CT—MRI—Ultrasound—Ultrasound and fluoro guided joint aspiration—CT guided bone biopsy—MR arthrogram—Percutaneous bone tumor ablation. Highlight the payment differences between facility and non-facility locations, and discuss the reasons for such differences. Review current literature on this topic, providing musculoskeletal radiologists with an improved understanding of how changes in healthcare may alter reimbursement.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Douglas S. Katz, MD - 2013 Honored Educator
Douglas S. Katz, MD - 2015 Honored Educator

MK194-ED-SUA8 Total Knee Replacement: What an Orthopedics Surgeon Wants to Know from Radiologist?

Participants
Dane G. Mackey, MD, New Orleans, LA (Presenter) Nothing to Disclose
Vinod Dasa, New Orleans, LA (Abstract Co-Author) Consultant, myoscience, Inc; Consultant, Ferinn Group; Consultant, Bioventus LLC; Research support, CROpper Medical Inc; Consultant, Sanwagakuenkenkyusho Co, Ltd
Raman Danrad, MD, New Orleans, LA (Abstract Co-Author) Nothing to Disclose
Bradley M. Spieler, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Eric Wallace JR, MD, Metairie, LA (Abstract Co-Author) Nothing to Disclose
Michael L. Mainstany, MD, New Orleans, LA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of the exhibit is to: a) Review preoperative radiographic assessment prior to knee replacement. b) Become familiar with common types of knee prosthesis and their radiographic appearances. c) Recognize post-operative complications and their radiographic appearances.

TABLE OF CONTENTS/OUTLINE
1. Pathophysiology of osteoarthritis and disease burden in national and global population. 2. Different types of knee prosthesis and their design. 3. Radiographic preoperative assessment of knee: a) Severity of OA: Kellog-Lawrence grading system b) Measurement of knee angle, mechanical axis, tibial translation, tibial slope and joint line asymmetry c) Status of mineralization d) Periarticular soft tissue including muscle bulk e) Templating to choose appropriate prosthesis. 4. Postoperative radiographic assessment a) immediate post operative radiographs b) baseline followup to assess alignment c) Short term complications with radiographic features d) Long term complications with radiographic features.
TEACHING POINTS

To demonstrate the spectrum of MRI findings in diabetic pedal osteomyelitis
To compare MRI features of pedal osteomyelitis with other conditions which both mimic and may coexist with osteomyelitis
To demonstrate MRI features of soft tissue findings in pedal osteomyelitis

TABLE OF CONTENTS/OUTLINE

Clinical relevance: Patients with advanced complications of diabetes are overrepresented in indigent and underserved communities
At our institution approximately 300 cases of pedal osteomyelitis are reported on MRI annually
MRI evaluation: Demonstrate MRI features of osteomyelitis from early to advanced bony involvement
Contrast MRI findings of pedal osteomyelitis with MR features of neuroarthopathy, a common mimicker
Distinguish reactive marrow edema from osteomyelitis, with a focus on STIR and T1 weighted imaging features
Discuss specific features of septic arthritis with osteomyelitis
Review MRI criteria for diagnosing intra-osseous abscess
Demonstrate MRI appearance of sinus tracts on T1, T2 and post-contrast images
Focus on utility of T2, post-contrast, and DWI imaging in diagnosing soft tissues abscesses
Provide examples of pedal osteomyelitis with fracture versus fracture alone
Demonstrate MRI appearance of pedal osteomyelitis with adjacent tendon rupture
MK323-SD-SUB1

Muscle Cross-Sectional Area and Strength of Knee Extensors and Flexors Impact Compartment-Specific Cartilage Health- A Longitudinal 3T MRI Study from the Osteoarthritis Initiative

Station #1

Participants
Michael G. Fox, MD, Charlottesville, VA (Moderator) Stockholder, Pfizer Inc;

Sub-Events

PURPOSE
To determine in a 48-month longitudinal study the effect of thigh muscle cross-sectional area (CSA) and strength, and specifically the ratio of extensor to flexor CSA (E/F ratio) on the progression of compositional and morphologic knee cartilage degeneration using 3T magnetic resonance imaging (MRI).

METHOD AND MATERIALS
Seventy subjects were selected from the Osteoarthritis Initiative (OAI). Subjects were only included if they were age 50-60, had no radiographic osteoarthritis (OA) and had constant muscle strength over 48 months as measured by isometric knee extension testing. For each patient, baseline CSA of the right thigh muscles was assessed on axial 3T MRI T1 weighted images and adjusted for intramuscular fat by a Goutallier-derived correction factor. E/F ratio was calculated as the ratio of extensor to flexor CSA. Extent of knee damage at baseline and 48-months was graded on right knee 3T MRI images using a modified whole organ MRI score (WORMS). Knee cartilage was segmented in 5 compartments (excluding the trochlea) at baseline and 48-months, and MRI T2 relaxation times were computed. Statistical analysis employed student’s t-test, multiple regression models and one-way analysis of variance.

RESULTS
We found that isometric chair-based knee extension strength was significantly positively correlated with mean thigh CSA at baseline (r=0.655, p<0.001). The E/F ratio had a significant direct association with progressive longitudinal deterioration of patellar cartilage (p=0.001). Interestingly, however, E/F ratio had a significant inverse association with longitudinal change in T2 values of the lateral femoral compartment (p=0.011), with a similar statistical trend in the medial femoral compartment (p=0.075), consistent with decreased compositional tibio-femoral joint cartilage degeneration.

CONCLUSION
Our results suggest that while high E/F CSA ratios of thigh muscle are associated with greater morphological degeneration at the patellofemoral joint, they simultaneously provide a protective effect for the tibio-femoral joint cartilage.

CLINICAL RELEVANCE/APPLICATION
Based on the results of this study, physiotherapeutic management of patients with mostly patellofemoral or tibio-femoral OA may differ with targeted strengthening of different muscle compartments.

MK324-SD-SUB2

Osteoarthritis (OA) of the Knee: Platelet Rich Plasma (PRP) Intraarticular Injection versus Hyaluronic Acid (HA) Viscosupplementation

Station #2

Participants
Alice La Marra, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Silvia Mariani, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Arrigoni, Coppito, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Andrea Mancini, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the results after HA and PRP intra-articular therapy in OA of the knee.

METHOD AND MATERIALS
On the basis of clinical and radiological diagnosis of OA of the knee (patient with grade 1, 2 or 3 osteoarthritis according to the
Kallgren and Lawrence scale), we treated 270 patients with HA (140 pts, Group A) and PRP (130 pts, Group B). Exclusion criteria were rheumatic and hematologic diseases. We performed MRI, clinical (VAS) and functional evaluation (WOMAC) before and 1 year after treatment. Group A included patients treated with HA and Group B those treated with PRP. We subsequently divided these groups into two subgroups to homogenize the results on the basis of age: Group Aa (95 pts aged 62-81) and Group Ab (45 pts aged 36-61); Group Ba (82 pts aged 62-81) and Group Bb (48 pts aged 36-61). We used an imaging scale ranging from 0 to 11, on the basis of distribution of joint effusion (subquadrupartital bursa, anterior/posterior recess, gastrocnemius-semimembranosus and popliteal bursa), chondral damage side (medial tibio-femoral, lateral, patello-femoral), and presence or not of subchondral edema.

**RESULTS**

Group Aa: MRI showed improvement of 66% (10 pre-treatment and 5 after), VAS improvement of 43% and Womac of 67%; Group Ab: MRI showed improvement of 28% (7 pre-treatment and 5 after) VAS improvement of 48 % and Womac of 40 %. Group Ba: MRI showed improvement of 31% (10 pre-treatment and 7 after), VAS improvement 33% and Womac 36%; Group Bb: MRI showed improvement of 84% (7 pre-treatment and 2 after);VAS improvement of 85% and Womac.

**CONCLUSION**

Our experience proves that the US-guided intra-articular injection of PRP is a good solution for primary OA of the knee, especially for young patients; conversely, for older patients, treatment with HA seems to be more effective.

**CLINICAL RELEVANCE/APPLICATION**

The treatments with PRP and HA are a valid alternative to physical, medical and surgical therapy for the patients with OA of the knee, especially for the efficacy in terms of reduction of symptoms.

**MK325-SD SUB3**

**CT Guided Minimally Invasive Percutaneous Treatment for Lumbar Disk Pathology: The Ozone Nucleolysis**

**Station #3**

**Participants**

Federico D'Orazio, LAquila, Italy (Presenter) Nothing to Disclose
Lorenzo Maria Gregori, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Aldo Giordo, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Alessandra Splendidiani, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Sergio Carducci, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Massimo Gallicci, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

**Purpose**

To evaluate the clinical effectiveness and morphologic changes in disk herniation after intradiscal, periganglionic and periradicular oxygenozone (O2O3) injection.

**METHOD AND MATERIALS**

From July 2010 to April 2014, we performed O2O3 chemonucleolysis in 1432 patients with low back pain and radicular pain secondary resistant to conservative therapy. Under CT guidance, intradiscal and periganglionic injection was administered with a paravertebral approach in 952 patients and an interlaminar approach in 540 patients by using 9 or 15 cm 22 gauge spinal needle. An Oswestry Low Back Pain Disability Questionnaire was administered before treatment and at intervals, the last at 6 month follow-up. The discs diseases treated were classified according to the nomenclature of the ASNR (bulging, protrusion, extrusion, free fragment).

**RESULTS**

After 6 months, treatment was successful in 1072 (74.9%) patients. In the remaining 360 (25.1) patients treatment was considered to have failed. The treatment was clinically successful in 88% of the extrusion, 79% of protrusions, in 61% of bulging and 51% of patients with concomitant degenerative phenomena.

**CONCLUSION**

Our study shows that the intradiscal ozone injection is effective in the treatment of intervertebral disk pathology. For this reason, oxygen-ozone injection is an option to treat lumbar disk herniation that has failed to respond to conservative therapy.

**CLINICAL RELEVANCE/APPLICATION**

In patients not responding to conservative therapy and refusing surgery, ozone injection can be safely administered to get relief from symptoms.

**MK326-SD SUB4**

**Can Combined Treatments be more Effective than RT Only for Painful Bone Metastasis? Our Experience with CT-guided Ablation with Radio-frequency and RT (RFA-RT); Microwave and RT (MW-RT); Cryotherapy and RT (CRYO-RT)**

**Station #4**

**Participants**

Andrea Mancini, MD, LAquila, Italy (Presenter) Nothing to Disclose
Francesco Arrigoni, Coppito, Italy (Abstract Co-Author) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Silvia Mariani, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

**Purpose**

To evaluate the effectiveness of percutaneous CT-guided ablation with RF or MW or CRYO added to RT versus RT only in the relief...
To evaluate the effectiveness of percutaneous CT-guided ablation with RF or MW or CRYO added to RT versus RT only in the relief of bone metastasis pain.

METHOD AND MATERIALS
From May 2007 to today, 54 oncologic patients were evaluated for a single painful bone metastasis. All lesions were larger than 3 cm with a central poorly oxygenated and necrotic area. Before ablation treatment for each patient we realized a validated visual analogic scale (VAS) for pain assessment. Inclusion criteria was VAS from 4 to 10. Exclusion criteria was the presence of other metastasis. Ablation had the role to destroy the necrotic center, which is unlikely to be treated by RT. By CT-guiding the ablation was done in 26 patients with radio-frequency (LeVeen needle electrode Boston Scientific Corporation), 8 patients with microwave (Single Evident Antenna, Covidien) and 20 patients with cryosystem (IceSeed, Galil Medical). All ablations were followed after 6 days by single fraction RT at 800 cGy.

RESULTS
Patients had pain relief for a period from 3 to 15 months (mean 8.1 months for CRYO, 7.4 for RF and 7.0 for MW) versus 3 to 15 months (mean 2.4-3 months) of RT (datas from literature). Technical success was 100%. No major complications occurred. The mean VAS after all ablations improved overall by 85% from 9.1 to 1.1 (mean 1.7).

CONCLUSION
These datas suggest that, in comparison with RT only, the adding of RF or MW or CRYO ablation can lead to a significant improvement in terms of pain relief in patients with painful bone metastasis.

CLINICAL RELEVANCE/APPLICATION
The CT-ablations improve the effectiveness of the treatment of the RT only because they act on the necrotic areas and can reduce the pain in the short term.

MK327-SD-SUBS
Fluid Attenuated Inversion Recovery DWI in Evaluation of Treatment Response in Acute Leukemia: Comparison with Conventional DWI

Participants
Jinliang Niu, MD, PhD, Shanxi, China (Presenter) Nothing to Disclose
Ying Xiong, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Xue Tian, Taiyuan, China (Abstract Co-Author) Nothing to Disclose
Dandan Zheng, Urumchi, China (Abstract Co-Author) Nothing to Disclose
Xiaohong J. Zhou, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare apparent diffusion coefficient (ADC) of fluid attenuated inversion recovery diffusion weighted imaging (FLAIR-DWI) to the ADC obtained with conventional DWI in lumbar bone marrow of patients with acute leukemia (AL), and to analyze the accuracy of ADC values of FLAIR-DWI in evaluating treatment response.

METHOD AND MATERIALS
Fifty-three patients with AL underwent MRI on GE Signa Excite 1.5T. Sagittal lumbar bone marrow was performed in conventional DWI sequence (b value=0,500s/mm²) and FLAIR-DWI(b value=0,500s/mm²,T1=2500ms). The ADC values derived from different DWI sequences were measured on ADC map respectively. 53 cases were divided into 28 untreated patients (including 114 vertebrae) and 25 treated patients (including 115 vertebrae). On base of treatment response, 25 treated patients were composed of 18 cases with complete remission (including 82 vertebrae) and 7 cases with non remission (including 33 vertebrae). The percentage of primitive leukemia cell in bone marrow were recorded.

RESULTS
In untreated patients, the ADC values of conventional DWI and FLAIR-DWI were (0.479±0.104),(0.445±0.115)×10¯³mm²/s respectively, there was statistically significant difference between different ADC values (t=3.805, p<0.05). There was similar results (t=10.078, p<0.05) in treated patients, the ADC values of conventional DWI and FLAIR-DWI were (0.718±0.261) and (0.568±0.248)×10¯³mm²/s respectively. The rate (20.89%) of decline from ADC values of conventional DWI to FLAIR-DWI was higher in treated group than that (7.10%) in untreated. The ADC values of FLAIR-DWI demonstrated good correlations with percentage of primitive leukemia cell in bone marrow in untreated patients (r=0.384, p=0.0043), but not in treated patients (r=-0.086, p=0.726). The ADC values of FLAIR-DWI were higher sensitivity and specificity in evaluating treatment response with area under the curve (AUC) of 0.794 than ADC values of conventional DWI with AUC of 0.695.

CONCLUSION
FLAIR-DWI can reduce ADC value of bone marrow in AL by suppressing the signal of free water. It may improve the accuracy of evaluating treatment response in patients with AL.

CLINICAL RELEVANCE/APPLICATION
On contrast to bone marrow biopsy, the results of this subject will provide a noninvasive method for evaluating treatment response in patients with AL.

Awards
Certificate of Merit

Participants
Glenn Erski, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Justin Holder, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
TEACHING POINTS

Fracture of the proximal humerus is the third most common type in individuals older than 65 years. The pattern and displacement of such fractures predicts the functional outcome and determines treatment strategies. Charles Neer developed a classification scheme in 1970 in order to accurately characterize surgically important aspects and pathologic features. This system continues to be widely used to this day. Through a review and subsequent quiz format, we intend to solidify understanding of: Physiologic relevance of Neer segments Neer classification criteria for displacement Neer fractures I-IV Implication of classification on treatment / prognosis

TABLE OF CONTENTS/OUTLINE

Neer Classification system Neer segments Defined Illustrated in multiple projections Physiologic significance of each segment Greater Tuberosity Lesser Tuberosity Articular Surface Humeral Diaphysis Neer criteria for displacement Neer Fracture Types Types I-V defined Treatment Prognosis Common associated findings (e.g. fracture -dislocation injuries) Quiz - case based review of teaching points

MK151-ED- SUB87 Coracoid: The Lighthouse of the Shoulder

Table #7

Awards
Certificate of Merit
Identified for Radiographics

Participants
Hussan Mohrmed, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Matthew R. Skalski, DC, Whittier, CA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
Eric A. White, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Aaron Schein, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Anderanik Tomasian, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
George Hatch III, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The coracoid process is a hook-shaped structure projecting anterolaterally from the superior aspect of the scapular neck. Surgeons often refer to it as “the lighthouse of the shoulder” given its proximity to major neurovascular structures and role in guiding surgical approaches. It also serves as an anchor for numerous important tendon/ligament attachments and landmark for other important shoulder structures. The aim of this exhibit is to review coracoid anatomy, describe related structures, illustrate the imaging appearance of common pathologies and touch on surgical considerations.

TABLE OF CONTENTS/OUTLINE

Illustrations of normal coracoid anatomy including muscle (pectoralis minor, short head of the biceps brachii, and coracobrachialis) and ligament attachments (coracoclavicular, coracohumeral, coracoacromial, and suprascapular) Variant anatomy Coracoid fractures: mechanisms, imaging, classification, associated injuries, and management Subcoracoid impingement: presentation, imaging, and treatment Coracoacromial arch, impingement, and rotator cuff pathology Coracohumeral ligament and the biceps pulley Coracoclavicular ligament injury and reconstruction Subcoracoid triangle sign in adhesive capsulitis Subcoracoid bursitis: causes and differentiation from subscapularis recess Coracoid transfer for anterior shoulder instability Tumors

MK199-ED- SUB88 MRI for Injuries of the Plantar Plate, Adjacent Joint Capsule, and Interosseous Tendons: Ten-year Experience and New Imaging Signs

Table #8

Participants
Ruben Kier, MD, North Haven, CT (Presenter) Nothing to Disclose
Anthony E. Zaklama, MD, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. The “unhappy tilt” sign of the flexor tendon on MRI helps detect injuries of the plantar plate and adjacent capsule. 2. Disruption of the “Fu Manchu mustache” appearance of the interosseous tendons helps detect tendinosis and tear. 3. These signs can be detected even on non-contrast MRI but are more conspicuous with contrast media. 4. MR arthrography with intra-articular injection of dilute gadolinium contrast media into the metatarsophalangeal joint provides excellent delineation of tears of the plantar plate and joint capsule that helps with surgical planning. 5. MRI with intravenous contrast media is a less invasive alternative to MR arthrography, and provides better assessment of other potential sources of pain in the forefoot

TABLE OF CONTENTS/OUTLINE


MK239-ED- SUB89 An Osseous Odyssey: A Woman’s Life as Told by her Musculoskeletal System

Table #9
Participants
Linda E. Chen, MD, Seattle, WA (Presenter) Nothing to Disclose
Christine M. Rehwald, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Sabah Servaes, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Felix S. Chew, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Alice S. Ha, MD, Seattle, WA (Abstract Co-Author) Grant, General Electric Company

TEACHING POINTS
After reviewing this exhibit, learners will acquire understanding of 1) imaging appearances of the musculoskeletal disorders affecting a woman's life from infancy to elderly years, 2) imaging evidence of musculoskeletal complications from pregnancy and childbirth, and 3) radiographic manifestations of treatments from diseases uniquely with female predominance.

TABLE OF CONTENTS/OUTLINE
1. Infancy and early childhood: developmental dysplasia of hip, McCune-Albright syndrome.
3. Childbearing:
   - Freiberg's infraction and Haglund syndrome, rheumatoid arthritis.
   - Pregnancy: transient osteoporosis of the hip, disc herniation and sciatica, deep musculoskeletal fibromatosis.
   - Childbirth: pubic symphysis diastasis or disruption, sacroccygeal dislocation and coccygodynia.
   - Post-partum: de quervain's, osteitis condensans illi.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Felix S. Chew, MD - 2012 Honored Educator
Contemporary Problems in Arthritis Evaluation (An Interactive Session)

Sunday, Nov. 29 2:00PM - 3:30PM Location: E450B

LEARNING OBJECTIVES

1) Describe the multimodality imaging features of common arthropathies. 2) Describe key imaging features that help distinguish one arthritis from another commonly confused entity. 3) Describe important clinical features that help establish the correct diagnosis of an arthropathy. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT

The purpose of this presentation is to discuss how to differentiate commonly confused arthropathies using a case based interactive format. The utility of multiple modalities and incorporation of clinical data in establishing a correct diagnosis will be reviewed.

RC104A Differentiating Rheumatoid Arthritis from Crystal Deposition Diseases

Participants
Donald J. Flemming, MD, Hershey, PA (Presenter) Royalties, Reed Elsevier

LEARNING OBJECTIVES

1) Describe the imaging features that differentiate rheumatoid arthritis and gout. 2) Describe the imaging features that differentiate rheumatoid arthritis and calcium pyrophosphate deposition disease.

ABSTRACT

Radiologists can have a tremendous impact on care of a patient suffering from an arthritis by confirming or establishing the correct diagnosis. Prevention of joint damage hinged on the correct diagnosis and therapeutic regimen. The purpose of this presentation is to review the imaging features that assist in differentiating rheumatoid from crystal deposition disease (gout and calcium pyrophosphate and hydroxyapatite deposition disease). A case based format will be used to demonstrate the critical radiographic, MRI, CT and ultrasound features that help establish the correct diagnosis.

RC104B Differentiating Appendicular Inflammatory from Degenerative Arthritis

Participants
Thomas M. Link, MD, PhD, San Francisco, CA, (thomas.link@ucsf.edu) (Presenter) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

LEARNING OBJECTIVES

1) To classify imaging studies of patients with arthropathies as inflammatory or degenerative. 2) To differentiate specific radiographic criteria of inflammatory arthropathies from those of degenerative osteoarthritis of the appendicular skeleton. 3) To identify findings that are found in both inflammatory and degenerative arthropathies, in particular in erosive osteoarthritis.

ABSTRACT

In general appendicular inflammatory arthropathies are characterized by loss of bone with juxta-articular osteopenia and erosive changes while degenerative arthritis shows increased bone formation with subchondral sclerosis and osteophytes. However, there is overlap as inflammatory arthropathies will eventually develop secondary degenerative changes and there is an erosive form of osteoarthritis (OA), which is typically found in older women. There are a number of criteria to differentiate OA and inflammatory arthropathies. These include location of abnormalities in the appendicular skeleton, which greatly helps to differentiate rheumatoid arthritis from OA (metacarpophalangeal/metatarsophalangeal joints in rheumatoid arthritis versus distal and proximal interphalangeal joints in OA) but not psoriatic arthritis and OA (distal and proximal interphalangeal joints in OA). Also inflammatory arthropathies and OA are both found at the radiocarpal, intercarpal and carpometacarpal joint 1. Differentiating erosive OA and psoriatic arthritis is a particular challenge as they both are erosive and may be found in the same locations. This lecture will present typical and more problematic cases of inflammatory and degenerative arthropathies, identify typical and overlapping findings and provide the attendees with a diagnostic approach to these entities.

RC104C Differentiating Sacroiliitis from Its Mimickers

Participants
David C. Salonen, MD, Toronto, ON (Presenter) Consultant, AbbVie Inc; Consultant, Johnson & Johnson;

LEARNING OBJECTIVES

1) Discuss radiographic and MR criteria ‘necessary’ for the diagnosis of sacroiliitis. 2) Describe the imaging features that differentiate inflammatory sacroiliitis from its mimickers.

ABSTRACT
**RC104D  Differentiating Ankylosing Spondylitis from Spinal Degenerative Disease**

Participants
Robert G. Lambert, MBBCh, Edmonton, AB (Presenter) Research Consultant, Abbott Laboratories

**LEARNING OBJECTIVES**

1) Differentiate specific patterns of bone marrow abnormality on spine MRI from non-specific changes. 2) Describe the patterns of bone formation on spine radiography in middle-aged patients that distinguish between degenerative causes and spondyloarthritis. 3) Recommend which patients with spinal ossification need further imaging to distinguish between spondyloarthritis and DISH.

**ABSTRACT**

Diffuse idiopathic skeletal hyperostosis (DISH) is a degenerative disorder characterized by flowing ossification in the spine occurring primarily in the anterior longitudinal ligament, and to a lesser extent, in paravertebral tissues and the peripheral part of the annulus fibrosus. The ossification is usually most prominent along the anterior and right anterolateral aspects of thoracic vertebral bodies and, on lateral x-ray, radiolucency may be noted between new bone and the vertebral body. Current classification criteria for DISH require spinal ankylosis across 3 consecutive intervertebral discs and less extensive ankylosis may present a diagnostic challenge when criteria are not met. Concomitant disc degeneration is frequent but is less prevalent at fused levels. DISH may involve the sacroiliac (SI) joints but with relative preservation of articular cartilage. Spondyloarthritis (SpA) is a group of inflammatory disorders that involve the joints and entheses of the axial and peripheral skeleton and is typified by ankylosing spondylitis (AS). Spinal involvement is characterized by inflammation at the attachment of the annulus fibrosus. Osteitis may be seen in the form of erosion and/or sclerosis of the vertebral corner and "squaring" of the vertebral bodies on lateral views of the spine is caused by adjacent periosteal reaction. In the periphery of the annulus fibrosus, formation of syndesmophytes are seen as vertical bony spurring that may extend to bridge the disc causing ankylosis. The inflammatory process may result in ankylosis of the costotransverse, costovertebral, and facet joints and interspinous ligaments. These two conditions are easily distinguished when seen in their common presentation. However, patients with an older than usual onset of SpA over the age of 40 may be hard to distinguish from early DISH and disc degeneration is common at all ages regardless of both DISH and SpA. In many cases when the diagnosis is uncertain, further imaging, especially with MRI, may be useful to distinguish between these two entities. However while some patterns of MRI involvement are highly specific for one condition or another, often bone marrow abnormalities in the spine are non-specific and being able to distinguish between these patterns is of considerable diagnostic importance.

**RC104E  Monitoring Response to Disease Modifying Therapy**

Participants
Eric Y. Chang, MD, San Diego, CA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the role of the radiologist in the management of arthropathies. 2) Compare the ability of different imaging modalities to detect inflammation and structural alteration. 3) Assess the response after disease modifying therapy according to established criteria.

**ABSTRACT**
**Pediatric MR: Normal or Not?**

**Sunday, Nov. 29 2:00PM - 3:30PM Location: N228**

**LEARNING OBJECTIVES**

1) Differentiate normal and abnormal signal intensity patterns of abdominal structures in children. 2) Recognize normal developmental variants that can simulate abdominal pathology.

**ABSTRACT**

In pediatric neuroradiology, magnetic resonance imaging is used to assess central nervous system (CNS) disease in the infant, child, and teenager. This requires 1) an understanding of normal brain development and maturation from gestation through adolescence; 2) a technical mastery of the neuroimaging techniques that are used in evaluating brain diseases of childhood; and 3) an overall grasp of the imaging features of numerous brain pathologies, both acquired and congenital. This lecture will focus on the common MR imaging features of the normal pediatric brain and spine and will compare and contrast with MR imaging features in specific brain diseases and disorders of development.

**Participants**

Geetika Khanna, MD, MS, Iowa City, IA (Moderator) Nothing to Disclose

**Learning Objectives**

1) Differentiate normal and abnormal signal intensity patterns of abdominal structures in children. 2) Recognize normal developmental variants that can simulate abdominal pathology.

**Abstract**

In pediatric neuroradiology, magnetic resonance imaging is used to assess central nervous system (CNS) disease in the infant, child, and teenager. This requires 1) an understanding of normal brain development and maturation from gestation through adolescence; 2) a technical mastery of the neuroimaging techniques that are used in evaluating brain diseases of childhood; and 3) an overall grasp of the imaging features of numerous brain pathologies, both acquired and congenital. This lecture will focus on the common MR imaging features of the normal pediatric brain and spine and will compare and contrast with MR imaging features in specific brain diseases and disorders of development.

**Participants**

Geetika Khanna, MD, MS, Iowa City, IA (Presenter) Nothing to Disclose

**Learning Objectives**

1) Differentiate normal and abnormal signal intensity patterns of abdominal structures in children. 2) Recognize normal developmental variants that can simulate abdominal pathology.
Sunday Afternoon Plenary Session

Sunday, Nov. 29 4:00PM - 5:45PM Location: Arie Crown Theater

**Report of the RSNA Research and Education Foundation**

Participants
Ronald L. Arenson, MD, San Francisco, CA (Presenter) Nothing to Disclose

Sub-Events

**PS12A** Report of the RSNA Research and Education Foundation

Abstract
The RandE Foundation - Our Future is Now This year marks the 100th anniversary of the RSNA's founding. As radiology looks toward the future, one wonders what the next 100 years will look like for our specialty and whether the central role of radiologists in healthcare will be sustained. Analogous to our clinical radiology mantra, if we are not at the radiology research table we will be on the menu. As a leading global force in radiology, the RSNA is poised to lead the specialty into the next century and exceed the incredible success of the past 100 years. The RandE Foundation will play a key role in radiology's future by continuing its support of inspiring investigators and those pursuing innovative approaches to education. To meet these research and education needs head-on, the Foundation launched Inspire-Innovate-Invest, The Campaign for Funding Radiology's Future® at last year’s annual meeting. 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. To date our campaign has been a success with individuals, private practice and corporate donors generously pushing us to the mid-way point in our goal. There is still a long way to go. The future of our specialty depends on the commitment and generosity of each of us, the members of the imaging community. This year, the Foundation will fund 92 grants totaling $3.6 million. 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? 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 robustness of our specialty.

**PS12B** Image Interpretation Session

Participants
Jonathan B. Kruskal, MD, PhD, Boston, MA (Presenter) Author, UpToDate, Inc
Donald P. Frush, MD, Durham, NC (Presenter) Nothing to Disclose
Bruce B. Forster, MD, Vancouver, BC (Presenter) Travel support, Siemens AG; Travel support, Toshiba Corporation;
Christine M. Glastonbury, MBBS, San Francisco, CA (Presenter) Author with royalties, Reed Elsevier
Michelle M. McNicholas, MD, Dublin, Ireland (Presenter) Nothing to Disclose
Melissa L. Rosado De Christenson, MD, Kansas City, MO (Presenter) Author, Thieme Medical Publishers, Inc; Author, Reed Elsevier; Author, American Registry of Pathology; Author, Oxford University Press; ; ;
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Melissa L. Rosado De Christenson, MD - 2012 Honored Educator
Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator
Jonathan B. Kruskal, MD, PhD - 2012 Honored Educator
Musculoskeletal Monday Case of the Day

Monday, Nov. 30 7:00AM - 11:59PM Location: Case of Day, Learning Center

Participants
William F. Conway, MD, PhD, Charleston, SC (Presenter) Nothing to Disclose
Russell W. Chapin, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Robert H. Hazelrigg, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Thomas Britt, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Nathaniel Jones, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Kevin G. Garrett, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew R. Gilott, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew P. Brill, DO, Oklahoma City, OK (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.
RSNA Diagnosis Live™: ’Bo you don’t know Didley’ - Test Your Diagnostic Skills at the Crack of Dawn

Monday, Nov. 30 7:15AM - 8:15AM Location: E451B

Participants
Adam E. Flanders, MD, Penn Valley, PA (Presenter) Nothing to Disclose
Christopher G. Roth, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Sandeep P. Deshmukh, MD, Philadelphia, PA, (sandeep.deshmukh@jefferson.edu) (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.
Case-based Review of Magnetic Resonance (An Interactive Session)

Monday, Nov. 30 8:30AM - 10:00AM Location: S100AB

LEARNING OBJECTIVES
1) Be familiar with the MRI appearance of common musculoskeletal derangements of the hip. 2) Develop a differential diagnosis for musculoskeletal soft tissue tumors based on MRI appearance. 3) Distinguish between common benign and malignant liver neoplasms. 4) Be familiar with the typical MRI appearance of select female pelvic disorders.

ABSTRACT
This session will help attendees recognize and manage select, commonly encountered musculoskeletal and abdominopelvic abnormalities based on their MRI appearances using a case-based, interactive format.

Sub-Events

MSCM21A Musculoskeletal MRI of the Hip and Pelvis

Participants
John R. Leyendecker, MD, Dallas, TX (Director) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Active Handout: Mini Nutan Pathria

MSCM21B MRI of Soft Tissue Masses of the Extremities

Participants
Kirkland W. Davis, MD, Madison, WI, (kdavis@uwhealth.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Distinguish characteristic extremity soft tissue masses on the basis of signal characteristics, such as high signal on T1-weighted images or low signal on all sequences.

ABSTRACT

MSCM21C MRI of the Liver

Participants
Nicole M. Hindman, MD, New York, NY, (Nicole.Hindman@nyumc.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize and analyze benign but unusual liver lesions. 2) Analyze uncommon presentations of liver lesions. 3) Recognize neoplastic mimics of benign lesions in the liver (e.g., a colon metastasis mimicking a hemangioma).

ABSTRACT
This session will cover common and uncommon presentations of liver lesions on several modalities (ultrasound, CT and MRI). A brief interactive review of common, but atypical presentations of both benign and malignant liver lesions will be presented. Malignant mimics of benign liver lesions will also be shown, with features that should be analyzed in order to better characterize the lesion, and appropriately raise concern (e.g., for a metastasis or intrahepatic cholangiocarcinoma instead of a benign hemangioma). Recent advances in liver lesion characterization will be covered.

MSCM21D MRI of the Female Pelvic Organs

Participants
Christine O. Menias, MD, Scottsdale, AZ, (menias.christine@mayo.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality...
educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Christine O. Menias, MD - 2013 Honored Educator
Christine O. Menias, MD - 2014 Honored Educator
Christine O. Menias, MD - 2015 Honored Educator
**RC204**

**Muscloskeletal Series: Knee and Hip MR Imaging**

Monday, Nov. 30 8:30AM - 12:00PM Location: E451B

**LEARNING OBJECTIVES**

1) Recognize common causes of false positives on MRI of the knee including misinterpretation of normal structures and normal variants, such as the dorsal defect of the patella. 2) Review causes of false negatives on MRI of the knee that may be undetected due to lack of recognition or that may look normal over time, such as a chronic cruciate ligament tear.

**ABSTRACT**

MRI if highly accurate for evaluation of the knee joint. This lecture will emphasize common pitfalls and pearls to get around them when evaluating the knee with MRI. Some anatomic structures and normal variants can simulate an abnormality of the menisci, ligaments, cartilage, bone and surrounding soft tissues of the knee on MRI. In addition there are some abnormalities that can be missed or misinterpreted.

**Participants**

Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) *(Moderator) Nothing to Disclose*

Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) *(Moderator) Nothing to Disclose*

**PURPOSE**

Recently, evidence has been accumulating for the existence of a previously unknown structure at the anterolateral aspect of the human knee named anterolateral ligament (ALL). The aim of this study was to evaluate the visibility and to describe the anatomical features of the ALL using magnetic resonance imaging (MRI) and to correlate the results with gross anatomical findings.

**METHOD AND MATERIALS**

16 human knees were obtained from cadavers (4 male, 9 female) at a mean age of 84.3 ±5.2 years. All specimens were examined with plain film radiography to exclude advanced degenerative arthrosis, prior osseous injuries as well as joint replacement. Subsequently, MRI scans were performed with a 3 Tesla machine (Ingenia, Philips). Two musculoskeletal radiologists independently reviewed coronal and axial T1- and proton density-weighted images to assess the visibility of the ALL. In all 16 knees the lateral supporting structures were carefully dissected by an orthopedic surgeon and an anatomist to identify the course and anatomy of the ALL as well as its length and thickness.

**RESULTS**

On the basis of MR imaging a consistent structure correspondent to the ALL was identified in 11 knees (68%). On anatomical dissection the ALL was found in 13 knees (81%). It originated at the lateral femoral epicondyle and its proximal part was blended with the lateral collateral ligament (LCL) making it difficult to distinguish these two structures. The ALL was distally separate from the LCL and ran obliquely to insert on the lateral tibial plateau between Gerdy’s tubercle and the fibular head. Measurements of a completely visible ALL on anatomic dissections revealed an average proximal length of 42.8 ±4.6 mm and a distal length of 34.3 ±10.8 mm, whereas its width was 6.46 ±2 mm.

**CONCLUSION**

MRI of the knee was accurate and sensitive in the identification of the intact ALL. It appeared as a thin black structure on T1 weighted sequences and was best visualized on coronal images. Information concerning this structure may be crucial with respect to the diagnosis and understanding of knee pathologies.

**CLINICAL RELEVANCE/APPLICATION**

The ALL is believed to be responsible for the Segond fracture and its rupture has been associated with anterolateral rotational knee...
The ALL is believed to be responsible for the Segond fracture and its rupture has been associated with anterolateral rotational knee instability. MRI imaging may provide valuable information about the ALL.

**RC204-03  Anterolateral Ligament Injury in Patient with Acute ACL Tears on MRI: Prevalence, Patterns and Relationships with Tibial Contusions**

**PURPOSE**

The anterolateral ligament (ALL) of the knee is believed to be involved in maintaining rotatory stability of the knee, may be injured with the anterior cruciate ligament (ACL) tear during pivot shift injuries and may be accountable for failed ACL repairs. We sought to describe the incidence and patterns of ALL injury in patients with acute ACL tears, and investigate if there is a relationship with various bone contusions, meniscal tears and posterolateral injuries.

**METHOD AND MATERIALS**

Knee MR examinations of 81 patients with acute ACL tears were retrospectively reviewed by two musculoskeletal radiologists to assess the ALL: visualization, location of tibial insertion, sprain and presence of an anterolateral tibia insertional bone contusion. Additional bone contusions in the postemorial, posterolateral and anteromedial tibia and lateral femoral condyle were noted, as well as meniscal tears and posterolateral injuries (popliteus tendon and fibular collateral ligament [FCL]). Statistical analysis for relationships of these findings with ALL injuries was obtained utilizing the Pearson correlation and Chi2 tests.

**RESULTS**

ALL injury, including sprain and/or an anterolateral tibia traction contusion, was seen in 49/81 (60%) (34/81 [42%] and 32/81 [40%], respectively), with an avulsion fracture in 3/32 (9%). Anteromedial and posterolateral tibial contusions were significantly more common in patients with ALL injury (p=0.004 and p=0.006, respectively). The anterolateral tibial traction contusion was characteristically subcortical, elongated (mean size (mm) 10.7CC x 12.7AP x 4.6TV), and involved the middle anteroposterior third of the tibia. There was correlation with posterolateral injury (p=0.046) and medial meniscal tears (32/81, p=0.049). There was no relationship between lateral meniscus tear, posterolateral tibial or lateral femur bone contusion and ALL injury.

**CONCLUSION**

ALL injury is present in more than 50% of ACL tears. It is specifically associated with anteromedial and posterolateral tibial contusions, and some demonstrate a characteristic anterolateral traction contusion.

**CLINICAL RELEVANCE/APPLICATION**

ALL injury is common on MRIs of acute ACL tears. Anteromedial and posterolateral tibia contusions are suspicious and anterolateral, elongated subcortical tibia contusion and ALL sprain should be assessed.

**RC204-04  Distal MCL Tears of the Knee: MRI Features of Stener-like Lesions**

**PURPOSE**

To analyze the MRI characteristics of distal MCL tears, without and with displacement superficial to the pes anserinus (Stener-like lesion [SLL]).

**METHOD AND MATERIALS**

In this IRB-approved study, MRI examinations of the knee at three institutions were selected which showed partial or complete tears of the (superficial) MCL centered distal to the joint line. MRI examinations were evaluated independently by two musculoskeletal radiologists for: a SLL of the distal MCL; coexistent tears of the meniscotibial and meniscofemoral ligaments; a wavy contour to the more proximal MCL; the vertical distance of the stump from the medial joint line; and the transverse distance of the stump from the medial tibial cortex. Additional co-existent knee injuries also were recorded.

**RESULTS**

The study included 32 patients (median age: 27 years; interquartile range 18 years). A SLL of the MCL was identified in 11 of 32 cases. The proximal stump margin was located significantly (p<.01, Mann Whitney U) more distal in cases with a SLL (mean=35 mm, sd=11 mm), as compared to without a SLL (mean=16 mm, sd=15 mm). The incidence of ACL tear, PCL tear, meniscotibial/meniscofemoral ligament tear, and lateral compartment osseous injury was high in cases with a SLL (91%, 36%,73%, and 91%, respectively), but not significantly different (p>0.10, Fisher’s exact test) from cases without a SLL (81%, 33%, 57%, and 91%, respectively). The MCL had a wavy appearance in 82% of cases with a SLL, and in 62% without a SLL.

**CONCLUSION**

A SLL of the MCL should be considered in the setting of a high-grade, distal MCL tear, particularly when there is a wavy appearance to the MCL. These lesions are accompanied very frequently by tears of the ACL and meniscotibial/meniscofemoral ligaments.
A SLL of the distal MCL is important to recognize for appropriate treatment and operative decision making.

**RC204-05  Postero-Lateral Instability (PLI) of the Knee: Can the Right Diagnosis of Posterior-Lateral Corner (PLC) Structures Involvement, Using the WB-MRI, Evades a Future Anterior Cruciate Ligament (ACL) Reconstruction Failure?**

**Monday, Nov. 30 9:25AM - 9:35AM Location: E451B**

Participants
Silvia Mariani, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Alice La Marra, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Arrigoni, Coppito, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The aim of our study was to evaluate the value of weight-bearing (WB)-MRI compared to standard-MRI in unmasking PLC structures involvement to determine a PLI.

**METHOD AND MATERIALS**

We prospectively analyzed 200 patients positive for an acute ACL injury, only 100 of them with suspicion of a PLI. All patients underwent a dedicated MRI in supine and WB position with knee flexion of 12°-15°. We evaluated knees for 3 direct signs of ACL injury (discontinuity, ACL altered morphology and deflection) and for 4 indirect signs (bone bruise, anterior tibial translation, uncovered lateral meniscus and hyperbuckled posterior cruciate ligament (PCL)). We evaluated the involvement of PLC capsuloligamentous structures. All patients underwent arthroscopy.

**RESULTS**

Among the direct signs we obtained that ACL deflection resulted the most statistical significant (p<0.004); among the indirect signs the anterior tibial translation was the most statistical significant (p<0.0001) followed by the uncovered lateral meniscus (p<0.005). Finally we evaluated the involvement of PCL capsuloligamentous structures (antero-lateral and posteromedial popliteomeniscal ligaments): both the ligaments were involved in 65/89 of the cases instead of the fewer one was involved in 24/89 of the cases. Arthroscopy confirmed ACL tear with diagnosis of PLI in 89% of cases. The 100 patients with no clinical suspicion of PLI didn’t show modifications of signs during the standard and WB-MRI.

**CONCLUSION**

The study discovers the value of WB-MRI in recognising the most sensitive direct and indirect signs of ACL injury and to diagnose a PLI involvement, leading patients to the right surgical treatment.

**CLINICAL RELEVANCE/APPLICATION**

The diagnosis of the PLI is always clinical however there is no a pre-operative specific test to diagnose it. The added value of the weight-bearing MRI is to provide further information in unmasking direct/indirect signs of ACL injury negative at standard-MRI. This may be very helpful for the orthopedic surgeon in the choice of possible treatment and to avoid an ACL graft failure.

**RC204-06  Posterolateral Corner Injuries**

**Monday, Nov. 30 9:35AM - 10:00AM Location: E451B**

Participants

**LEARNING OBJECTIVES**

1) Understand the anatomy of the posterolateral corner of the knee. 2) Realize the importance of the posterolateral corner in injury of the knee. 3) Be able to recognize major and minor posterolateral corner injury on MRI.

**RC204-07  Postoperative Meniscus**

**Monday, Nov. 30 10:10AM - 10:30AM Location: E451B**

Participants
Robert D. Boutin, MD, Sacramento, CA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Differentiate between the 3 surgical techniques applied to the torn meniscus (the “three R’s”: Resection, Repair, and Replacement) -- each resulting in a different ‘normal’ MRI appearance of the postoperative meniscus. 2) Detect recurrent/residual tears in the post-operative meniscus on MRI.

**ABSTRACT**

After highlighting relevant anatomy, we review the current indications and techniques used for meniscus surgery, and focus on MRI interpretation of the postoperative meniscus, including recurrent tears and outcomes/complications.

**RC204-08  Pitfalls in Hip MRI Interpretation**

**Monday, Nov. 30 10:30AM - 10:55AM Location: E451B**

Participants
Donna G. Blankenbaker, MD, Madison, WI, (dblankenbaker@uwhealth.org) (Presenter) Nothing to Disclose
METHOD AND MATERIALS
A PACS and report database was searched for MRI knee examinations describing a medial BHMT from 2006 to 2013. These exams were then screened for the availability of a prior MRI performed after a trauma with no BHMT. The prior MRI was reviewed for presence of a meniscal tear or lesion borderline for a tear, tear configuration (oblique, horizontal, vertical, or complex), tear location (anterior horn, body, and/or posterior horn), tear zone (red, white, and/or pink), tear extension to articular surfaces of the meniscus (inferior, superior or both) and the presence of concomitant anterior cruciate ligament pathology (disruption or reconstruction). The time interval between the initial MRI and the BHMT MRI was recorded, as was patient age and gender.

RESULTS

931 MRIs with reported BHMT yielded 39 subjects with prior MRI. Of these, only 7/39 (17.9%) had no clear meniscus tear on the initial study and 6/7 had edema type signal at the posteromedial margin of the medial meniscus. Of the 32/39 (82.1%) with prior meniscal tears: 27/32 (84.4%) were vertical or complex with a vertical component, 4/32 (12.5%) were oblique, and 1/32 (3.1%) were horizontal. All of the prior meniscal tears involved the posterior horn while 10/32 (31.2%) also involved the meniscal body. The red zone was most often involved (28/32, 87.5%), while the white and pink zones were involved in 12/32 (37.5%) and 15/32 (46.8%) respectively. Concomitant ACL pathology was common on the initial exams, seen in 26/39 (66.6%). Of the 26 patients with ACL pathology, 16 had an active ACL tear and 10 had a prior ACL reconstruction. 28/32 (87.5%) of the initial meniscus tears including all vertical tears involved both articular surfaces.

CONCLUSION

In the setting of knee trauma and ACL injury, MR findings of a vertical medial meniscus tear involving the red zone and both articular meniscal surfaces should raise concern for the potential evolution of a BHMT.

CLINICAL RELEVANCE/APPLICATION

A non displaced peripheral vertical medial meniscal tear is an important observation on a posttraumatic knee MRI. Orthopedists should consider repair to prevent the evolution of a BHMT.
An orthopaedic surgeon (blinded to MR findings) reviewed the arthroscopy reports for the documentation of clinical laxity determined by examination under anesthesia (reference standard).

**RESULTS**

None of the 57 MR reports described the findings related to laxity. Logistic regression was performed using clinical laxity as the dependent variable and gender, age, and MR findings of laxity scored as independent variables. Clinical laxity was much more common in women (26 women, one man). It was also more common in older patients. Statistically significant associations were noted between clinical laxity and gender (odds ratio for men = 0.009, p = 0.0001) and the presence of both MR findings of laxity (odds ratio = 11.1, p = 0.039).

**CONCLUSION**

Hip laxity is commonly underdiagnosed on pre-operative MR reports, compared with exam under anesthesia. We were able to confirm an association between clinical laxity and the MR findings of anterior recess widening and anterior capsular thinning.

**CLINICAL RELEVANCE/APPLICATION**

Atraumatic hip instability is increasingly recognized as a cause of hip pain that is potentially treatable, but difficult to diagnose preoperatively. MR may help identify patients with laxity, thus influencing surgical management.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Michael L. Richardson, MD - 2013 Honored Educator
Michael L. Richardson, MD - 2015 Honored Educator

**PURPOSE**

The aims of this study were to test useful parameters for ischiofemoral impingement (IFI) on both supine and standing anteroposterior hip radiographs, and to suggest optimal cut-off points for detection of IFI on radiograph.

**METHOD AND MATERIALS**

We performed a retrospective study for all patients who had a clinical history of hip pain. All hip joints with quadratus femoris muscle (QFM) edema characterized by increased signal intensity on axial FatSat T2-weighted MR images were selected as an IFI patient group, and an age- and sex-matched control group was created from the same cohort by propensity-score matching. Two readers independently measured the parameters, including ischiofemoral space (IFS), quadratus femoris space (QFS) and hamstring tendon area (HTA) on MR images. The ischiofemoral distance (IFD) and femur neck shaft angle (NSA) were also measured on radiographs. Differences in each parameters between the two study groups were assessed by using the Mann-Whitney U test. Interobserver agreement was quantified by using the intraclass correlation coefficient. The area under the ROC curve (AUC) was calculated as a measure of discriminative ability. Youden's J statistic was used to select the optimum cut-off points for each parameters on radiograph.

**RESULTS**

A total of 30 patients with QFM edema (44 hip joints, age: 54.8±11 years) were included in the IFI patient group. A total of 88 patients without QFM edema (88 hip joints, age: 51.8 ± 13.4) were selected as control group from a cohort after propensity score matching. IFS, QFS, NSA and IFD showed statistically significant differences between two groups (p < 0.05). IFS, QFS and IFD showed almost perfect interobserver agreements (r > 0.8). IFDs showed good discrimination abilities (AUC > 0.80). Optimal cut-off points for IFD by reader 1 were 19.9 mm and 16.2 mm on supine radiograph and standing radiograph, respectively. Optimal cut-off points for IFD by reader 2 were 21.1 mm and 17.0 mm, respectively.

**CONCLUSION**

IFDs on both supine and standing hip radiographs showed good diagnostic performances for detection of IFI. It could be used as a good screening tool with optimal cut-off points.

**CLINICAL RELEVANCE/APPLICATION**

The measurements of ischiofemoral distances on both supine and standing hip radiographs are useful screening tool with good diagnostic performances for detection of ischiofemoral impingement.

**RC204-11 Supine Versus Standing Radiographs for Ischiofemoral Impingement Using a Propensity Score-Match**

**PURPOSE**

The aims of this study were to test useful parameters for ischiofemoral impingement (IFI) on both supine and standing anteroposterior hip radiographs, and to suggest optimal cut-off points for detection of IFI on radiograph.

**METHOD AND MATERIALS**

We performed a retrospective study for all patients who had a clinical history of hip pain. All hip joints with quadratus femoris muscle (QFM) edema characterized by increased signal intensity on axial FatSat T2-weighted MR images were selected as an IFI patient group, and an age- and sex-matched control group was created from the same cohort by propensity-score matching. Two readers independently measured the parameters, including ischiofemoral space (IFS), quadratus femoris space (QFS) and hamstring tendon area (HTA) on MR images. The ischiofemoral distance (IFD) and femur neck shaft angle (NSA) were also measured on radiographs. Differences in each parameters between the two study groups were assessed by using the Mann-Whitney U test. Interobserver agreement was quantified by using the intraclass correlation coefficient. The area under the ROC curve (AUC) was calculated as a measure of discriminative ability. Youden's J statistic was used to select the optimum cut-off points for each parameters on radiograph.

**RESULTS**

A total of 30 patients with QFM edema (44 hip joints, age: 54.8±11 years) were included in the IFI patient group. A total of 88 patients without QFM edema (88 hip joints, age: 51.8 ± 13.4) were selected as control group from a cohort after propensity score matching. IFS, QFS, NSA and IFD showed statistically significant differences between two groups (p < 0.05). IFS, QFS and IFD showed almost perfect interobserver agreements (r > 0.8). IFDs showed good discrimination abilities (AUC > 0.80). Optimal cut-off points for IFD by reader 1 were 19.9 mm and 16.2 mm on supine radiograph and standing radiograph, respectively. Optimal cut-off points for IFD by reader 2 were 21.1 mm and 17.0 mm, respectively.

**CONCLUSION**

IFDs on both supine and standing hip radiographs showed good diagnostic performances for detection of IFI. It could be used as a good screening tool with optimal cut-off points.

**CLINICAL RELEVANCE/APPLICATION**

The measurements of ischiofemoral distances on both supine and standing hip radiographs are useful screening tool with good diagnostic performances for detection of ischiofemoral impingement.

**RC204-12 Validation of 3D MRI for the Measurement of Skeletal Muscle Volumes**

**PURPOSE**

The aims of this study were to test useful parameters for ischiofemoral impingement (IFI) on both supine and standing anteroposterior hip radiographs, and to suggest optimal cut-off points for detection of IFI on radiograph.

**METHOD AND MATERIALS**

We performed a retrospective study for all patients who had a clinical history of hip pain. All hip joints with quadratus femoris muscle (QFM) edema characterized by increased signal intensity on axial FatSat T2-weighted MR images were selected as an IFI patient group, and an age- and sex-matched control group was created from the same cohort by propensity-score matching. Two readers independently measured the parameters, including ischiofemoral space (IFS), quadratus femoris space (QFS) and hamstring tendon area (HTA) on MR images. The ischiofemoral distance (IFD) and femur neck shaft angle (NSA) were also measured on radiographs. Differences in each parameters between the two study groups were assessed by using the Mann-Whitney U test. Interobserver agreement was quantified by using the intraclass correlation coefficient. The area under the ROC curve (AUC) was calculated as a measure of discriminative ability. Youden's J statistic was used to select the optimum cut-off points for each parameters on radiograph.

**RESULTS**

A total of 30 patients with QFM edema (44 hip joints, age: 54.8±11 years) were included in the IFI patient group. A total of 88 patients without QFM edema (88 hip joints, age: 51.8 ± 13.4) were selected as control group from a cohort after propensity score matching. IFS, QFS, NSA and IFD showed statistically significant differences between two groups (p < 0.05). IFS, QFS and IFD showed almost perfect interobserver agreements (r > 0.8). IFDs showed good discrimination abilities (AUC > 0.80). Optimal cut-off points for IFD by reader 1 were 19.9 mm and 16.2 mm on supine radiograph and standing radiograph, respectively. Optimal cut-off points for IFD by reader 2 were 21.1 mm and 17.0 mm, respectively.

**CONCLUSION**

IFDs on both supine and standing hip radiographs showed good diagnostic performances for detection of IFI. It could be used as a good screening tool with optimal cut-off points.

**CLINICAL RELEVANCE/APPLICATION**

The measurements of ischiofemoral distances on both supine and standing hip radiographs are useful screening tool with good diagnostic performances for detection of ischiofemoral impingement.
PURPOSE
To validate the use of 3D MRI in volumetric computation of muscle wasting
To demonstrate the role for 3D MRI in evaluating diseased muscles around hip replacements

METHOD AND MATERIALS
We have applied a novel automated segmentation propagation framework to the MR images of 18 patients with unilateral metal on metal hip replacements. The MR images were manually segmented into the following muscles: Gluteus maximus, Gluteus minimus, Iliopsoas and Tensor Fasciae Latae. MR images were bias-field corrected. The scans were divided in half to create two databases, healthy and diseased, which were processed separately. Each MR image in the database was affinely registered to all the other images using a block matching algorithm and aligned to a common space. We obtained an average matrix for the alignment of images in the database using least trimmed square regression. Consensus segmentation was achieved using similarity and truth estimation algorithm for propagated segmentations (STEPS). The proposed framework was assessed using a leave-one out validation approach. This was used to quantify a clinically relevant imaging biomarker.

RESULTS
The MR images of 18 patients (11 female, 7 male) aged 64 ± 15yrs underwent novel automated segment propagation. The leave-one out cross validation framework assessing the influence of non-rigid registration and label fusion parameters gave the average Dice score for healthy hip muscles is 0.864 (range 0.804-0.931). The average Dice score for pathological hip muscles is 0.827 (range 0.753-0.899).

CONCLUSION
The accuracy of the proposed automated framework was verified by leave one out cross validation. The values obtained for the average are promising given that only 17 MR images are in the database. We would expect these scores would to rise with a larger database of images. Future work would involve the expansion of this database in order to define more variability and obtain more accurate automated segmentation.

CLINICAL RELEVANCE/APPLICATION
3D MRI, a technique applied successfully in brain imaging, offers a novel way to monitor the muscle disease formation and progression in patients with hip arthroplasties. This automated segmentation framework can be used to verify volume discrepancies in unilateral hip arthroplasty patients which is currently done manually. This technique will aid patient monitoring and surgical planning.

LEARNING OBJECTIVES
1) Become familiar with normal anatomy and common pathology of muscles, tendons, and bursae around the hip. 2) Demonstrate understanding of the pathomechanisms and imaging findings of extra-articular hip impingement syndromes.

ABSTRACT
Relevant extra-articular hip anatomy will be reviewed, followed by MRI findings of common pathology of tendons, muscles, and bursae around the hip. Pathomechanisms and imaging findings of extra-articular hip impingement syndromes will be discussed.
Participants
Andrea S. Doria, MD, Toronto, ON (Moderator) Consultant, Bayer AG; Consultant, Novo Nordisk AS; Consultant, Baxter International Inc
Tal Laor, MD, Cincinnati, OH (Moderator) Nothing to Disclose
Siddharth P. Jadhav, MD, Houston, TX (Moderator) Nothing to Disclose
Sarah D. Bixby, MD, Boston, MA (Moderator) Nothing to Disclose

ABSTRACT

LEARNING OBJECTIVES

1) To review the nomenclature and criteria for the diagnosis of juvenile idiopathic arthritis (JIA) in children. 2) To recognize the sites in children commonly affected by JIA. 3) To illustrate the spectrum of abnormalities identified with magnetic resonance imaging in children with JIA.

PURPOSE

The value of subclinical synovitis on magnetic resonance imaging (MRI) in clinically inactive patients with juvenile idiopathic arthritis (JIA) is yet to be unraveled. This study was performed to determine whether (dynamic) contrast-enhanced MRI parameters of a previously affected target joint in patients with clinically inactive JIA can predict a flare of joint inflammation during 2-year follow-up.

METHOD AND MATERIALS

Thirty-two JIA patients with clinically inactive disease at the time of MRI of the knee were prospectively included. Dynamic contrast-enhanced (DCE) MRI provided both descriptive measures and time-intensity-curve shapes, representing functional properties of the synovium. Conventional MRI outcome measures included validated scores for synovial hypertrophy, bone marrow edema, cartilage lesions and bone erosions. During a 2-year period the patients were examined at regular time points and clinical flares were registered.

RESULTS

MRI analysis revealed synovial hypertrophy in 13 (39.4%) of the clinically inactive patients. Twelve patients (37.5%) had at least one flare during 2-year clinical follow-up. Median time-to-flare was 0.68 years (IQR 0.18-1.97) and 50% of the flaring patients did so within the first 6 months (Figure 1). Persistently inactive and flaring patients differed significantly in the maximum enhancement of the DCE-MRI (p<0.05), whereas no difference was found between these two groups in any of the baseline scores of conventional MRI.

CONCLUSION

Our prospective clinical follow-up study indicates that the assessment of ‘maximum enhancement’ upon DCE-MRI may be able to predict a clinical flare within 2 years in inactive JIA patients. In the future, functional imaging biomarkers, such as DCE-MRI can be combined with serum markers or gene profiling data, leading to the construction of a predictive model to more precisely decide about treatment strategies in any individual patient.

CLINICAL RELEVANCE/APPLICATION

The presence of a relatively high maximum enhancement on dynamic contrast-enhanced MRI of the knee in clinically inactive patients with juvenile idiopathic arthritis indicates a risk of flaring.
Participants
Peter H. Van Geertruyden, MD, Fort Belvoir, VA (Abstract Co-Author) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Timothy G. Sanders, MD, Keswick, VA (Abstract Co-Author) Nothing to Disclose
Jana M. Crain, MD, Atherton, CA (Abstract Co-Author) Nothing to Disclose
Brendan T. Doherty, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To present a series of Salter-Harris injuries with periosteal entrapment, to better understand incidence and distribution, appearance and potential complications with regard to healing.

METHOD AND MATERIALS
Two musculoskeletal radiologists retrospectively reviewed 142 MRI exams with Salter-Harris injuries from 2007 to present for the presence of periosteal entrapment. Evaluation included Salter-Harris grade, location, presence of periosteal entrapment, and degree of entrapment measured in distance extending within the physis. Available follow-up imaging findings and clinical evaluations were recorded.

RESULTS
Of 144 Salter-Harris injuries on MRI, 59 cases were type I injuries, 48 cases were type 2 injuries, 20 cases were type 3 injuries, 14 cases were type 3 injuries, and 3 cases were type 5 injuries. The most common location for type I injuries was the distal fibula. The most common location for type 2 injuries was the distal radius. Type 3 and 4 Salter-Harris injuries showed no particular location preference. Of the 144 cases, 96 cases were in boys and 48 in girls. Average age of boys was 13 years, 9 months. The average age for girls was 12 years, 4 months.

CONCLUSION
Periosteal entrapment is observed in 7% of Salter-Harris injuries by MRI; entrapment is an under-reported phenomenon in current literature. In our series periosteal entrapment occurred most commonly at the distal tibia and fibula. Continued follow-up will reveal whether premature physeal arrest/growth disturbance is associated with periosteal entrapment.

CLINICAL RELEVANCE/APPLICATION
To make aware the frequency and potential implications of periosteal entrapment in Salter Harris fractures.

Participants
Uygar Teomete, MD, Miami Beach, FL (Presenter) Nothing to Disclose
Yuwei Zhou, Coral Gables, FL (Abstract Co-Author) Nothing to Disclose
Ozgur Dandin, MD, Bursa, Turkey (Abstract Co-Author) Nothing to Disclose
Weizhao Zhao, Coral Gables, FL (Abstract Co-Author) Nothing to Disclose
Taner Dandinoglu, Bursa, Turkey (Abstract Co-Author) Nothing to Disclose
Onur Osman, PhD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (Abstract Co-Author) Nothing to Disclose

PURPOSE
(1) To develop a computer aided diagnosis (CAD) system for detection of plastic bowing fractures of the pediatric forearm and (2) to compare its feasibility with respect to the radiologists’ interpretation.

METHOD AND MATERIALS
Following IRB approval, we retrospectively analyzed the forearm radiographs of the patients presenting to the pediatric emergency room following trauma. We included a total of 55 pediatric patients from all age groups. We used morphological operations to extract the forearm diaphyseal features. In geometry, the radius of curvature, R, is a measure of the radius of the circular arc which best approximates the curve at that point. Along with the border of the bone, at every point, the more “bending” of the curve, the smaller of the radius of curvature; the “flatter” of the curve, the bigger of the radius of curvature. Average of R increases with increased bowing level. Curvature of the radial and ulnar diaphyses were calculated for the normal patients with normal interpretation and for the patients with plastic bowing fracture. Leave one out cross validation scheme was used for avoiding bias in our evaluations. Results were compared with the radiologist’s interpretation. t-test was used to determine statistical significance level.

RESULTS
Curvature values were obtained from our CAD method in the training step. With a sensitivity of 80% in detecting plastic bowing fractures, we recorded 92% specificity. When compared to radiologists’ conventional readings, we did not find significant differences between the proposed method and the radiologists’ reading using t-test (p>0.05).

CONCLUSION
The proposed automated computer aided detection method can be used as a second opinion to aid the radiologist’s decision making by highlighting the suspicious regions for plastic bowing fracture. To best of our knowledge, this is the first attempt towards automatizing quantitative evaluation of pediatric buckle fractures from radiographs.
CLINICAL RELEVANCE/APPLICATION

Our CAD method is fast, effective an reliable. It can be used as a standalone application or as a plugin to the PACS viewer in a radiology workstation. Its use as a second opinion may obviate the need to obtain additional radiographs of the contralateral forearm for comparison, preventing unnecessary radiation exposure to the child.

RC213-05 Growth Recovery Lines are More Common in Infants at High- vs. Low-risk for Abuse

Monday, Nov. 30 9:20AM - 9:30AM Location: N230

Participants
Matthew A. Zapala, MD, PhD, Boston, MA (Presenter) Nothing to Disclose
Andy Tsai, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Growth recovery lines (GRLs), AKA growth arrest, Harris, and Parks lines are transverse radiodense metaphyseal bands believed to be due to a temporary arrest of enchondral ossification-caused by local or systemic insults such as intermittent illness and malnutrition. The purpose of this study was to determine if GRLs are more common in infants at high- vs. low-risk for abuse.

METHOD AND MATERIALS

The reports of initial high detail ACR compliant skeletal surveys done at a large pediatric hospital between 1999 and 2013 were reviewed, along with the relevant clinical records. Infants were considered at low-risk for abuse if they had a skull fracture without significant intracranial injury (ICI) on CT, a history of a fall and the determination of Child Protection Team (CPT)/social work assessment. High risk infants had significant ICI, retinal hemorrhages, skeletal injuries (other than skull fractures) and the determination of risk by CPT/social work assessment. There were 53 low-risk infants (age range, 0.4-12 months; mean, 4.7 months) and 21 high-risk infants (range, 0.8-9.1; mean, 4.2). Using a 4 point Likert scale, a pediatric radiology attending and fellow independently evaluated the frontal radiographs of the lower extremities from the skeletal surveys for the presence of at least one GRL involving the distal femurs/tibias. The data were pooled and differences between the two groups were calculated.

RESULTS

Intra- and inter-reader agreement was very good (Cohen's kappa inter-reader = 0.77 and intra-reader = 0.82 and 0.84). The relative prevalence of GRLs in the low-risk groups was 38% (SD 8%, reader 1 = 17/53, reader 2 = 23/53) vs. 71% (SD 7%, reader 1 = 16/21, reader 2 = 14/21) in the high-risk group (p < 0.001, odds ratio 4.1, 95% CI 1.8 to 9.8).

CONCLUSION

GRLs are encountered at a significantly higher rate in infants at high- vs. low-risk for abuse. This difference may reflect the response of enchondral ossification to intermittent stresses associated with abusive events. However, since healing classic metaphyseal lesions may appear as radiodense transverse metaphyseal bands, some of the apparent GRLs in the high-risk group may reflect the residua of inflicted metaphyseal injury.

CLINICAL RELEVANCE/APPLICATION

GRLs may carry special significance when encountered in infants with suspected abuse. The possibility that some apparent GRLs may in-fact reflect healing occult metaphyseal injuries deserves further study.

RC213-06 Definition of a Scoring System for Assessment of Skeletal Age Using MRI of Hand and Wrist in Healthy Males and Females Children: Gender Differences

Monday, Nov. 30 9:30AM - 9:40AM Location: N230

Participants
Mivlia Martino, MS, Rome, Italy (Presenter) Nothing to Disclose
Rosa Maria Armendola, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Ernesto Torei, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Sofia Battistis, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Richard C. Semelka, MD, Chapel Hill, NC (Abstract Co-Author) Research support, Siemens AG.; Consultant, Guerbet SA.
Jacopo Carbone, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

Magnetic Resonance Imaging (MRI) of hand and wrist is a radiation free tool used to create a gender specific scoring system method for the skeletal age (SA) estimation in the healthy pediatric population.

METHOD AND MATERIALS

96 healthy young male (chronological age (CA) 1y6mo to 19y) and 108 females (CA range 4y to 19y) were enrolled. 9 bones of the wrist and hand have been analyzed at different stages of the skeletal maturation detecting different pattern of growth among tubular and carpal bones based on several anatomic features of the cartilaginous and osseous component. Two operators first in consensus and after 6 months blinded from CA established a MRI scoring system. Correlation between CA and MRI bone age estimation was determined with Pearson coefficient (R2). Spearman's correlation coefficient (r) was used to analyze each carpal and tubular bones stages development.

RESULTS

A significant linear correlation (R2) between MRI bone age estimation and CA was demonstrated in males (R2 = 0.976, A operators in consensus, R2 = 0.978 B first operator in the double-blind, R2 = 0.977 C second operator in double-blind) and females (R2 = 0.9694, operators in consensus, R2 = 0.9751 B first operator double-blind, R2 = 0.9710 C second operator in double-blind).Radius and Ulna showed a stronger correlation with the skeletal age in both males and females (Radius r = 0.975, Ulna r = 0.963720 p <.05000). A good linear correlation was observed (males R2=0.96; females R² = 0.9472) between the sum of scoring system assigned for each subject and the CA in years. The growth curve resulting from the correlation...
between CA and SA shows in males 2 peaks than 3 observed in females and related to the growth spurt in the pubertal age following by phases of deceleration.

**CONCLUSION**

The score system for MRI bone age estimation can be potentially used as a clinical tool to evaluate skeletal development. Males and females have patterns of maturation corresponding to a different clinical speed of growth. The MRI score system shows specific anatomical details characterizing the pubertal age when between the sexes there is a gap of about 2 years.

**CLINICAL RELEVANCE/APPLICATION**

Bone age estimation is performed in pediatric patients with growth failure and advanced or delayed puberty maturation mainly covering the clinical areas of endocrine, skeletal and metabolic diseases.

**RC213-07  Pediatric Elbow MR**  
Monday, Nov. 30 9:40AM - 10:00AM Location: N230

Participants  
John D. MacKenzie, MD, San Francisco, CA (Presenter) Research Grant, General Electric Company

**LEARNING OBJECTIVES**

1) Review developmental anatomy of the pediatric elbow as depicted by MRI. 2) Review technical imaging considerations when imaging the pediatric elbow with MRI. 3) Review unique lesions that occur at the pediatric elbow as depicted by MRI.

**ABSTRACT**

MRI presents an unique view into the detection and characterization of pediatric elbow pathology. Developmental changes at the pediatric elbow have a characteristic and predictable anatomy and it is important for the radiologist to understand the normal developmental appearance and separate this from pathology. Technical imaging considerations for high resolution MRI will be reviewed. Common pathologies unique to the pediatric elbow will be discussed and placed into context with their appearance on MRI.

**RC213-08  Imaging of Slipped Capital Femoral Epiphysis: From Early Diagnosis to Late Sequelae**  
Monday, Nov. 30 10:20AM - 10:40AM Location: N230

Participants  
Delma Y. Jarrett, MD, Boston, MA, (delma.jarrett@childrens.harvard.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize imaging findings of SCFE using radiographs, MR, CT, and US. 2) Understand surgical management and normal post-operative appearance of SCFE. 3) Recognize imaging findings of immediate and delayed post-operative complications of SCFE.

**RC213-09  Absence of Rickets in Infants with Fatal Abusive Head Trauma and Classic Metaphyseal Lesions**  
Monday, Nov. 30 10:40AM - 10:50AM Location: N230

Participants  
Jeannette M. Perez-Rossello, MD, Boston, MA (Presenter) Nothing to Disclose  
Anna McDonald, Boston, MA (Abstract Co-Author) Nothing to Disclose  
Andrew E. Rosenberg, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose  
Andy Tsai, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose  
Paul K. Kleinman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To determine if rickets is present in infant homicides with classic metaphyseal lesions (CMLs) and other skeletal injuries.

**METHOD AND MATERIALS**

This study was exempt from the institutional human subjects board review because the infants were all deceased. An archival review (1984-2012) was performed of the radiologic and histopathologic findings of 46 consecutive infant fatalities referred from the state Medical Examiner's Office for the evaluation of possible child abuse. Thirty infants with distal femoral histologic material were identified. Additional inclusion criteria were: 1) The medical examiner determined that the infant had sustained a head injury and that the manner of death was a homicide; 2) At least one CML was evident on skeletal survey; 3) CMLs were confirmed at autopsy; and 4) Non-CML fractures were also present. Nine infants (mean age 3.9 months, range: 1-9 months) were identified. Two pediatric radiologists independently reviewed the skeletal surveys for rachitic changes at the wrists and knees. A bone and soft tissue pathologist reviewed the distal femoral histologic sections for rickets.

**RESULTS**

There were no radiographic or pathologic features of rickets in the cohort.

**CONCLUSION**

Our findings provide no support for the view that the CML is due to rickets. Rather, they strengthen a robust literature that states that the CML is a traumatic injury commonly encountered in physically abused infants.

**CLINICAL RELEVANCE/APPLICATION**

This work confirms the traditional view that the classic metaphyseal lesion is a fracture encountered in abused infants rather than a manifestation of rickets. The classic metaphyseal lesion is a characteristic fracture in child abuse and should be reported as such.
Correlation between age and pre-intervention imaging findings and the need for reintervention.

Clear since only 1 patient (4%) in our study needed reintervention after open reduction. This needs further evaluation. There is no Hip spica MRI is useful in determining need for reintervention after closed hip reduction. Value of MRI after open reduction is not.

CONCLUSION

Biomechanical muscle imbalance. Variables leading to a 42% rate of re-intervention in children who could have been determined on the fluoroscopic images alone. Mean lateral displacement was 11.2 mm (range 3-20mm) and mean superoinferior displacement was 5.7 mm (range 0-19mm). There was no correlation between age (P value=0.12), acetabular angle (P value=0.46), degree of lateral displacement (P value=0.82) and degree of superoinferior displacement (P value=0.54) and the need for re-intervention. Out of 23 hips that underwent closed reduction, 8 (42%) needed reintervention. Out of 23 hips that underwent open reduction, 1 (4%) needed reintervention but this was no correlation between age (P value=0.12), acetabular angle (P value=0.46), degree of lateral displacement (P value=0.82) and degree of superoinferior displacement (P value=0.54) and the need for re-intervention. Out of 19 hips that underwent closed reduction, 8 (42%) needed reintervention. Out of 23 hips that underwent open reduction, 1 (4%) needed reintervention but this could have been determined on the fluoroscopic images alone. Variables leading to a 42% rate of re-intervention in children who undergo closed reduction may be operator dependent or be related to extra-articular causes such as femoral version and biomechanical muscle imbalance.

RESULTS

A 4 year (2008-2012) retrospective analysis was performed of pediatric (age< 18 years) pelvic MRI studies. Only patients with the following indications were accepted; acute hip pain, limping, or refusal to bear weight. Exclusion criteria included known trauma, known pelvic pathology, and follow-up studies. Each study was anonymized. The coronal STIR series and later the full MRI studies, including all series, were reviewed in a randomized order independently by a pediatric radiologist (rad1) and a musculoskeletal radiologist (rad2). The full MRI study was considered the gold standard. Analysis of the interobserver variability on the negative and positive studies of the STIR only series was reported using kappa statistics, and overall percentage agreement.

CONCLUSION

Coronal STIR of the pelvis has high sensitivity (94%) with good interobserver agreement in detecting pathology in children with acute hip pain. However, the study should be supervised by a radiologist and, when positive, a full MR study should be performed as it may change findings in 42% to 54% of cases.

CLINICAL RELEVANCE/APPLICATION

Coronal STIR MR can be used as a screening for evaluation of acute non-traumatic hip pain in children. However, when positive, a full MR study should be performed as it can alter the findings in about half of the cases.

RC213-11 Utility of Post Intervention Hip Spica MRI, Retrospective Evaluation of Experience at a Large Children's Hospital

Participants

Monica M. Forbes-Amrhein, MD, PhD, Zionsville, IN (Presenter) Nothing to Disclose
Matthew R. Wanner, MD, Zionsville, IN (Abstract Co-Author) Nothing to Disclose
Trenton D. Roth, MD, Indianapolis, IN (Abstract Co-Author) Institutional research support, Siemens AG; Institutional research support, Koninklijke Philips NV
Megan B. Marine, MD, Carmel, IN (Abstract Co-Author) Nothing to Disclose
Boaz Karmazyn, MD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose

METHOD AND MATERIALS

The objective of this study is to evaluate utility of post intervention hip spica MRI and to determine if there are pre-intervention predictors of failed reduction and need for reintervention. We also evaluate rates of reintervention after closed and open reduction.

RESULTS

The full MRI study was considered the gold standard. Analysis of the interobserver variability on the negative and positive studies of the STIR only series was reported using Kappa statistics, and overall percentage agreement.

CONCLUSION

Hip spica MRI is useful in determining need for reintervention after closed hip reduction. Value of MRI after open reduction is not clear since only 1 patient (4%) in our study needed reintervention after open reduction. This needs further evaluation. There is no correlation between age and pre-intervention imaging findings and the need for reintervention.
**RESULTS**

Overall, there was one patient who presented with a GCS of 14 that did not meet CG 56. 278 patients underwent c-spine imaging and 217 had complete data. 80 patients met the criteria for a CT of the c-spine under CG 56.

**PURPOSE**

To determine the prevalence and morphologic alterations of subtalar coalitions which lie entirely posterior to the middle facet (MF), AKA “posteromedial subtalar (PMST) coalition.”

**METHOD AND MATERIALS**

After obtaining IRB approval, radiology records from 2004-2012 were reviewed to identify CT studies of patients with confirmed subtalar coalition. 97 subjects (48 male, 49 female, mean age 13.70 years) with subtalar coalition were identified. Electronic medical records were reviewed and symptoms of foot or ankle pain were confirmed in all subjects. In 41 (42%) subjects the coalition was bilateral. CT images of 138 subtalar coalitions were reviewed to determine site of coalition. Multiple planes were reconstructed of the foot. In those patients with isolated PMST coalition, multiplanar reformatted images along the long axis of the sustentaculum tali (ST) were generated, from which the antero-posterior dimensions of the ST and MF were measured. A posterior sustentaculum (PS) measurement was then calculated defining the posterior extension of the ST beyond the middle facet (PS = ST-MF). Ratios of the MF to the PS measurements were calculated. 33 patients undergoing CT for triplane ankle fracture (21 male, 12 female, mean age 13.70 years) served as controls. Measurement were performed independently by two readers, and intra- and inter-reader reliability was estimated via a component of variance model.

**RESULTS**

97 of the 138 coalitions (70.2%) affected the MF and 2 (1.4%) involved the posterior facet. There were 39 (28.2%) isolated PMST coalitions identified in 33 patients (18 male, 15 female, mean age 14.07 years). The mean AP measurement of the MF and PS in the patients with PMST coalition were 12.70 mm and 15.90 mm, respectively, compared to 16.50 mm and 6.36 mm in the control population (p<.001). The ratio of the MF to PS was 0.80 for PMST coalition patients versus 2.6 for controls (p<.001).

**CONCLUSION**

In our cohort, 1/4 of all subtalar coalitions were of the PMST variety associated with an intact, but significantly shorter MF, and longer ST. This observation may aid in accurate diagnosis and provide insights into the morphogenesis of this relatively common disorder.

**CLINICAL RELEVANCE/APPLICATION**

The presence of a “normal” middle facet at imaging may lead to missed isolated PMST coalitions; the morphology of the ST and MF provide helpful imaging clues to the diagnosis.

**RC213-13**

**A Retrospective Study to Evaluate the Effect Recent Changes to NICE Guidelines Will Have on Imaging of the Paediatric Cervical Spine in Blunt Trauma in the UK**

**Participants**

Joseph Davies, MBBS, MRCS, London, United Kingdom (Presenter) Nothing to Disclose
Sammy Anwuzia, BSc, MSc, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jane Evanston, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Susan Cross, MBChB, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Paediatric cervical spine (c-spine) injury is a rare but devastating event. Imaging, particularly Computed Tomography (CT) is the investigation of choice to exclude injury. CT is however associated with increased thyroid radiation dose and risk of developing malignancy vs plain radiographs. Insufficient paediatric c-spine trauma data exists to produce robust imaging guidelines. There have been recent changes to NICE UK guidelines relating to evaluation of paediatric (<10 years) c-spine injury in trauma. We set out to investigate effects these changes have on the use of Computed Tomography (CT) in the investigation of c-spine injury.

**METHOD AND MATERIALS**

5 year retrospective study of c-spine imaging in patients <10 years presenting to a level 1 trauma centre following blunt trauma. Data was collected relating to trauma mechanism, clinical presentation, radiologic evaluations and injury type. Patients with incomplete data were excluded. Criteria for c-spine CT in NICE head injury guideline 56 (CG 56) (GCS<8, inadequate plain radiographs, strong suspicion despite normal plain radiographs) and NICE head injury guideline 176 (CG176) (GCS <13, intubated, focal neurology, polytrauma, suspicion despite normal radiographs) were retrospectively applied to all cases with complete data to determine the proportion of patients requiring c-spine evaluation with CT.

**RESULTS**

278 patients underwent c-spine imaging and 217 had complete data. 80 patients met the criteria for a CT of the c-spine under CG 56, 4 of which had a significant c-spine injury. 1 patient with c-spine injury and a presenting GCS of 14 did not meet CG 56. 206 patients met the criteria for a CT under CG 176, 5 of which had a significant injury. Overall, there was one patient who presented...
with significant c-spine injury who did not meet CG 56 guidelines, but falls under CG 176 criteria.

**CONCLUSION**

CG 176 is more inclusive and if followed will result in higher proportion of paediatric blunt trauma cases being eligible for a c-spine CT without an initial plain radiograph series. Increased paediatric thyroid radiation exposure will result.

**CLINICAL RELEVANCE/APPLICATION**

New guidelines are more sensitive for selecting c-spine injury, specificity is lower and results in potentially unnecessary thyroid irradiation. Further study is required to develop more robust paediatric trauma imaging guidelines.

---

**RC213-14 Three-Point Dixon Technique for Fat Quantification and for Identifying Wasting Progression Rate of Pelvic and Thigh Muscles in Duchenne Muscular Dystrophy**

Monday, Nov. 30 11:30AM - 11:40AM Location: N230

Participants
- Jing Du, MD, Beijing, China (Presenter) Nothing to Disclose
- Jiangxi Xiao, Beijing, China (Abstract Co-Author) Nothing to Disclose
- Xiaoying Wang, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
- Ying Zhu, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
- Fei Y. Li, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Three-point Dixon technique was applied to quantify fat fraction (FF) and identify the annual rate of disease progression of leg muscles in Duchenne muscular dystrophy (DMD).

**METHOD AND MATERIALS**

This prospective study was approved by the Ethical Committee. Ninety boys with genetically and/or pathologically confirmed DMD were recruited. Imaging was performed with a 3-T unit by using a 32 channel phased-array coil. A quantitative water-fat separation method (IDEAL-Quant) was used. Imaging parameters were as follows: TR=6.3ms, TE=1ms, 6 echoes, bandwidth=111.11 kHz, FOV=32-40cm, slice thickness=7mm, matrix=160x160, flip angle=3°, covering from the iliac crest to the knee, total imaging time=1min3sec. Images were processed on ADW4.6 workstation and FF of each muscle was calculated. The region of interest (ROI) was manually placed by tracing the outline of the individual muscle on the section level of the muscle belly. 18 muscles on each side were analyzed. Spearman correlation test was used to evaluate the correlation between age and FF. Linear correlation was used to show the relationship between age and FF.

**RESULTS**

90 DMD boys aged 2-13 (mean 5.8 years) were enrolled. The gluteus maximus was the most severely infiltrated (mean FF 28.82%±19.96%), followed by the adductor magnus (mean FF 23.13%±22.47%). The least affected muscle was the obturator externus (mean FF 3.67%±1.13%). Positive correlation was obtained between FF value and age for all the muscles with correlation coefficient varied from 0.28 to 0.76. Significant correlation was seen in the gluteus maximus muscle (r=0.68), adductor magnus (r=0.74), and the quadratus femoris (r=0.74~0.76). The muscle wasting progression can be calculated as (A+B*age). A stands for a constant and B stands for annual progression rate varied from 0.3% to 6.1% for different muscles.

**CONCLUSION**

IDEAL-Quant method can be used to quantitatively assess leg muscle fatty infiltration and identify muscle wasting progression in DMD patients.

**CLINICAL RELEVANCE/APPLICATION**

IDEAL-Quant method can be used to quantitatively assess leg muscle fat infiltration in DMD. This method should be used to monitor disease severity and follow-up.

---

**RC213-15 Sports Injuries of the Pediatric Knee**

Monday, Nov. 30 11:40AM - 12:00PM Location: N230

Participants
- Jennifer Stimec, MD, Toronto, ON (Presenter) Nothing to Disclose
Master Class in Musculoskeletal Ultrasound (Hands-on)

Monday, Nov. 30 8:30AM - 10:00AM Location: E258

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Consultant, General Electric Company Consultant, Koninklijke Philips NV Stockholder, Koninklijke Philips NV Stockholder, General Electric Company Grant, Siemens AG Grant, General Electric Company
Catherine J. Brandon, MD, Ann Arbor, MI (Presenter) Stock options, VuCOMP, Inc
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Alberto S. Tagliafico, MD, Genova, Italy (Presenter) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose

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.

Active Handout: Marnix T. van Holsbeeck
**SSC07**

**ISP: Musculoskeletal (Cartilage: Mechanics, Quantitative MRI and Repair)**

**Monday, Nov. 30 10:30AM - 12:00PM Location: E450B**

<table>
<thead>
<tr>
<th>MK</th>
<th>BQ</th>
<th>MR</th>
</tr>
</thead>
</table>

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

**Participants**
Daniel B. Nissman, MD, MPH, Raleigh, NC (Moderator) Royalties, John Wiley & Sons, Inc
Michael P. Recht, MD, New York, NY (Moderator) Nothing to Disclose

**Sub-Events**

**SSC07-01**  
**Musculoskeletal Keynote Speaker: Cartilage: Understanding Quantitative Evaluation through Structure and Biomechanics**  
Monday, Nov. 30 10:30AM - 10:50AM Location: E450B

**Participants**
Michael P. Recht, MD, New York, NY (Presenter) Nothing to Disclose

**SSC07-03**  
**Weight Loss Is Associated with Slower Cartilage Degeneration Over 48 Months in Obese and Overweight Subjects: Data from the Osteoarthritis Initiative**  
Monday, Nov. 30 10:50AM - 11:00AM Location: E450B

**Participants**
Alexandra S. Gersing, MD, San Francisco, CA (Presenter) Nothing to Disclose
Martin Solka, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Gabby B. Joseph, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Benedikt J. Schwaiger, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Ursula R. Heilmeyer, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Georg Feuerriegel, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
John Mbapte Wamba, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (Abstract Co-Author) Instructor, F. Hoffmann-La Roche Ltd Expert Witness, Mallinckrodt plc Consultant, Mallinckrodt plc
Michael C. Nevitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (Abstract-Co-Author) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

**PURPOSE**
To investigate the association of different degrees of weight loss with progression of knee cartilage degeneration in overweight and obese subjects.

**METHOD AND MATERIALS**
In this study, 290 subjects (age 61.7±9.1y; 171 females) with a BMI>25kg/m² from the Osteoarthritis Initiative (OAI) with risk factors for OA or radiographically mild to moderate OA were included. Subjects with weight loss were categorized into groups with a large (≥10%, n=36) or moderate amount of weight loss (5-10%, n=109) over 48 months, and were frequency matched to a group with stable weight (BMI change <3%, n=145). Changes of focal cartilage defects assessed with 3T MRI cartilage WORMS (Whole-Organ Magnetic Resonance Imaging Score) and T2 maps of the right knee for five cartilage compartments (patella, medial and lateral femur, medial and lateral tibia) including laminar and texture analysis, were analyzed using multivariate regression models adjusting for age, sex, baseline BMI and KL.

**RESULTS**
Overall cartilage WORMS showed significantly less progression in both weight loss groups compared to the stable weight group (5-10% weight loss, P=0.035; >10% weight loss, P<0.0001) over 48 months and changes were associated with changes of BMI (r=0.31, P=0.02). Subjects with >10% weight loss showed significantly less T2 value increase in the bone layer averaged over all compartments compared with stable weight subjects (mean diff. 1.0msec [95%CI 1.3, 0.6] P=0.01), suggesting slower cartilage deterioration, yet no significant change in T2 was found between 5-10% weight loss and stable weight group. In the medial compartment of the >10% weight loss group, overall T2 and cartilage WORMS changes were significantly less (P<0.0001, for each) and homogeneity was increased (P=0.004), compared to the group with stable weight.

**CONCLUSION**
While changes in cartilage defects were significantly associated with the amount of weight loss in all subjects, only subjects with >10% weight loss showed significantly reduced cartilage deterioration measured with T2. Our data show evidence that weight loss has a protective effect against cartilage degeneration and that a larger amount of weight loss is more beneficial.

**CLINICAL RELEVANCE/APPLICATION**
MR-based knee cartilage T2 measurements and semiquantitative grading allow monitoring of the protective effect of weight loss on joint health and are useful to determine which amount of weight loss is most beneficial in overweight and obese patients.

**SSC07-04**  
**The TEFR Field Study: Results of Continuous Biochemical and Morphological Cartilage Analysis of Hindfoot, Ankle, and Knee Joints in Course of a 4,500 km Ultramarathon Race throughout Whole Europe Using T2*-mapping on a Mobile MRI Truck Trailer**
This work compared a newly developed 3D-TESS sequence with a CPMG method to evaluate T2-mapping of human articular cartilage. The aim was to assess the capability of the 3D-TESS sequence and CPMG method to detect cartilage lesions compared to conventional multi-echo spin-echo T2-mapping.

**METHOD AND MATERIALS**

Twelve volunteers and ten patients with focal cartilage lesions were included in the study. All subjects underwent 3-Tesla MRI scans consisting of a multi-echo multi-slice spin echo sequence (CPMG) as a reference method for T2 mapping, and 3D TESS with the exact same geometry settings, but variable acquisition times: standard (TESSs 4:35 min) and quick (TESSq 2:05 min). T2 values were obtained from inline reconstructed T2* maps by using a pixelwise, monoexponential nonnegative least squares fit analysis. Statistical analyses regarding cartilage T2* and thickness changes and influencing factors were done on the finishers of the race.

**RESULTS**

With exception of the patellar joint, nearly all cartilage segments showed a significant initial mean T2* signal increase within the first 1500km run: ankle 25.6%, subtalar joint 20.9%, midtarsal joint 26.3%, femorotibial Joint (FTJ) 25.1 to 44.0%. Interestingly, an unexpected secondary T2* decrease was observed in ankle (-30.6%) and hindfoot joints (-28.5% and -16.0%), but not in the FTJ. A significant loss of cartilage thickness was detected in the FTJ, but not in the other joints. A side dependent, positive relationship between muscle volumes of the thigh and cartilage T2* at baseline could be found in the FTJ. Osteochondral lesions were detected, however all were already present at baseline and showed no changes throughout TEFR. Reasons for stopping the race were not associated with joint problems.

**CONCLUSION**

After initial significant intrachondral matrix changes, a subsequent T2* value recovery indicates the ability of the cartilage matrix to regenerate under ongoing running burden in ankle and hindfoot joints. In contrast, for the FTJ no T2* signal recovery could be observed accompanied by loss of cartilage thickness. No new lesions were observed during TEFR. Asymmetry of cartilage T2* behavior is in line with the hypothesis of the “breaking” limb and demonstrates leg-preference even in well-trained ultra-runners.

**CLINICAL RELEVANCE/APPLICATION**

The capability of most parts of human cartilage to recover in the presence of extreme physical stress has not been shown previously indicating a high regenerative potential of human joint cartilage.
coefficients and confidence intervals were calculated. (ROI) were manually placed in all zones of the tibial and talar cartilage. For statistical workup Pearson product-moment correlation postprocessed and quantitative maps were generated. The articular cartilage was subdivided into 6 areas and regions-of-interest (resolution 0.5x2x2mm) sequence was performed in sagittal orientation. Using a dedicated software tool (ImageJ) data were multiplanar T1w and Pdw sequences. For quantitative measurements a 3D T2* (24 echoes ranging from 4.6-52.9ms; image resolution 0.5x2x2mm) sequence was performed in sagittal PDw, T1 VIBE, DESS and T1-mapping with enhanced delineation of the transplants. Mean relaxation times of the cartilage transplants were reduced at 7T comparted to 3T for T1 (537 vs. 757ms), T2 (42 vs. 45ms) and T2* (11 vs. 14ms). Patient study: Compared to 3T, image quality at 7T was clearly superior in sagittal PDw, T1 VIBE, DESS and T1-mapping with enhanced delineation of the transplants. Mean relaxation times with mean values of 931ms (T1 enhanced), 43ms (T2) and 15ms (T2*). Volunteer study: The delineation of acetabular and femoral cartilage was excellent in T2- (3.2±0.9) and T2*-maps (3.2±0.4). Gadolinium improved cartilage delineation in T1-maps (2.9±0.8 vs. 1.7±0.6) as well as in T1 VIBE (3.3±0.6 vs. 2.2±0.9). T1-, T2- and T2*-relaxation times showed a high correlation in unenhanced and contrast-enhanced sequences (all p<0.001) in volunteers with mean values of 931ms (T1 enhanced), 43ms (T2) and 15ms (T2*). Patient study: Compared to 3T, image quality at 7T was clearly superior in sagittal PDw, T1 VIBE, DESS and T1-mapping with enhanced delineation of the transplants. Mean relaxation times of the cartilage transplants were reduced at 7T compared to 3T for T1 (537 vs. 757ms), T2 (42 vs. 45ms) and T2* (11 vs. 14ms).

CLINICAL RELEVANCE/APPLICATION

A comprehensive hip cartilage protocol after contrast agent administration was established at 7T MRI, including morphological sequences as well as T1-mapping for dGEMRIC, T2- and T2*-mapping. The application of this protocol in patients after ACT showed predominantly superior image quality with better evaluation of the cartilage transplants compared to 3T MRI.

RESULTS

A comprehensive hip cartilage protocol after contrast agent administration was established at 7T MRI, including morphological sequences as well as T1-mapping for dGEMRIC, T2- and T2*-mapping. The application of this protocol in patients after ACT showed predominantly superior image quality with better evaluation of the cartilage transplants compared to 3T MRI.

CONCLUSION

7 Tesla can help to noninvasively follow up patients after acetabular cartilage transplantation, as imaging of the thin and spherical shaped hip cartilage remains challenging at lower field strengths.

CLINICAL RELEVANCE/APPLICATION

7 Tesla MRI system both ankles of 20 elite professional soccer players from the highest european level and 20 age-matched healthy individuals were investigated. After resting in supine position for 30 minutes, all individuals were examined applying multiplanar T1w and Pdw sequences. For quantitative measurements a 3D T2* (24 echoes ranging from 4.6-52.9ms; image resolution 0.5x2x2mm) sequence was performed in sagittal orientation. Using a dedicated software tool (ImageJ) data were postprocessed and quantitative maps were generated. The articular cartilage was subdivided into 6 areas and regions-of-interest (ROI) were manually placed in all zones of the tibial and talar cartilage. For statistical workup Pearson product-moment correlation coefficients and confidence intervals were calculated.
RESULTS
In professional soccer players the T2* values were significantly higher in all tibial and talar compartments than those in healthy participants (mean, 21.36 ms vs. 16.44 ms; p<0.001). This difference was most evident in the posterior zones of the tibiotalar cartilage. In the athletes, there was a trend towards higher T2* values at the anterior medial compartments of the articular cartilage, however, compared to the healthy control group this was not statistically significant (p=0.08).

CONCLUSION
Based on these initial results, T2* values of the tibiotalar joint seem to be elevated in professional soccer players compared to an age-matched control group indicating cartilage degeneration. T2* measurements might potentially serve as a quantitative noninvasive tool for the detection of articular cartilage lesions at early stage.

CLINICAL RELEVANCE/APPLICATION
Quantitative MR imaging of tibiotalar articular cartilage using T2* measurements could serve as a complementary tool for early detection of subtle cartilage defects and further investigation should be encouraged.

SSC07-08  MRI-T2 Mapping Assessment after Treatment of Knee Osteoarthritis with Mesenchymal Stem Cells at One Year Follow-up

Monday, Nov. 30 11:40AM - 11:50AM Location: E450B

Participants
Joan C. Vilanova, MD, PhD, Girona, Spain (Presenter) Nothing to Disclose
Marina Huguet, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Lluis Orozco, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Robert Soler, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Anna Munar, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

PURPOSE
To confirm the feasibility of osteoarthritis treatment with mesenchymal stem cells (MSCs) in humans, and to demonstrate its efficacy on MRI and clinical outcome on a larger population with osteoarthritis of the knee

METHOD AND MATERIALS
Fifty patients with clinical and radiologic diagnosis of osteoarthritis of the knee (graded according to the ICRS (International Cartilage Repair Society) were treated with autologous MSCs by intrarticular injection. Clinical outcomes were followed for 1 year (including pain, disability, and quality of life). Cartilage assessment was performed using MRI T2-mapping at 88 pre-determined anatomical regions previous to treatment at 12 months after treatment; by determining the T2 relaxation values (RV) in each region of the knee. Inter, intraobserver and equipment errors were calculated for reproducibility, and for the statistical analysis to determine significant differences on T2 RV’s before and after treatment. Statistical analysis was performed by Students t-test or by one-way analysis of variance (ANOVA) and the corresponding non-parametric tests

RESULTS
The mean T2 RV’s (ms) previous to treatment (mean±SD) (60.3±6.1) was significantly higher than at 12 months (53.1±6.2) (p<0.04). A positive correlation was identified between the baseline mean average T2 RV’s and the mean final average (ms) improvement T2 RV’s score (r=0.38; p<0.05). T2 RV’s decreased in 37 of 50 patients, 10 remained the same and 3 worsened between 7 and 10%. The median pain reduction was 60% for daily activities and 63% for sport activities. A good positive correlation was observed between the amount of clinical improvement and the initial score (r=0.49), (P<0.001)

CONCLUSION
Non-invasive technique MRI T2-mapping is a valuable tool to assess the follow up of cartilage after MSC therapy for knee osteoarthritis

CLINICAL RELEVANCE/APPLICATION
Stem cell therapy could be an effective, feasible and safe treatment for knee osteoarthritis; and MRI T2-mapping can be a useful imaging biomarker tool to correlate and assess the clinical outcome

SSC07-09 Prevalent Partial and Full-thickness Focal Cartilage Defects Predict Cartilage Damage Progression in the Same Subregion and Development of Incident Cartilage Damage in the Same Tibiofemoral Compartment: The MOST Study

Monday, Nov. 30 11:50AM - 12:00PM Location: E450B

Participants
Ali Guermazi, MD, PhD, Boston, MA (Presenter) President, Boston Imaging Core Lab, LLC; Research Consultant, Merck KgaA; Research Consultant, Sanofi-Aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophic; Research Consultant, AstraZeneca PLC Daichi Hayashi, MBBS, PhD, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose
Frank W. Roemer, MD, Boston, MA (Abstract Co-Author) Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC Emily K. Quinn, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michel D. Crema, MD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC
David T. Felson, MD, MPH, Boston, MA (Abstract Co-Author) Consultant, Zimmer Holdings, Inc

PURPOSE
To assess if depth of focal cartilage damage affects the risk of incidence and progression of cartilage loss in the tibiofemoral joint (TFJ).

METHOD AND MATERIALS

To assess if depth of focal cartilage damage affects the risk of incidence and progression of cartilage loss in the tibiofemoral joint (TFJ).
Persons with or at high risk of knee OA with MRI readings at baseline and 30-month were included. Semiquantitative MRI analysis was done using the Whole Organ MRI Score (WORMS) for cartilage damage, meniscal damage and extrusion, bone marrow lesions (BMLs), effusion and synovitis. Baseline focal cartilage damage was defined as grade 2 (partial-thickness) or grade 2.5 (full-thickness). In a subregion-based analysis, we assessed the risk of cartilage loss over 30 months comparing subregions of TFJ with baseline cartilage grade 2.5 vs grade 2. In the compartment-based analysis, we included only knees with a solitary grade 2 or 2.5 lesion at baseline and all other subregions in the same compartment having no cartilage damage. We estimated the risk of incident cartilage loss (grade≥2) in any non-damaged subregions for compartments with baseline full-thickness and partial thickness defects. In addition knees or compartments with grade 2 and 2.5 cartilage damage at baseline were compared to those without. Logistic regression was used to account for correlations among multiple subregions/compartments within a knee.

RESULTS

927 subregions (683 knees) were included in the subregion-based analysis. Risk of cartilage damage progression for grade 2.5 lesions compared to grade 2 lesions were comparable. However, compared to subregions with no cartilage damage, subregions with grade 2 or 2.5 cartilage defects had higher risk for cartilage loss (aOR 8.2, 95%CI 6.7-10.0). 374 compartments were included in the compartment-based analysis. There was no significant difference in regard to risk of incident damage between compartments that had grade 2 and grade 2.5 cartilage defects at baseline. However, compared to compartments with no baseline cartilage damage, those with grade 2 or 2.5 cartilage defects in a subregion had higher risk for incident cartilage damage in other subregions at follow-up (aOR 1.7, 95%CI 1.2-2.5).

CONCLUSION

Prevalent focal cartilage defects are a risk factor for local cartilage damage progression in the same subregion and increase risk for development of incident cartilage damage in the same TFJ compartment regardless of defect depth.

CLINICAL RELEVANCE/APPLICATION

Even small superficial cartilage lesions are relevant for cartilage damage progression.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ali Guermazi, MD, PhD - 2012 Honored Educator
**Pre-Operative Radiographic Findings Predict Outcomes after Total Hip Replacement**  
**Station #1**

**Participants**  
Daniel B. Nissman, MD, MPH, Raleigh, NC (Moderator) Royalties, John Wiley & Sons, Inc

**Sub-Events**  
**MK328-SD-MOA1**  
**Pre-Operative Radiographic Findings Predict Outcomes after Total Hip Replacement**

**Purpose**
Total hip replacement (THR) is the definitive treatment for end-stage arthritis. However, 4-6% of THRs have poor pain and function outcomes. This study determines x-ray findings associated with 2-year outcomes in the operated and non-operated hip.

**Method and Materials**
Primary THR enriched for poor outcomes (WOMAC <60) undergoing THR for osteoarthritis and a convenience sample of THR with good outcomes (WOMAC >60) enrolled in an institution registry between 1/2008 and 12/2010 were selected. All had baseline and 2-year self-report data, pre-op pelvis x-rays, and no contralateral THR. Patients with a new TJR within 2 years, inflammatory arthritis or trauma were excluded. Pre-op radiographs were scored for both hips, including joint space narrowing score (sum of 5 regions of the femoral head, 0=no narrowing, 1=narrowing), presence of synovial herniation pits, subchondral cysts, osteophyte score (0-10), hip offset and migration, and modified Kellgren-Lawrence (mKandL) score. Univariate analysis and multivariate logistic regression were performed.

**Results**
274 THR radiographs were reviewed: 40 (14.6%) with poor pain, 58 (21.2%) poor function and 208 (76%) with good WOMAC pain and function at 2 years. THR with poor pain were more likely to be female (p-value 0.02). Controlling for age, sex, pre-operative BMI, co-morbidities, and activity level, each additional region of narrowing on the operative side decreased the odds of poor pain: OR 0.51 (95% CI 0.35-0.73). On the non-operative side, the presence of synovial pits increased the odds poor pain: OR 3.2 (95% CI 1.24-8.09). On the operative side, each additional region of narrowing decreased the odds of poor function: OR 0.44 (95% CI 0.30-0.65). On the non-operative side, the odds of poor function are increased by the presence of femoral cysts: OR 3.17 (95% CI 1.03-9.81), superior joint space narrowing: OR 2.42 (95% CI 1.03-5.67), and decreased by the presence of femoral head flattening: OR <0.001 (95% CI <0.001-0.29). Pain outcomes predicted correctly in 78.7% with x-rays vs. 71.9% (c-statistic 0.79 vs 0.72). Function: 78.5% with x-rays vs. 63.3% (c-statistic 0.79 vs 0.64).

**Conclusion**
Radiograph findings can be used to predict odds of poor pain or function 2-years after THR. Severe operative side changes predict benefit, while non-operative side changes may prevent optimal improvement.

**Clinical Relevance/Application**
This may allow surgeon to advise patients at high risk for poor outcomes.

**Honored Educators**
John A. Carrino, MD, MPH - 2013 Honored Educator
John A. Carrino, MD, MPH - 2015 Honored Educator

**MK329-SD-MOA2**  
**The Utility of Clinical Examination and MRI Semi-quantitative Scoring Methods for Assessing Knee Joint Effusions in Osteoarthritis, and Their Relationship to Clinical Status and Medium-term Outcomes. Data from the Osteoarthritis Initiative**

**Station #2**

**Participants**  
Benjamin R. Smith, MBChB, Edmonton, AB (Presenter) Nothing to Disclose
Robert G. Lambert, MBChB, Edmonton, AB (Abstract Co-Author) Research Consultant, Abbott Laboratories
OBJECTIVE
To evaluate the sensitivity and specificity of clinical examination of knee joint effusions in patient's with osteoarthritis (OA) as referenced to semi-quantitative MRI effusion scoring methods (MOAKS/KIMRRISS).

METHOD AND MATERIALS
This cohort study includes 80 patients selected from the OA Initiative database - 40 who had cortisone injections within 1 year of presentation and 40 matched patients who did not. The following data was extracted: 1. Result of the patella tap and bulge tests at presentation. 2. WOMAC score at presentation. 3. Incidence of cortisone injection within 1yr. 4. Incidence of total knee replacement (TKR) within 5 yrs. The baseline MRIs were analysed for the presence of joint effusions using two invidual semi-quantitative scoring methods - MOAKS score and KIMRRISS score (developed at our institution). Two MSK radiologists read the scans independently.

RESULTS
A total of 63/80 (79%) of patients had MRI detectable effusions at presentation. 23% of patients had a positive bulge sign (specificity 0.75, sensitivity 0.6), and just 5% of patients had a positive patella tap sign. Bulge-positive patients had significantly higher WOMAC pain (5.4 vs 3.7, \(p=0.03\)) and disability (27 vs 18 \(p=0.02\)) scores at presentation compared to bulge negative knees. 78% of bulge-positive knees progressed to cortisone injection within 1 year vs 58% bulge-negative (\(p=0.007\)). 98% MRI effusion-positive knees had cortisone injections within 1 year vs 42% MRI effusions-negative knees (\(p<0.001\)). 30% of MRI effusion-positive knees progressed to TKR by year 5, vs 0% of MRI effusion-negative knees. Having a positive-bulge sign was associated with a 2-3 x increased incidence of TKR at yr 5.

CONCLUSION
MRI and clinically detectable effusions in knee OA at presentation are strongly associated with worse WOMAC scores, increased incidence of cortisone injections at 1 year and progression to TKR by year 5. No MRI effusion-negative patients had TKR by year 5, compared to 30% of effusion-positive knees.

CLINICAL RELEVANCE/APPLICATION
Semi-quantitative MRI scoring methods for knee effusions (MOAKS and KIMRRISS) provide a useful and sensitive tool in evaluating knee OA, and have strong correlation with clinical status and outcomes.
METHOD AND MATERIALS

Patients with suspected meniscal tear but normal menisci on MR imaging were included. Radial reformats of routinely performed 3D T1 weighted sequence were evaluated retrospectively by two blinded readers. The following measurements and observations were obtained: visibility/non-visibility of the anteroinferior, posterosuperior and posteroinferior fascicle; the region where the fascicles are visualized in degrees compared to the tangential to posterior surface of the menisci. Intra-/Inter-reader agreement were tested.

RESULTS

37 patients with 40 MR examinations of the knee were included in the study. 115 of 120 fascicles could be identified. The anteroinferior fascicle was visible from 44°-40° (range:70°/-1.8°), the posterosuperior from 63°-55° (range 93°/-89.7°), and the posteroinferior from 56°-36° (range 89.6°/-88.9°). Intra- and inter-reader agreement showed moderate to substantial agreement.

CONCLUSION

In this study all three popliteomeniscal fascicles could be consistently visualized on 3D T1 weighted images.

CLINICAL RELEVANCE/APPLICATION

Better understanding of the clinical significance of injuries to the posterolateral corner of the knee has led to an increasing focus on clinical evaluation and treatment of this region. The popliteomeniscal fascicles function as stabilizers of the lateral meniscus. In the literature there is usually described an anteroinferior fascicle and a posterosuperior fascicle. More recently in a cadaveric MR-arthrography study a third, the posteroinferior fascicle was described.

HONORED EDUCATORS

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jon A. Jacobson, MD - 2012 Honored Educator

MK332-SD-MOAS

Prevalent Partial and Full-thickness Focal Cartilage Defects Predict Cartilage Damage Progression in the Same Subregion and Development of Incident Cartilage Damage in the Same Tibiofemoral Compartment: The MOST Study

Station #5

Participants

Ali Guermazi, MD, PhD, Boston, MA (Presenter) President, Boston Imaging Core Lab, LLC; Research Consultant, Merck KgAa; Research Consultant, Sanofi-Aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophic; Research Consultant, AstraZeneca PLC
Daichi Hayashi, MBBS, PhD, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose
Frank W. Roemer, MD, Boston, MA (Abstract Co-Author) Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC
Emily K. Quinn, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michel D. Crema, MD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab LLC
David T. Felson, MD, MPH, Boston, MA (Abstract Co-Author) Consultant, Zimmer Holdings, Inc

PURPOSE

To assess if depth of focal cartilage damage affects the risk of incidence and progression of cartilage loss in the tibiofemoral joint (TFJ).

METHOD AND MATERIALS

Persons with or at high risk of knee OA with MRI readings at baseline and 30-month were included. Semiquantitative MRI analysis was done using the Whole Organ MRI Score (WORMS) for cartilage damage, meniscal damage and extrusion, bone marrow lesions (BMLs), effusion and synovitis. Baseline focal cartilage damage was defined as grade 2 (partial-thickness) or grade 2.5 (full-thickness). In a subregion-based analysis, we assessed the risk of cartilage loss over 30 months comparing subregions of TFJ with baseline cartilage grade 2.5 vs grade 2. In the compartment-based analysis, we included only knees with a solitary grade 2 or 2.5 lesion at baseline and all other subregions in the same compartment having no cartilage damage. We estimated the risk of incident cartilage loss (grade≥2) in any non-damaged subregions for compartments with baseline full-thickness and partial thickness defects. In addition knees or compartments with grade 2 and 2.5 cartilage damage at baseline were compared to those without. Logistic regression was used to account for correlations among multiple subregions/compartment within a knee.

RESULTS

927 subregions (683 knees) were included in the subregion-based analysis. Risk of cartilage damage progression for grade 2.5 lesions compared to grade 2 lesions were comparable. However, compared to subregions with no cartilage damage, subregions with grade 2 or 2.5 cartilage defects had higher risk for cartilage loss (aOR 8.2, 95%CI 6.7-10.0). 374 compartments were included in the compartment-based analysis. There was no significant difference in regard to risk of incident damage between compartments.
that had grade 2 and grade 2.5 cartilage defects at baseline. However, compared to compartments with no baseline cartilage damage, those with grade 2 or 2.5 cartilage defects in a subregion had higher risk for incident cartilage damage in other subregions at follow-up (aOR 1.7, 95%CI 1.2-2.5).

CONCLUSION
Prevalent focal cartilage defects are a risk factor for local cartilage damage progression in the same subregion and increase risk for development of incident cartilage damage in the same TFJ compartment regardless of defect depth.

CLINICAL RELEVANCE/APPLICATION
Even small superficial cartilage lesions are relevant for cartilage damage progression.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/
Ali Guermazi, MD, PhD - 2012 Honored Educator

PARTICIPANTS
Lulu He, DO, Cleveland, OH (Presenter) Nothing to Disclose
Jennifer Bulien, MSc, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Stephen F. Hatem, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose

PURPOSE
Bipartite medial cuneiform (BMC) is an uncommon and underrecognized variant that has received little mention in radiology literature and texts. There is increasing evidence suggesting that BMC may be an etiology for midfoot pain. As with Lisfranc injuries, BMC can be easily overlooked amidst the complex anatomy of the midfoot. We have observed a beaked appearance of the navicular in patients with BMC. The purpose of this study is to evaluate the "beaked navicular sign" as an indirect radiographic finding of BMC.

METHOD AND MATERIALS
IRB approval was obtained. 11 cases of BMC were identified in adult patients from institutional teaching files. 36 age matched random controls were also identified. Lateral foot radiographs of these 47 subjects were retrospectively reviewed for the presence or absence of the "beaked navicular" sign by 4 readers. The medial cuneiform was masked in each image to prevent direct identification of BMC. Agresti-Coull confidence intervals were constructed for sensitivity and specificity of the "beaked navicular" sign for BMC.

RESULTS
Among the four readers, the sensitivity of the 'beaked navicular' sign ranged from 82% (0.51 - 0.96, 95% CI) to 91% (0.60 - 1.00, 95% CI), specificity from 86% (0.71 - 0.94, 95% CI) to 97% (0.85 - 1.00, 95% CI). Positive predictive value ranged from 64% (0.39 - 0.84, 95% CI) to 91% (0.60 - 1.00, 95% CI) and negative predictive value from 94% (0.79 - 1.0, 95% CI ) to 97%(0.84 - 1.000, 95% CI).

CONCLUSION
Our study confirms the 'beaked navicular" sign as a sensitive and specific indirect radiographic sign of BMC, with high negative predictive value.

CLINICAL RELEVANCE/APPLICATION
Recognition of the beaked navicular sign should prompt careful evaluation for the potentially symptomatic BMC.

PARTICIPANTS
Vanja Varenika, MD, San Francisco, CA (Presenter) Nothing to Disclose
Amelie M. Lutz, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Christopher F. Beaulieu, MD, PhD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Matthew D. Bucknor, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine whether known variant anatomical relationships between the sciatic nerve and piriformis muscle can be readily identified on routine MRI studies of the hip and to calculate the prevalence of the most common variants.

METHOD AND MATERIALS
Hip MRI studies containing axial T1 sequences acquired over a period of four years at two university medical centers underwent repeat interpretation by musculoskeletal radiologists. The anatomical relationship between the sciatic nerve and the piriformis muscle was analyzed and categorized according to the Beaton and Anson classification system. The presence of a split sciatic nerve, defined as separate common peroneal and tibial nerve bundles at the level of the ischial tuberosity, was also recorded.

RESULTS
At one institution, a total of 125 consecutive scans were reviewed after the exclusion of 9 cases for severe metal artifact from
Prior hip arthroplasty. Conventional anatomy (Type I) in which an undivided sciatic nerve passes below the piriformis muscle was identified in 88% of cases. The remaining 12% of cases demonstrated a Type II pattern in which one division of the sciatic nerve passes through the piriformis while the second passes below. Another 102 consecutive scans were reviewed at a second institution after exclusion of 29 cases. In that series, 20% of cases demonstrated a Type II pattern. A single Type III variant was also identified in which one division of the sciatic nerves above the piriformis while the other courses below. The remaining three types of variants described in the Beaton and Anson classification system were not identified. Over 95% of variant cases were associated with a split sciatic nerve. By contrast, only 4% of cases at the first institution and 14% at the second demonstrated a split sciatic nerve in the context of otherwise conventional anatomy.

CONCLUSION
Anatomic variations of the sciatic nerve course in relation to the piriformis muscle can be identified on MRI and are fairly common, occurring in 12-20% of scans reviewed. Almost all of the variants identified were Type II. MRI allows for accurate determination of variant anatomy, facilitating optimal treatment planning.

CLINICAL RELEVANCE/APPLICATION
Variant relationships between the sciatic nerve and piriformis muscle are associated with piriformis syndrome and identification of these variants on MRI is important in diagnosis and treatment planning.

MK156-ED-MOA9 Echographic Evaluation of the Brachial Plexus: How to Do It

Station #9

Participants
Aleen V. Altamirano, MD, Masaya, Nicaragua (Abstract Co-Author) Nothing to Disclose
Andres Zamora Diaz, MD, Ticuantepe, Nicaragua (Presenter) Nothing to Disclose
Eliette H. Castillo Ballardaz, MD, Managua, Nicaragua (Abstract Co-Author) Nothing to Disclose
Maryum Lira Corrales, MD, Managua, Nicaragua (Abstract Co-Author) Nothing to Disclose
Jamynce Altamirano Carcache, Managua, Nicaragua (Abstract Co-Author) Nothing to Disclose
Juan J. Montenegro, Managua, Nicaragua (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The goal of this exhibit is to: (1) Review the anatomy of the brachial plexus. (2) Recognize the anatomic landmarks by ultrasound. (3) Explain a step-by-step guide for the echographic exploration of the brachial plexus. (4) Demonstrate the value of ultrasonography in specific pathologies of the brachial plexus.

TABLE OF CONTENTS/OUTLINE
A- Objectives.B- Graphic illustrations showing the brachial plexus anatomy, correlation with ultrasound studies and cadaveric specimens.C- Ultrasound instrumentation and preparation of the patient.D- Normal echographic appearance of the brachial plexus and ultrasound technique using anatomic landmarks.E- Limitations and pitfalls of the ultrasound for the evaluation of the brachial plexus.F- Assessment of frequent pathological conditions involving the brachial plexus

MK203-ED-MOA10 High-resolution Imaging of Metabolic Bone Diseases

Station #10

Awards
Certificate of Merit

Participants
Janina M. Patsch, MD, PhD, Vienna, Austria (Presenter) Nothing to Disclose
Galateia J. Kazakia, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Andrew J. Burghardt, BS, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Ursula R. Heilmeier, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Thomas L. Nickolas, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (Abstract Co-Author) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

TEACHING POINTS
Metabolic bone diseases are of high prevalence and major clinical relevance: Patients affected display a major risk of fragility fractures. Besides densitometric techniques that are used in clinical practise (e.g. DXA or QCT), high-resolution bone imaging has evolved as an important non-invasive tool in bone research. In the proposed educational exhibit, we aim to demonstrate high-resolution characteristics of metabolic bone diseases with a special focus on high resolution peripheral quantitative computed tomography (HR-pQCT): Examples of female and male healthy volunteers will be shown along with cases of primary and secondary osteoporosis, disuse, chronic kidney disease, diabetes mellitus and hypo- and hyperparathyroidism. Special emphasis will be put on teaching disease-specific differences of pathologic bone microarchitecture (e.g. cortical porosity in diabetic bone disease; subperiosteal resorptions in hyperparathyroidism) based on non-invasive imaging.

TABLE OF CONTENTS/OUTLINE
High-resolution imaging of metabolic bone diseases: Technical background (HR-pQCT; HR-MRI); Cases: healthy men/women; postmenopausal and age-related osteoporosis; secondary osteoporosis; chronic kidney disease bone and mineral disorder; disuse; diabetes mellitus; hyper- and hypoparathyroidism; pediatrics: x-linked hypophosphatemic rickets, spinal muscle atrophy (SMA)

MK251-ED-MOA11 Adult Spinal Deformity: Pertinent Radiographic Findings for the Surgeon

Station #11

Awards
Certificate of Merit

Participants
Casey J. Schmitz, MD, Temple, TX (Presenter) Nothing to Disclose
Ricardo D. Garza-Gongora, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Linda M. Parmán, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Mark Rahm, Temple, TX (Abstract Co-Author) Royalties, Spine Smith LP; Speaker, Johnson & Johnson; Institutional research
support, K2M Group Holdings, Inc
Jeffrey D. Stevens, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to:
1. Explain the Scoliosis Research Society classification of adult spinal deformity.
2. Analyze important spinopelvic parameters, including sagittal measurements and global balance modifiers.
3. Discuss how these findings effect management considerations.

TABLE OF CONTENTS/OUTLINE

Use and image and diagram rich platform to discuss the following and provide a systematic algorithmic approach for analyzing and reporting these findings:
Scoliosis Research Society (SRS) classification of adult spinal deformity. Most important parameters for surgical planning in the adult, including segmental (subluxation), regional (lumbar lordosis) or global sagittal imbalance. Regional spinal Cobb measurements of thoracic kyphosis and lumbar lordosis, as well spinopelvic parameters, such as pelvic tilt, pelvic inclination, sagittal vertical axis, and T1 pelvic angle. Concepts behind pelvic compensation mechanisms and imbalanced sagittal profiles. Discuss the surgical implications of the above findings.
Musculoskeletal Monday Poster Discussions

Monday, Nov. 30 12:45PM - 1:15PM Location: MK Community, Learning Center

MK

AMA PRA Category 1 Credit ™: .50

PURPOSE

Involvement of sacroiliac joint is usually the first manifestation of seronegative spondyloarthopathy; this condition can be detected with high accuracy by MRI sequences, according to the axial spondyloarthritis classification criteria published by the Assessment of SpondyloArthritis international Society (ASAS). The aim of our study was the evaluation of response to treatment with HUMIRA (Adalimumab), a recombinant human IgG1 monoclonal antibody specific for human TNFa, through MRI.

METHOD AND MATERIALS

In collaboration with the Department of Rheumatology, we followed a group of 20 patients with clinical and laboratoristic diagnosis of SpA, performing three sessions of MRI: the first before starting treatment (t0), 6 months later (t1) and 1 year after treatment (t2), in the period between December 2013 and February 2015. The examinations were performed with a 1.5 T Siemens Sonata MRI scanner, with standardized acquisitions: axial, coronal and oblique sequences, according to the plane of synchondrosis joint, TSE T1 and T2 TIRM; post-contrastographic T1 FAT SAT.

RESULTS

Of the 20 patients at t0 everyone had a clinical confirmation of low back pain and a positive bone marrow edema, signal-presence of bone marrow hyperintensity on FAT SAT T1-weighted images and enthesitis, 2 had bony bridges (10%), 13 shown subchondral sclerosis and fatty change (65%) and 12 of them presented microerosions (60%). At t1, 2 of the 20 patients have discontinued therapy because of side effects; of the remaining 18, 6 patients showed an improvement in clinical regression of pain, while none of these showed a concomitant improvement in the images acquired. At t2, 16 of the 18 patients showed an important clinical reduction of low back pain with periods of exacerbation, 2 were not responding to treatment. The acquired images showed a reduction of contrast enhancement and enthesitis in all cases, while only 6 showed a reduction of bone marrow edema (30%) and no changes as regards the sclerosis, the microerosions, fatty change and subchondral bony bridges.

CONCLUSION

This study showed that MRI is now recognized to play a pivotal role in the diagnosis of early sacroiliitis and for evaluation of response to treatment, in particular the actual effectiveness of treatment with HUMIRA in terms of disease progression and quality of life.

CLINICAL RELEVANCE/APPLICATION

MRI is an important tool in the evaluation of treatment response of early sacroiliitis.

Papers

MK335-SD-MOB1

Role of MRI in the Evaluation of Response to Treatment with HUMIRA (Adalimumab) in Patients with Non-radiographic Axial Spondyloarthritis (SpA): A Preliminary Study

Station #1

Participants

Daniel B. Nissman, MD, MPH, Raleigh, NC (Moderator) Royalties, John Wiley & Sons, Inc

Sub-Events

MK336-SD-MOB2

Bone Marrow Diffusion-Weighted MRI of Multiple Myeloma Patterns

Station #2

Participants

Vassilis Koutoulidis, MD, Athens, Greece (Abstract Co-Author) Nothing to Disclose

Sofia Fontara, MD, Athens, Greece (Presenter) Nothing to Disclose

Evangelos Terpos, MD,PhD, Athens, Greece (Abstract Co-Author) Nothing to Disclose

Dimitrios K. Matsaridis, MD, Athens, Greece (Abstract Co-Author) Nothing to Disclose

Flora Zagouri, Athens, Greece (Abstract Co-Author) Nothing to Disclose

Andriani Boultdaki, MD, Athens, Greece (Abstract Co-Author) Nothing to Disclose

Efstathios Kastritis, Athens, Greece (Abstract Co-Author) Nothing to Disclose

Meletios-Athanasios Dimopoulos, Athens, Greece (Abstract Co-Author) Nothing to Disclose

Lia A. Moulopoulos, MD, Athens, Greece (Abstract Co-Author) Nothing to Disclose

PURPOSE

To calculate and compare ADC values in newly diagnosed patients with multiple myeloma (MM), to identify possible differences in ADC values among diffuse, focal, and normal MM MRI patterns and to establish the presence of a threshold value which may distinguish abnormal from normal patterns.
METHOD AND MATERIALS

95 patients with newly diagnosed untreated MM were studied with MRI of the lumbosacral spine, with a 1.5 Tesla unit. There were 46 men and 49 women with a mean age 67 years (range 37-89). 16 healthy individuals served as a control group (7 men, 9 women, mean age 59.2 years, range 47-76). Conventional MR images were obtained according to bone marrow MRI protocols; MRI patterns of involvement were normal in 51, focal in 20, diffuse in 24 patients. DWI was obtained with an Echo Planar Imaging sequence using 5 b-values (0, 150, 250, 500, 750 sec/mm2).

RESULTS

Mean ADC values (x 10-3 mm2/sec) were: 0.360 ± 0.108 (range: 0.153 - 0.593) for the normal MM pattern, 1.101 ± 0.308 (range: 0.715 ± 2.015) for the focal MM pattern, 0.783 ± 0.132 (range: 0.552 ± 1.017) for the diffuse MM pattern. Mean ADC value of apparently normal marrow in patients with a focal pattern was 0.431 ± 0.128 (range: 0.113-0.704). Mean ADC of healthy controls was 0.360 ± 0.135 (range: 0.152 - 0.542). One way analysis of variance (ANOVA) showed a significant difference in ADC values within the groups of the study. An ADC value above 0.548x10-3 mm2/sec was found to be diagnostic of diffuse myelomatous infiltration of the bone marrow with 100% sensitivity and 98% specificity.

CONCLUSION

Normal, focal and diffuse MRI patterns of involvement in patients with MM have distinct ranges of ADC values on DWI. An ADC value above 0.548x10-3 mm2/sec is diagnostic of diffuse myelomatous infiltration of the bone marrow with very high accuracy.

CLINICAL RELEVANCE/APPLICATION

Diffuse MRI pattern of marrow involvement correlates with poor prognosis in patients with multiple myeloma (MM) both in the conventional chemotherapy and novel agent era and this exam is recommended in differentiates from normal MRI pattern involvement.

MK337-SD-MOB3  Radiographic Interpretation of Carpometacarpal Arthroplasty: Correlation between Radiographic Loosening and Clinical Outcome

Station #3

Participants
Laurence D. Stillwater, MD, Winnipeg, MB (Presenter) Nothing to Disclose
Brett F. Memauri, MD, Winnipeg, MB (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess the radiographic appearance and interpretation of loosening in patients following first carpometacarpal joint pyrohemisphere arthroplasty.

METHOD AND MATERIALS

A retrospective review over a six-year period was performed identifying patients with first carpometacarpal pyrohemisphere implants. All post-operative radiographs were reviewed and compared with clinical information. Loosening was defined as greater than 1 mm of periprosthetic lucency or increasing lucency on serial studies. Adverse clinical outcome was defined as infection, complex regional pain syndrome, subluxation or inability to return to activities of daily living. Statistical analysis included Cohen's Kappa coefficient to measure inter-reader agreement for radiographic interpretation as well as the agreement between radiographic loosening and an undesired or adverse clinical outcome.

RESULTS

A total of 73 post-operative radiographs were reviewed. The mean age of the study subjects was 58 years. The mean radiographic follow up was 13 months (range: 1-56). All arthroplasties were performed for osteoarthritis. Only 1 repeat surgery was performed. There was good agreement amongst readers in regards to radiographic interpretation, K = 0.66 (p = 1.54 x 10-8, 95% CI [0.48, 0.83]). The strength of agreement between radiographic loosening and adverse clinical outcome was poor, K = 0.23 (p = 0.04, 95% CI [0.02, 0.45]). The sensitivity of radiography in predicting an adverse clinical outcome was 63%, specificity 65%, positive predictive value 39% and negative predictive value 83%.

CONCLUSION

There is good agreement amongst readers in the assessment for loosening of pyrohemisphere implants. Poor agreement is seen between radiographic loosening and an adverse clinical outcome. Moreover, the sensitivity and specificity of radiography to predict adverse clinical outcomes are low. Although radiography may be useful in the right clinical context, it should not be utilized as the sole predictor of adverse clinical outcomes following carpometacarpal arthroplasty.

CLINICAL RELEVANCE/APPLICATION

Poor agreement is seen with radiography and adverse clinical outcome post carpometacarpal arthroplasty; while it may be useful in the right clinical context, it should not be the sole predictor.

MK338-SD-MOB4  Incidence and Patterns of Anteromedial Corner Injury of the Knee in Patients with Acute Anterior Cruciate Ligament Injury

Station #4

Participants
Jina Park, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ja-Young Choi, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Yusuhn Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hye Jin Yoo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Hwan Hong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Chong Bum Chang, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
We aimed to determine incidence and patterns of the anteromedial corner injury of the knee on MRI of the patients with acute anterior cruciate ligament (ACL) injury, and to find MR findings associated with injuries of the medial patellofemoral ligament (MPFL) and medial patellar retinaculum (MPR) of the patients.

**METHOD AND MATERIALS**

We retrospectively reviewed preoperative knee MR images of 122 consecutive patients with ACL injury who had taken MRI in an average of 7 days after trauma and who underwent arthroscopic ACL reconstruction. 42 patients were excluded due to suboptimal image sequences, prior knee fracture or chronicity of ACL tear. This left 80 knees for this study (male: female = 64:16, mean age, 29.6 years). All MR images were independently assessed by two musculoskeletal radiologists for MPFL and MPR injuries. In addition, MR images were also evaluated for PCL, MCL, LCL, menisci, vastus medius obliquus (VMO), and bone contusion distribution.

**RESULTS**

In the 80 knees with acute ACL injuries, MPFL injuries were found in 66.3% (53 knees; periligamentous edema 32.5%, partial tear 26.3%, and complete tear 7.5%). MPR abnormalities were found in 51.3% (41 knees; periligamentous edema 27.5%, partial tear 18.8%, complete tear 5.0%). MPFL and MPR injuries were significantly associated with MCL injury (p < 0.0001), VMO strain (p < 0.0001), and bone contusion of lateral femoral condyle (p = 0.0001 and 0.022, respectively), but not with meniscal tears, PCL or LCL injuries.

**CONCLUSION**

Anteromedial corner injuries, i.e., MPFL and MPR injuries, were frequently observed on knee MRI of the patients with acute ACL injury.

**CLINICAL RELEVANCE/APPLICATION**

We believe that it would be worth researchers starting to consider potentially coexisting anteromedial corner injuries, i.e., MPFL and MPR injuries in a patient with ACL injury as a possible predictor variable for poorer outcome or early patellofemoral osteoarthritis after ACL reconstruction.

**MK339-SD-MOB5**

**Multiparametric Quantitative MRI Shows No Difference in Cartilage Composition between Patients with Patellofemoral Pain and Healthy Control Subjects**

<table>
<thead>
<tr>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rianne v. Heijden, MD, Rotterdam, Netherlands (Presenter) Nothing to Disclose</td>
</tr>
<tr>
<td>Edwin H. Oei, MD, PhD, Palo Alto, CA (Abstract Co-Author) Nothing to Disclose</td>
</tr>
<tr>
<td>Esther E. Bron, MSc, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose</td>
</tr>
<tr>
<td>Jasper Van Tiel, MD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose</td>
</tr>
<tr>
<td>Peter Van Veldhoven, Leidschendam, Netherlands (Abstract Co-Author) Nothing to Disclose</td>
</tr>
<tr>
<td>Stefan Klein, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose</td>
</tr>
<tr>
<td>Jan Verhaar, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose</td>
</tr>
<tr>
<td>Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG</td>
</tr>
<tr>
<td>Sita Bierma-Zeinstra, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose</td>
</tr>
<tr>
<td>Marienke van Middelkoop, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose</td>
</tr>
</tbody>
</table>

**PURPOSE**

Diminished cartilage quality is hypothesized as an etiological factor for patellofemoral pain (PFP), a common knee pathology in young subjects with unknown etiology. Our purpose was to investigate differences in cartilage quality between patients with PFP and control subjects by measuring cartilage composition with three different quantitative MRI techniques.

**METHOD AND MATERIALS**

Patients diagnosed with PFP and healthy control subjects aged 14-40 years were included and underwent MRI at 3T. The MRI protocol included high-resolution SPGR, T1GD (delayed gadolinium enhanced MRI of cartilage (dGEMRIC)), T1p and T2 mapping sequences to measure cartilage glycosaminoglycan (T1GD and T1p) and collagen content (T2). T1GD was only conducted in adults due to the need of contrast administration. An experienced observer manually annotated the whole trochlear and patellar cartilage on approximately 20 slices of the high-resolution scan. Automated image registration was applied to compensate for subject motion. Differences in relaxation times for trochlear and patellar cartilage were compared between patients and control subjects by linear regression analyses, adjusted for age, BMI, gender, sports participation and time of day during visit.

**RESULTS**

64 patients and 70 control subjects were included of which 40, equally distributed between groups, were adolescents. Mean age was 23.2 (6.4), mean BMI was 22.9 (3.4) and 56.7% was female. Mean T1GD relaxation times of patellar (657.8 vs. 669.5 milliseconds (ms)) and trochlear cartilage (661.7 vs. 660.4ms) did not significantly differ between patients and controls (Table 1). There was also no significant difference in mean T1p relaxation times of patellar (46.6 vs. 45.8ms) and trochlear cartilage (50.8 vs. 50.1ms) and mean T2 relaxation times of patellar (33.2 vs. 32.8ms) and trochlear cartilage (36.7 vs. 36.6ms) between patients and controls. Analysis of pre-specified medial and lateral subregions within the patellar and trochlear cartilage did also not reveal any significant differences.

**CONCLUSION**

Our findings suggest that cartilage composition as measured with quantitative MRI does not play a role in the etiology of PFP.

**CLINICAL RELEVANCE/APPLICATION**

Diminished cartilage quality has been hypothesized as an etiological factor for PFP for many years, but our findings suggest that cartilage composition does not play a role in the etiology of PFP.
2D Fast Spin-echo Sequences at 3T

Station #6

Participants
Jisook Yi, MD, Bucheon-Si, Korea, Republic Of (Presenter) Nothing to Disclose
Jang Gyu Cha, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Koo Lee, Bucheon-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Bora Lee, Bucheon-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the accuracy of a three-dimensional (3D) isotropic T2-weighted fast spin-echo (FSE) magnetic resonance (MR) sequence as compared with a conventional two-dimensional (2D) sequence in the diagnosis of anterior talofibular ligament (ATFL) tear, osteochondral lesion of talus (OLT), and Os subfibulare/avulsion fracture of distal fibula (OSF).

METHOD AND MATERIALS
Between November 2013 and July 2014, thirty-five patients who had undergone ankle MRI with the 2D T2-weighted FSE sequence and the 3D isotropic T2-weighted FSE sequence and subsequent ankle arthroscopy were included. Each MR imaging sequence was independently scored by two readers retrospectively for the presence of complete or partial tear of ATFL, OLT, and OSF. Diagnostic performance based on each sequence type was compared by using the area under the receiver operating characteristic curve (AUC). Interobserver agreement was expressed as unweighted kappa value.

RESULTS
Arthroscopic findings enabled confirmation of the presence of 21 complete tear of ATFL, 14 partial tear of ATFL, 17 OLT, and 7 OSF. The AUCs for the readers using the 3D T2-weighted FSE sequence versus those obtained with the 2D sequence were 0.71-0.96 versus 0.72-0.97 for reader A and 0.52-0.81 versus 0.65-0.92 for reader B in the detection of ATFL tears, 0.68 versus 0.83 for reader A and 0.74 versus 0.80 for reader B in the detection of OLTs and 0.83 versus 0.85 for reader A and 1 versus 0.89 for reader B in the detection of OSF. The mean AUCs between the 2D and 3D sequences were not significantly different. The interobserver agreement rate between two readers using the 3D T2-weighted FSE sequence versus those obtained with the 2D sequence were fair versus moderate for ATFL tear, substantial versus moderate for OLT, and substantial versus substantial for OSF.

CONCLUSION
The accuracy of 3D isotropic FSE MRI may be comparable with that of conventional 2D MRI in the diagnosis of ATFL tears, OLT and OSF with a shorter imaging time.

CLINICAL RELEVANCE/APPLICATION
Three-dimensional isotropic T2-weighted FSE MRI of the ankle shows similar accuracy as more conventional imaging in the evaluation of ATFL tears, OLT and OSF of the ankle, with a faster imaging time.

MK186-ED- MOB8
Turf Toe and Other Injuries of the Hallux Plantar Plate - An Illustrative Review

Station #8

Participants
Stephanie N. Histed, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Daria Motamedi, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose
Kira Chow, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Sulabha Masih, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Shahla Modarressi, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The first metatarsophalangeal (MTP) joint is flexible and strong, with complex capsuloligamentous anatomy. Injury to this joint can involve ligaments, capsular components, and osseous structures. 1. Review the complex capsuloligamentous anatomy of the 1st MTP joint and the supporting soft tissue structures of the plantar plate.2. Review mechanism of injury, clinical presentation, incidence, risk factors, and treatment for turf toe.3. Review the optimal imaging modalities and common radiographic findings for 1st MTP joint pathologies. Modalities will include Xray, US, and MRI.4. Review other pathologies of the 1st MTP joint that can mimic turf toe.

TABLE OF CONTENTS/OUTLINE
1. Review of the complex anatomy of the 1st MTP joint and plantar plate with illustration, as well as normal US and MR imaging.2. Summary of turf toe injury including mechanism, presentation, risk factors, and treatment.3. Imaging review of pertinent findings in turf toe on CR, US and MRI.4. Review additional pathology of the 1st MTP joint with imaging findings to include osseous (fractures, sesamoiditis, avascular necrosis), soft tissue (tendonitis, tenosynovitis), hyperdorsiflexion injury, and arthritides.

MK166-ED- MOB9
Normal and Injured Ankle Ligaments on Ultrasonography with Magnetic Resonance Imaging Correlation

Station #9

Awards
Certificate of Merit

Participants
Qian Dong, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (Abstract Co-Author) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ;
David P. Fessell, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Sung Moon Kim, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Catherine J. Brandon, MD, Ann Arbor, MI (Abstract Co-Author) Stock options, VuCOMP, Inc
Corrie M. Yablon, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Gandikota Girish, MBBS, FRCR, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

By completion of this educational exhibit, the learner will be able to: Understand ultrasonography (US) examination technique and potential scanning pitfalls of ankle ligaments. Recognize US appearance of normal and injured ankle ligaments with magnetic resonance imaging (MRI) correlation.

TABLE OF CONTENTS/OUTLINE

Ankle ligaments US examination technique and scanning pitfalls are reviewed. Illustrating US appearance of normal and injured ankle ligaments with MRI correlation including lateral complex, medial complex and deltoid ligaments, syndesmosis, and spring calcaneonavicular ligament complex.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jon A. Jacobson, MD - 2012 Honored Educator

MK204-ED-MOB10  Spectrum of MR Imaging Findings in Musculoskeletal Tuberculosis: A Pictorial Review

Participants
Tejas Gosalia, MBBS, MD, Mumbai, India (Presenter) Nothing to Disclose
Foram B. Gala, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Bharat M. Gala, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Bipin R. Shah, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1)To determine the imaging morphology of musculoskeletal tuberculosis. 2)To identify the various sites of tuberculosis involving the musculoskeletal system. 3)Usefulness of MRI in distinguishing tuberculous pathology from others. 4)To determine the treatment outcome on follow up MRI.

TABLE OF CONTENTS/OUTLINE

Tuberculosis is one of the major health problem in developing countries. Extra pulmonary Tuberculosis is on the rise especially with increase in incidence of AIDS. Musculoskeletal Tuberculosis comprises a bulk of extra-pulmonary tuberculosis. The various sites involved are spine (most common), sacro-iliac, hip, knee, ankle, wrist and elbow joints. Although it can affect almost any joint. The spectrum of spinal tuberculosis consists of Intradiscal soft tissue, osteitis, posterior sub ligamentous collections, pre and bilateral paravertebral collections, bilateral psoas abscesses, involvement of costo-vertebral joints, compression on cord and nerve roots. In the joints the primary imaging finding is synovitis which later causes erosions of the articular margins of the bones involved. In chronic stages the disease can present as extensive erosions, loose body formation, deformity and loss of joint function. A tuberculous sinus tract can be demonstrated extending from the intramedullary region up to the adjacent soft tissues and skin.

MK258-ED-MOB11  Assessment and Multiparametric Functional MRI Evaluation of Arthritis

Participants
Teodoro Martin, MD, Jaen, Spain (Presenter) Nothing to Disclose
Marta Gomez Cabrera, MD, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Joan C. Villanova, MD, PhD, Girona, Spain (Abstract Co-Author) Nothing to Disclose
Maria Jose Romero Rivera, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Fernando Caro Mateo, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Jordi Broncano, MD, Cordoba, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Luna, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Optimize the MRI protocol in the assessment of joints, including classic morphological and new functional sequences such as Dixon sequence, DWI, DCE-MRI and T2 mapping and dGEMRIC for cartilage evaluation. 2. Analyse the utility of these techniques for articular evaluation, including large and small joints, in several clinical scenarios.

TABLE OF CONTENTS/OUTLINE

Emergency Radiology (Emergent Musculoskeletal and Spine Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: N227

Participants
Sujit Vaidya, MD, London, United Kingdom (Moderator) Nothing to Disclose
Bharti Khurana, MD, Boston, MA (Moderator) Nothing to Disclose

Sub-Events

SSE06-01 CT for Thoracic and Lumbar (T- and L-) Spine Fractures: Can CT Findings Accurately Predict Posterior Ligament Complex (PLC) Disruption?

PURPOSE
To test the ability of secondary CT findings in patients with T- and L- spine fractures to predict disruption of the posterior ligament complex, a crucial determinant of fracture instability.

METHOD AND MATERIALS
105 consecutive ER patients with thoracic or lumbar spine fracture (fx) who had both CT and MRI from 2008-2012 were included. A composite gold standard was based on disruption of any PLC component by MRI or intraoperative exam findings. 3 blinded readers (2 neuroradiology trained emergency radiologists and 1 spine surgeon) graded CT scans for: VBT vertebral body translation/rotation, FJD facet joint subluxation/dislocation, FJW facet joint widening, FPL facet/pedicle/lamina fx, SPF spinous process fx, ISW interspinous distance widening, PEF posterior endplate corner fx. Analysis included interobserver agreement, and univariate and multivariate logistic regressions (performed separately by reader) to test associations between CT findings and gold standard PLC disruption (PLCD).

RESULTS
53 of the 105 patients had PLC disruption by gold standard. Interobserver agreement (averaged across reader pairs) was good for all CT findings, ranging from 92% for VBT to 72% for ISW. In univariate analysis, the strongest predictors of PLCD were FPL (OR 3.9-5.2, p<0.001 for all readers) and ISW (OR 1.8-3.1, all p<0.05). SPF and VBT showed significant results for 2/3 readers. PEF was not associated with PLCD. The overall presence of at least one of the CT findings had 70% average interobserver agreement, and univariate and multivariate logistic regressions (performed separately by reader) to test associations between CT findings and gold standard PLC disruption (PLCD).

CONCLUSION
Several secondary CT findings can substantially increase suspicion for PLC disruption, with any abnormal CT finding increasing the odds of disruption by 5.4 or greater across all readers.

CLINICAL RELEVANCE/APPLICATION
Close attention to secondary CT findings in patients with T- or L- spine fractures may help radiologists predict PLC disruption and expedite appropriate management.

Honored Educators
Bharti Khurana, MD - 2014 Honored Educator
Aaron D. Sodickson, MD, PhD - 2014 Honored Educator
PURPOSE

Purpose: The NEXUS-criteria** are validated criteria to identify adult patients who need conventional radiography of the cervical spine after blunt trauma. Despite the fact that CT is internationally seen as the 'golden standard' when cervical spine injury is suspected, the NEXUS-criteria have never been validated for CT. We tested the accuracy of the NEXUS-criteria for CT with simultaneously implementation of the Dutch guidelines for blunt trauma (CBO, 2009) of the cervical spine after high-energy trauma.

**Hoffman et al. NEJM 2000:94-99

METHOD AND MATERIALS

Methods: A retrospective observational study in the period January 1st 2012 to December 31st 2013, including all patients aged 15 years and older with a high-energy-trauma (HET). We evaluated the NEXUS-criteria against the outcome of a fracture or no fracture of the cervical spine determined by CT.

RESULTS

Results: A total of 875 patients were included, from which 599 patients had a positive- and 276 patients had a negative NEXUS-screening. In the group with the positive NEXUS-criteria 35 fractures were found. One patient with a negative NEXUS-screening had a fracture. This leads to a sensitivity of 0,972 (95% CI: 0,837-0,998) and a negative predictive value of 0,996 (95% CI: 0,976-0,999) of the NEXUS criteria.

CONCLUSION

Conclusion: The NEXUS-criteria have a good sensitivity as well as a good negative predictive value for CT of the cervical spine when injury of the cervical spine is suspected in patients with a high-energy-trauma aged 15 years and older.

CLINICAL RELEVANCE/APPLICATION

Daily practice at the emergency room.
The assessment of bone marrow edema is limited in conventional CT. Dual-energy CT (DECT) with virtual non-calcium (VNCa) images allows subtraction of bone mineral to better reveal the fluid attenuation of bone marrow. The purpose of this study is to describe our clinical experience with DECT VNCa images for the detection of bone marrow edema in acute fractures of the thoracic spine.

METHOD AND MATERIALS

In this retrospective study, 397 thoracic vertebral bodies from 36 consecutive patients were assessed for the presence of bone marrow edema in acute fractures. Each of these patients underwent DECT of the thoracic spine (100kV-Sn140kV, 255refmAs, 40x0.6mm) using a dual source 128-slice CT scanner (Definition FLASH, Siemens Healthcare, Germany) between November 9, 2014 and March 31, 2015. The DECT data was post-processed using a 3-tissue algorithm to create VNCa images on a multimodality CT workspace. Each vertebral body was independently evaluated by two readers for the presence or absence of abnormal bone marrow edema on greyscale and color-coded maps. Attenuation of each of the vertebral bodies was then subjected to receiver operating characteristic (ROC) curve analysis to determine the sensitivity, specificity, and accuracy of using bone marrow edema to diagnose acute fractures of the thoracic spine.

RESULTS
Vertebral positive for acute fracture demonstrated a statistically significant increase in the attenuation of abnormal bone marrow edema (114.2 ±15.06HU in acute fractures compared to -2.118 ±1.699HU in non-fractures, p<0.0001). Inter-observer agreement for the presence of abnormal bone marrow edema was excellent (k=0.865). The ROC analysis of the CT attenuation values demonstrated an area under curve (AUC) of 0.987 with an optimal cutoff value of 43.5 HU. This resulted in a sensitivity of 100%, specificity of 93.8%, and an accuracy of 92.9% for detection of acute fractures of the thoracic spine.

CONCLUSION
Findings from this study show that bone marrow edema and using a cut-off value of 43.5HU in virtual non-calcium images reconstructed from dual-energy CT can be useful in the diagnosis of acute fractures of the thoracic spine.

CLINICAL RELEVANCE/APPLICATION
Virtual non-calcium images derived from DECT allow detection of bone marrow edema and, therefore, provide a convenient and accurate modality for detection and characterization of acute fractures.

SSE06-05  Diagnostic Value of CT in Patients with Suspected Thoracic Spine Fractures Due to Minor Trauma

PURPOSE
To investigate the accuracy of biplane radiography in the detection of thoracic spine fractures in patients with minor trauma using computed tomography (CT) as the reference.

METHOD AND MATERIALS
130 consecutive patients (71 males; 59 females; mean age 69 ± 22.7 years; range 18-95 years) with minor trauma of the thoracic spine and low to moderate back pain on physical examination were included retrospectively. All had undergone biplane radiography first, followed by a CT scan in a time frame of 4 days because of aggravation of their symptoms. A contingency table and the Chi-square test (X2) were used to compare both diagnostic methods.

RESULTS
CT revealed 95 fractures in 71/130 patients (54.6%). Most fractures were diagnosed in the thoracolumbar junction (n=27). Biplane radiography was true positive in 42/130 patients (32.3%), false positive in 20/130 patients (15.4%), true negative in 42/130 (32.3%), and false negative in 26/130 patients (20%), showing a sensitivity of 61.8%, a specificity of 67.7%, a positive predictive value of 67.7%, and a negative predictive value of 61.8%. None of the fractures missed on biplane radiography was unstable. Presence of a fracture on biplane radiography was highly statistical significant, if this was simultaneously proven by CT (X2 = 11.3; p= 0.00077).

CONCLUSION
Sensitivity and specificity of biplane radiography in the diagnosis of thoracic spine fractures in patients with minor trauma are low.

CLINICAL RELEVANCE/APPLICATION
Considering the wide availability of CT that is usually necessary for taking significant therapeutic steps, indication for x-ray in minor trauma patients should be very restrictive.

SSE06-06  140kVp Spectral Filtration CT of the Cervical Spine: Reduced Artifact and Reduced Radiation Dose in the Emergency Setting
Attempts to reduce radiation exposure at the cervical spine are frequently and negatively limited by beam hardening artifact and photon starvation at the cervicothoracic junction. The purpose of this study is to compare image quality and radiation dose of conventional 120kVp CT versus a novel spectral filtration CT (SFCT) mode, which uses 140kVp and an added tin filter to produce small quantities of highly penetrating photons, in acute trauma patients.

METHOD AND MATERIALS

20 consecutive patients underwent SFCT of the cervical spine (Sn140kV, 450refmAs, 40x0.6mm) using a dual source 128-slice CT system (Definition FLASH; Siemens Healthcare, Forchheim, Germany) and were compared to 20 patients who underwent conventional 120kVp CT. Attenuation was measured by placing circular regions of interest on the spinal cord at the C2, C5, and C7 levels. Statistical analysis of this data was performed using Mann-Whitney U tests. Image quality was graded by 2 readers using a semi-objective 4-point scoring system at the same spinal levels. These results were subjected to Wilcoxon Signed-Rank Test for statistical analysis.

RESULTS

The findings show a statistically significant decrease in the radiation dose when using SFCT versus conventional 12-kVp CT. SFCT reduced the computed tomography dose index (CTDI) by 47.4% (-12.5, p<0.0022) and the dose length product (DLP) by 43.3% (-246.7, p<0.0022). Moreover, subjective analysis of image quality demonstrated a statistically significant improvement in image quality at both the C5 and C7 level due to reduction of bone hardening artifact (median=3, p<0.0313).

CONCLUSION

The findings show a significant objective decrease in radiation dose as well as a significant subjective improvement in image quality through reduction of bone hardening artifact in spectral CT versus conventional CT. These results indicate that spectral filtration CT shows great promise in imaging of the cervical spine.

CLINICAL RELEVANCE/APPLICATION

Given the large number of C-Spine imaging referrals, a young patient base, and the potentiality of serious injury, there is a necessity for high-quality, reduced-dose C-Spine imaging in the ER setting.
Musculoskeletal (Foot and Ankle)

Monday, Nov. 30 3:00PM - 4:00PM Location: E450B

SSE14-01 Frondiform Ligament, Sinus Tarsi Bursa and Fluid about the Extensor Digitorum Longus Tendon: MRI Evaluation with Cadaveric Correlation

Participants
Cree M. Gaskin, MD, Keswick, VA (Moderator) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc.;
Kathryn J. Stevens, MD, Menlo Park, CA (Moderator) Nothing to Disclose

Sub-Events

PURPOSE
To describe the association between fluid in the sinus tarsi and fluid about the extensor digitorum longus tendon (EDL) based on MRI and cadaveric studies. The frondiform ligament (FL, also called stem of inferior extensor retinaculum) exits the sinus tarsi to form a sling around the EDL. The sinus tarsi bursa extends between the inferior extensor retinaculum and the dorsolateral talar neck and may communicate with the EDL sheath. We hypothesize that fluid can advance from the sinus tarsi, via the frondiform ligament or sinus tarsi bursa, and surround the EDL, simulating tenosynovitis.

METHOD AND MATERIALS
Patient's MRI studies: All ankle MRIs with key phrases "extensor digitorum longus tenosynovitis" and "sinus tarsi ganglion" as well as 100 consecutive ankle MRIs were retrospectively reviewed. All cases with history of EDL or anterior ankle pathology were excluded.

Cadavers: 2 fresh frozen cadaveric ankle specimen underwent MRI after injection, under ultrasound guidance, of saline solution into EDL tendon sheath and of Gadolinium solution into the sinus tarsi fat.

RESULTS
Patients' MRI studies: Review of 258 MRIs revealed 31 cases (11 males, 20 female, age range 29-83, mean age 54), with sinus tarsi fluid, (15 encapsulated fluid sinus tarsi bursae, 16 non-encapsulated fluid), extending along FL toward EDL. In 30 cases (97%), fluid exited sinus tarsi, along FL, only partially surrounding the EDL. In 1 case fluid encircled the EDL. Most common associated findings included ligamentous injury (n= 10), posterior tibial tendon dysfunction (PTTD) (n = 9), flat-foot (n=6), osteoarthrosis (n= 4).

Cadavers: There was no MR evidence of communication between the EDL tendon sheath, FL or sinus tarsi after saline injection into the tendon sheath. Contrast was noted to exit the sinus tarsi dorsally, along FL, up to the EDL (n=1) and near EDL (n=1) on MRI images obtained after sinus tarsi injection.

CONCLUSION
Fluid within the sinus tarsi can advance via the FL or sinus tarsi bursa and partially or completely surround the EDL. This phenomenon, often seen with ligament injury or PTTD, should not be mistaken for tenosynovitis of EDL.

CLINICAL RELEVANCE/APPLICATION
Learning point: Before making the diagnosis of EDL tenosynovitis, the radiologist should ensure that the fluid is not originating from the sinus tarsi and extending along the FL or sinus tarsi bursa, to simulate tenosynovitis.

SSE14-02 Early Findings of Charcot Arthropathy on MR Imaging

Monday, Nov. 30 3:10PM - 3:20PM Location: E450B

Participants
Lodewijk J. van Holsbeeck, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Noam Belkind, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Viviane Khoury, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
PURPOSE
To retrospectively identify early ligamentous, tendinous, and osseous injuries predictive of joint deformity characteristic of Charcot arthropathy.

METHOD AND MATERIALS
The MR imaging reports database was searched for the word "Charcot"; the 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. From the imaging perspective, only feet were included that had at least two MRI studies, with one study antedating the onset of clinical or imaging evidence of neuropathic deformity. Images were reviewed by a musculoskeletal radiologist with 20 years of experience in consensus with a musculoskeletal fellow 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
Thirteen feet in twelve patients were identified with MR imaging preceding Charcot arthropathy. Six of the neuropathic changes were located at the Lisfranc joint, three at the Chopart joint, one at the metatarsophalangeal joints, and two at a combination of these joints. Findings that preceded the Charcot changes included subchondral bone marrow edema in 10/13, subchondral fracture in 3/13, tear of a supporting ligament in 8/13, and tendinopathy in 3/13. Interestingly, of the 7 patients with eventual Charcot arthropathy at the Lisfranc joint, none had Lisfranc ligament tears on earlier MRI imaging. In general, the pattern of bone marrow edema and ligamentous/tendinous tears demonstrated on early MRI studies predicted the location of eventual Charcot arthropathy.

CONCLUSION
Paying close attention to subchondral and subtle ligamentous findings in diabetic feet can help detect neuropathic changes early, at a stage when these injuries are still manageable conservatively.

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.

SSE14-03  Accessory Anterolateral Talar Facet in Symptomatic and Asymptomatic Populations: Prevalence and Relevant Associated Findings on Ankle MRI

Monday, Nov. 30 3:20PM - 3:30PM Location: E450B

Participants
Ustun Aydinoguz, MD, Ankara, Turkey (Presenter) Speaker, AbbVie Inc; Spouse, Stockholder, Edita Medical Writing Editing Ltd;
Spouse, Employee, Edita Medical Writing Editing Ltd;
O. Melih Topcuoglu, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Aysegul Gormez, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Tijen Cankurtaran, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Elif D. Topcuoglu, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Fatma Bilge Ergen, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the prevalence of and relevant findings associated with the accessory anterolateral talar facet (AALTF), which has been reportedly implicated in talocalcaneal impingement under certain conditions, on ankle MRI in symptomatic and asymptomatic persons.

METHOD AND MATERIALS
This is a case-control study with institutional review board approval. Two observers independently reviewed routine 1.5-T or 3-T MRI (that included -but was not limited to- sagittal T1W and fat-suppressed T2W sequences) of 110 symptomatic ankles (61 right, 49 left) in 100 consecutive patients (54 females, 46 males; age range, 16-79 years [mean, 41.5]) and limited (sagittal T1W and fat-suppressed T2W sequences) 1.5-T MRI of 104 age-, gender-, and side-matched ankles in 104 asymptomatic volunteers for the presence of AALTF (Figure). Exclusion criteria for both symptomatic and asymptomatic groups included history of acute or chronic fracture and/or operation at the ankle, and the presence of a neoplastic bone or soft tissue mass at the ankle. In the asymptomatic group, an additional exclusion criterion was the presence of any injury (including sprain) to the ankle in the last 30 days. Calcaneal cortical thickness, and talar or calcaneal fibrocystic and/or edema-like bone marrow changes at the critical angle of Gissane were noted.

RESULTS
There was no statistically significant difference between the symptomatic and asymptomatic populations with respect to age (mean and distribution), gender, and ankle side. AALTF was present in 36 symptomatic ankles (32.7%) versus 27 asymptomatic (26.0%) ankles (P=0.297). Interobserver agreement was very good (kappa=0.851, 95% CI=0.772-0.929) for the detection of AALTF. Subjacent talar bone marrow edema-like change was significantly more frequent in persons with AALTF (P<0.0001), while chronic reactive osseous changes at Gissane angle were not (P>0.05).

CONCLUSION
Higher prevalence of AALTF on MRI in symptomatic versus asymptomatic ankles is not statistically significant. AALTF may be associated with subjacent talar bone marrow edema-like change.

CLINICAL RELEVANCE/APPLICATION
Accessory anterolateral talar facet, which has been reported to have a role in talocalcaneal impingement, is identified on MRI in one quarter of asymptomatic persons and may be associated with subjacent bone marrow edema-like change in both symptomatic and asymptomatic populations.

SSE14-04  Association of Superior Peroneal Retinaculum Abnormalities with Lateral Ankle Ligament Injuries
Bone Bruise vs. Non-displaced Fracture at MRI: A Novel Grading System to Guide Reporting and Predict Return to Play

Monday, Nov. 30 3:40PM - 3:50PM Location: E450B

Participants
Blake Bowden, Philadelphia, PA (Presenter) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Peter F. DeLuca, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Johannes B. Roedi, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
James M. McCrossin, MS, Voorhees, NJ (Abstract Co-Author) Nothing to Disclose
Sandra Rutigliano, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
MRI is the standard of care imaging modality for suspected radiographically occult fracture from direct trauma. To date, MR criteria for bone contusion vs. fracture are not well established. We sought to generate an algorithm using MR to grade traumatic nondisplaced osseous injury in a cohort of athletes with trauma by correlating specific MR findings and imaging patterns with clinical scenarios and return to play (RTP).

METHOD AND MATERIALS
20 MR exams of the lower extremity (1.5T, extremity coil, 16 initial, 4 follow-up) in 15 professional hockey players with direct trauma and normal radiographs were reviewed by 2 MSK radiologists blinded to additional clinical information. Bone marrow edema (BME) was graded as 1=patchy/ill defined, 2=focal and mild, 3=focal and intense, 4=intense throughout bone. Marrow replacement on T1 weighted sequences was observed along with small and large regions of linear or curvilinear hypointensity. Presence and number of cortical breeches were observed as well as microtrabecular disruption, soft tissue contusion and hematoma. Locations of osseous injury were categorized as weight-bearing or not, and subchondral or not.

RESULTS
MRIs included 9 foot, 6 ankle and 1 proximal tibia. Mean interval from injury to MR was 0.8 days and mean interval to follow-up MR was 10.3 days. Mean RTP for athletes with any linear hypointensity on MR was 10.8 days vs. 7.5 days for those without (a=.267 unpaired t-test) and there was no difference in RTP for small vs large or curvilinear hypointensities. Mean RTP for athletes with T1 marrow replacement and grade 3 marrow edema in a weight-bearing location on MRI was 13.5 days vs. 4.2 days those without (a=.040). Subchondral lesions had a slightly longer RTP without statistical significance. 6 subjects had CT and all were observed as normal. No cortical breeches were observed. 3/4(75%) subjects with grade 1 BME had a RTP within 2 days. Soft tissue edema and hematoma did not correlate with RTP.
CONCLUSION
The MRI constellation of T1 marrow replacement, grade 3 BME and weight-bearing location correlates with a longer return to play than other MRI findings including linear hypointensities and microtrabecular disruption, and can be reported as nondisplaced fracture.

CLINICAL RELEVANCE/APPLICATION
With non-displaced traumatic osseous injury, MRI should be interpreted as non-displaced fracture when focal intense subcortical bone marrow edema is accompanied by T1 marrow replacement.

SSE14-06 Association of Tarsal Tunnel Disease with Medial Hindfoot Coalitions

CONCLUSION
The MRI constellation of T1 marrow replacement, grade 3 BME and weight-bearing location correlates with a longer return to play than other MRI findings including linear hypointensities and microtrabecular disruption, and can be reported as nondisplaced fracture.

CLINICAL RELEVANCE/APPLICATION
With non-displaced traumatic osseous injury, MRI should be interpreted as non-displaced fracture when focal intense subcortical bone marrow edema is accompanied by T1 marrow replacement.

SSE14-06 Association of Tarsal Tunnel Disease with Medial Hindfoot Coalitions

CONCLUSION
The MRI constellation of T1 marrow replacement, grade 3 BME and weight-bearing location correlates with a longer return to play than other MRI findings including linear hypointensities and microtrabecular disruption, and can be reported as nondisplaced fracture.

CLINICAL RELEVANCE/APPLICATION
With non-displaced traumatic osseous injury, MRI should be interpreted as non-displaced fracture when focal intense subcortical bone marrow edema is accompanied by T1 marrow replacement.

SSE14-06 Association of Tarsal Tunnel Disease with Medial Hindfoot Coalitions

CONCLUSION
The MRI constellation of T1 marrow replacement, grade 3 BME and weight-bearing location correlates with a longer return to play than other MRI findings including linear hypointensities and microtrabecular disruption, and can be reported as nondisplaced fracture.

CLINICAL RELEVANCE/APPLICATION
With non-displaced traumatic osseous injury, MRI should be interpreted as non-displaced fracture when focal intense subcortical bone marrow edema is accompanied by T1 marrow replacement.
ISP: Musculoskeletal (MR Evaluation of Nerves)

Monday, Nov. 30 3:00PM - 4:00PM Location: E451B

Participants
Gustav Andreisek, MD, Zurich, Switzerland (Moderator) 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; Speaker, Guerbet SA; Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, 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; 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;
Anne Cotten, MD, Lille, France (Moderator) Nothing to Disclose

Sub-Events

SSE15-01 Musculoskeletal Keynote Speaker: MRI Evaluation of Nerves-Application and Implementation

Monday, Nov. 30 3:00PM - 3:20PM Location: E451B

Participants
Sandip Biswal, MD, Stanford, CA (Presenter) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

ABSTRACT

MR imaging of the peripheral nerves and brachial/lumbosacral plexi has become an important tool in the evaluation and workup of the chronic pain patient. High-quality imaging of these structures is now consistently possible due to technical improvements in field strength, coil, and pulse sequence technology. This imaging approach is able to highlight inflammatory (e.g. neuritis) and physical (e.g. impingement, mass lesions) changes in the nerves. We will review the technical requirements for imaging the peripheral nervous system, discuss the imaging findings nerve injury/inflammation and provide examples of normal and pathologic cases.


Monday, Nov. 30 3:20PM - 3:30PM Location: E451B

Participants
Andrei Manoliu, MD,PhD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Micheal Ho, Zurich, Switzerland (Presenter) Nothing to Disclose
Evelyn Dappa, Mainz, Germany (Abstract Co-Author) Nothing to Disclose
Andreas Boss, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Daniel Nanz, PhD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Felix P. Kuhn, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE

Panoramical radiographs or cone-beam CT images are the current standard-of-care to assess teeth, mandibular, and mandibular canal pathologies, but do not allow assessment of the mandibular nerve itself nor of its branches. Most recent MR technologies allow cortical bone imaging as well as dedicated MR neurography of the peripheral nerves. We propose a technique for "MR neurographic orthopantomograms" exploiting UTE imaging of bone and teeth complemented with high-resolution morphological and functional MR neurography.

METHOD AND MATERIALS

IRB approved study in 10 healthy volunteers. The whole mandibles were imaged at 3.0T (Skyra, Siemens Healthcare) using a 64-channel head coil with isotropic spatial resolution (0.9x0.9x0.9mm) for subsequent multi-planar reformatting. Bone images were acquired using a 3D UTE PETRA sequence (echo time, 0.07ms; acquisition time, 4:56min). Morphological nerve imaging was accomplished with a 3D PSIF sequence with diffusion-based suppression of small blood vessel signals (4:16min) and with a 3D SPACE STIR sequence (9:23 min). Functional MR neurography was accomplished using a new accelerated diffusion tensor imaging technique (2D RESOLVE multiband prototype sequence = diffusion-weighted and readout-segmented echo planar imaging with blipped CAIPIRINHA and simultaneous two-slice acquisitions) (9:34min). Qualitative and quantitative image analysis was performed.

RESULTS

Image acquisition and subsequent post-processing into 'MR neurographic orthopantomogram' by overlay of morphological and functional images were feasible in all 10 volunteers without artifacts. All teeth, mandibular bones and mandibular nerves were assessable and normal. Fiber tractography with quantitative evaluation of physiological diffusion properties of mandibular nerves yielded the following mean±SD values: FA, 0.43±0.05; mean diffusivity (mm²/s), 0.0043 ±0.0003; radial diffusivity, 0.0034±0.0002, and axial diffusivity, 0.0021±0.0001.

CONCLUSION

The proposed technique of 'MR neurographic orthopantomogram' exploiting UTE imaging complemented with high-resolution...
Clinical indications included trauma (n=4), hereditary neuropathy (n=1), pain (n=7), winged scapula (n=5), Parsonage Turner syndrome (n=1) and mass (n=1). The long thoracic was not confidently identified in all exams in the anterior scalene triangle, retroclavicular space or lateral chest wall. In 3/18, electrodiagnostic studies showed evidence of denervation in the serratus anterior muscle while MRN revealed denervation in the serratus anterior (44% (8/18)), trapezius (22% (4/18)) and rhomboid (5% (1/18)).

RESULTS
Of 122 consecutive studies, substantial alteration of the pre-imaging clinical impression was found in 30 cases (24.6%). The therapeutic management was likewise affected substantially in 27 cases (22.1%).

CONCLUSION
No consecutive series of brachial plexus MRN findings this large has been reported. We show that this examination can significantly impact diagnostic evaluation and clinical treatment of patients with upper extremity neurologic lesions.

Clinical indications included trauma (n=4), hereditary neuropathy (n=1), pain (n=7), winged scapula (n=5), Parsonage Turner syndrome (n=1) and mass (n=1). The long thoracic was not confidently identified in all exams in the anterior scalene triangle, retroclavicular space or lateral chest wall. In 3/18, electrodiagnostic studies showed evidence of denervation in the serratus anterior muscle while MRN revealed denervation in the serratus anterior (44% (8/18)), trapezius (22% (4/18)) and rhomboid (5% (1/18)).

METHOD AND MATERIALS
All consecutive brachial plexus MRN examinations performed at 1.5T using a uniform protocol at our institution between 6/1/2013 and 10/31/2014 were examined retrospectively. Relevant clinical data were collected. Effects on the pre-imaging clinical diagnosis and therapeutic management were classified as no change, mild change, or substantial change. A separate disease etiology, significant and previously unknown incidental findings, or marked deviation from expected degree of severity were classified as substantial changes. Changes in management from conservative to surgical and vice versa were classified as substantial.

RESULTS
Of 122 consecutive studies, substantial alteration of the pre-imaging clinical impression was found in 30 cases (24.6%). The therapeutic management was likewise affected substantially in 27 cases (22.1%).

CONCLUSION
No consecutive series of brachial plexus MRN findings this large has been reported. We show that this examination can significantly impact diagnostic evaluation and clinical treatment of patients with upper extremity neurologic lesions.

METHOD AND MATERIALS
All consecutive brachial plexus MRN examinations performed at 1.5T using a uniform protocol at our institution between 6/1/2013 and 10/31/2014 were examined retrospectively. Relevant clinical data were collected. Effects on the pre-imaging clinical diagnosis and therapeutic management were classified as no change, mild change, or substantial change. A separate disease etiology, significant and previously unknown incidental findings, or marked deviation from expected degree of severity were classified as substantial changes. Changes in management from conservative to surgical and vice versa were classified as substantial.

RESULTS
Of 122 consecutive studies, substantial alteration of the pre-imaging clinical impression was found in 30 cases (24.6%). The therapeutic management was likewise affected substantially in 27 cases (22.1%).

CONCLUSION
No consecutive series of brachial plexus MRN findings this large has been reported. We show that this examination can significantly impact diagnostic evaluation and clinical treatment of patients with upper extremity neurologic lesions.

METHOD AND MATERIALS
All consecutive brachial plexus MRN examinations performed at 1.5T using a uniform protocol at our institution between 6/1/2013 and 10/31/2014 were examined retrospectively. Relevant clinical data were collected. Effects on the pre-imaging clinical diagnosis and therapeutic management were classified as no change, mild change, or substantial change. A separate disease etiology, significant and previously unknown incidental findings, or marked deviation from expected degree of severity were classified as substantial changes. Changes in management from conservative to surgical and vice versa were classified as substantial.

RESULTS
Of 122 consecutive studies, substantial alteration of the pre-imaging clinical impression was found in 30 cases (24.6%). The therapeutic management was likewise affected substantially in 27 cases (22.1%).

CONCLUSION
No consecutive series of brachial plexus MRN findings this large has been reported. We show that this examination can significantly impact diagnostic evaluation and clinical treatment of patients with upper extremity neurologic lesions.

METHOD AND MATERIALS
All consecutive brachial plexus MRN examinations performed at 1.5T using a uniform protocol at our institution between 6/1/2013 and 10/31/2014 were examined retrospectively. Relevant clinical data were collected. Effects on the pre-imaging clinical diagnosis and therapeutic management were classified as no change, mild change, or substantial change. A separate disease etiology, significant and previously unknown incidental findings, or marked deviation from expected degree of severity were classified as substantial changes. Changes in management from conservative to surgical and vice versa were classified as substantial.

RESULTS
Of 122 consecutive studies, substantial alteration of the pre-imaging clinical impression was found in 30 cases (24.6%). The therapeutic management was likewise affected substantially in 27 cases (22.1%).

CONCLUSION
No consecutive series of brachial plexus MRN findings this large has been reported. We show that this examination can significantly impact diagnostic evaluation and clinical treatment of patients with upper extremity neurologic lesions.
CONCLUSION
Despite high resolution MRN, the long thoracic nerve is not confidently identified, though secondary signs including denervation are detected and add to EMG findings.

CLINICAL RELEVANCE/APPLICATION
MRN can serve as an adjunct clinical tool to electrodiagnostic testing for the evaluation of secondary signs of long thoracic neuropathy.

SSE15-06 Diffusion Weighted Imaging(DWI) and Neurography(DWN) of Human Lumbar Nerve Roots: Quantitative and Morphological Assessments of Nerve Roots Compression in Lumbar

Monday, Nov. 30 3:50PM - 4:00PM Location: E451B

Participants
Qingwei Song, MD, Dalian, China (Presenter) Nothing to Disclose
Meiyu Sun, Dalian, China (Abstract Co-Author) Nothing to Disclose
Li Na Zhang, MD, Dalian, China (Abstract Co-Author) Nothing to Disclose
Bin Xu, BA, Dalian, China (Abstract Co-Author) Nothing to Disclose
Ailian Liu, MD, Dalian, China (Abstract Co-Author) Nothing to Disclose
Ziheng Zhang, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the application of DWI in the assessment of lumbosacral nerve root ganlias compression in lumbar intervertebral disc herniation through structural visualization, morphological analysis and the computed quantitative ADC values.

METHOD AND MATERIALS
This prospective study was approved by our Institutional Review Board and the written informed consent of each attendee was obtained. 30 lumbar intervertebral disc herniation:patients:(mean age=49.9 years, range=17-78 years; 20 male: 10 female) , with low back pain and confirmation from the conventional MR imaging were recruited. The original DW images and the reconstructed 3D maximum intensity projection (MIP) images of the L4/L5 and L5/S1 lumbosacral nerve ganglions were:blindly reviewed by two experienced radiologists. The morphologic parameters, i.e. nerve ganglions length, midpoint width and areas, of L4/L5 and L5/S1 were measured from the 3D MIP images and the ADC values of nerve ganglions were measured from the ADC maps generated by workstation, Functool 4.4. All the measured values of the compressed nerve roots and ganglions were statistically compared with the contralateral using t-test.

RESULTS
The high performance of DWI on showing the lumbosacral nerve roots, dorsal ganglions, and especially the postganglionic nerves of L4/L5 and L5/S1 assured the assessment of the interrelation between the nerve roots and the herniated intervertebral disc. No significant difference was observed from the values of the two sides of the L4 nerve ganglions’ length, midpoint width and area and ADC for L3/L4 herniation. However, for L5/S1 herniation, the length and area of the compressed nerve ganglions of L5 and S1 were significantly bigger than the contralateral (t=10.39, p<0.05), and the ADC values of L5 and S1 were significantly higher than the contralateral (t=13.06, P<0.05).

CONCLUSION
DWI can clearly display the lumbosacral nerves roots and ganglions. The qualitative morphological analysis through 3D MIP reconstruction and the quantitative measurements of the ADC value of nerves ganglions were substantially contributed to the evaluation of the compression of nerve roots and ganglions for the patients with lumbar intervertebral disc herniation.

CLINICAL RELEVANCE/APPLICATION
DWI should be in the setting of the scanning protocol for the diagnosis of the nerve roots and ganglions disorders
Musculoskeletal Tuesday Case of the Day

Tuesday, Dec. 1 7:00AM - 11:59PM Location: Case of Day, Learning Center

Participants
William F. Conway, MD, PhD, Charleston, SC (Presenter) Nothing to Disclose
Russell W. Chapin, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Robert H. Hazelrigg, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Thomas Britt, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Nathaniel Jones, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Kevin G. Garrett, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew R. Gillett, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew P. Brill, DO, Oklahoma City, OK (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.
RSNA Diagnosis Live™: 'Tic Tac D’Oh' - Test Your Diagnostic Skills at the Crack of Dawn

Tuesday, Dec. 1 7:15AM - 8:15AM Location: E451B

CA  GI  HN  MK  NR

AMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Adam E. Flanders, MD, Penn Valley, PA (Presenter) Nothing to Disclose
Christopher G. Roth, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Sandeep P. Deshmukh, MD, Philadelphia, PA, (sandeep.deshmukh@jefferson.edu) (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.
Participants
Martin Torriani, MD, Boston, MA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) To discuss how MRI-based cartilage mapping techniques yield biomarkers of cartilage integrity, and discuss the technical
requirements and current indications for clinical use of these methods. 2) To describe the emerging capabilities of high-resolution
MR imaging to examine bone microarchitecture and its potential in providing biomarkers of bone strength. 3) To discuss potential
applications of MR spectroscopy in musculoskeletal neoplasms and fat quantification of musculoskeletal tissues such as marrow and
muscle.

ABSTRACT
There is strong incentive to increase the role of quantitative techniques in clinical musculoskeletal imaging, especially applications
related to cartilage health, bone structure, tumor and metabolic imaging. This Hot Topic session will discuss clinical applications of
biomarkers of cartilage integrity (T1rho, T2, T2* and dGEMRIC), bone structure by high-resolution MRI, and tissue metabolism (MR
spectroscopy for tumor imaging, muscle and marrow fat content).

Sub-Events
SPSH30A  T2, T2*, T1rho and dGEMRIC as Biomarkers of Cartilage Integrity

Participants
Thomas M. Link, MD, PhD, San Francisco, CA, (thomas.link@ucsf.edu) (Presenter) Research funded, General Electric Company;
Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

LEARNING OBJECTIVES
1) To define how T2, T2*, T1rho and dGEMRIC quantitatively assess cartilage matrix composition. 2) To describe the requirements
for applying these quantitative measurements to clinical imaging. 3) To critically assess previous clinical studies and list indications
for using quantitative cartilage imaging biomarkers.

SPSH30B  Bone Microarchitecture by MRI

Participants
Gregory Chang, MD, New York, NY (Presenter) Speaker, Siemens AG

LEARNING OBJECTIVES
1) To define bone microarchitecture and its contribution to bone strength and fracture risk. 2) To describe the technical
requirements for MRI of bone microarchitecture, including hardware, pulse sequences, and image post-processing. 3) To provide an
overview of clinical studies of MRI of bone microarchitecture.

SPSH30C  MR Spectroscopy of the Musculoskeletal System

Participants
Martin Torriani, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To define how MR spectroscopy quantitatively measures tissue biochemistry. 2) To describe general guidelines for usage of MR
spectroscopy in musculoskeletal clinical imaging, including technical factors, quantification/analysis and interpretation. 3) To assess
the state-of-the-science in regards to the use of MR spectroscopy for musculoskeletal tissues.
RC304

MUSCULOSKELETAL SERIES: ULTRASOUND

Tuesday, Dec. 1 8:30AM - 12:00PM Location: E450A

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credits ™: 3.25

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Moderator) Consultant, General Electric Company Consultant, Koninklijke Philips NV Stockholder, Koninklijke Philips NV Stockholder, General Electric Company Grant, Siemens AG Grant, General Electric Company
Jon A. Jacobson, MD, Ann Arbor, MI, (jjacobsn@umich.edu) (Moderator) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ;

LEARNING OBJECTIVES

1) The 'Ultrasound' Series Course will review musculoskeletal sonography through live instruction by expert refresher course instructors, interspersed with scientific presentations.

Sub-Events

RC304-01 Elbow Ultrasound (Demonstration)

Tuesday, Dec. 1 8:30AM - 9:00AM Location: E450A

Participants
Jon A. Jacobson, MD, Ann Arbor, MI (Presenter) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ;

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jon A. Jacobson, MD - 2012 Honored Educator

RC304-02 Ultrasound of the Distal Biceps Brachii Tendon Using Four Approaches: Reproducibility and Reader Preference

Tuesday, Dec. 1 9:00AM - 9:10AM Location: E450A

Participants
Shefali P. Kothary, MD, New York, NY (Presenter) Nothing to Disclose
Theodore T. Miller, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Gabrielle P. Konin, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Ogonna K. Nwawka, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Yoshimi Endo, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Gregory R. Saboeiro, MD, New York, NY (Abstract Co-Author) Research funded, Terumo Corporation Speakers Bureau, Bioventus LLC

PURPOSE

To determine which sonographic appearance of the distal biceps tendon is preferred by readers and if images obtained by two different operators are reproducible.

METHOD AND MATERIALS

An IRB approved, HIPAA compliant prospective study was performed evaluating the distal biceps brachii tendon in 40 elbows in 20 volunteers. The subjects had no history of biceps injury or abnormality, and were without antecubital pain. There were 8 males and 12 females, ages 24 to 67 years (mean age of 37) with a body mass index (BMI) of 18.3 to 31.1 (mean BMI of 24.7). Distal biceps brachii tendons of each subject were scanned in long axis using a 6-15 MHz linear transducer on a GE Logic 9 by two experienced musculoskeletal radiologists independently (operator A and B) using four different approaches: anterior, lateral, medial, and posterior. Five musculoskeletal radiologists independently reviewed the static images, and ranked the 4 approaches based on overall combination of echogenicity of the tendon, visualized length, and visualization of the insertion.

RESULTS

The appearance of the distal tendon obtained via the medial approach was preferred by readers in 78.5% (314/400) of cases (74.5% performed by operator A and 82.5% performed by operator B). The anterior approach was preferred by readers in 19.25% (77/400) of cases (24.0% by operator A and 14.5% by operator B). The lateral approach was preferred in 2.25% (9/400) of cases (1.5% by operator A and 3% by operator B), and the posterior approach was never preferred.

CONCLUSION

The appearance of the distal biceps brachii tendon using the medial approach is preferred by readers and is reproducible between different operators.

CLINICAL RELEVANCE/APPLICATION
When sonographically evaluating the elbow for suspected pathology of the distal biceps tendon, the medial approach should be the primary method of visualization, supplemented by the other approaches if necessary.

**RC304-03 Shear Wave Elastography (SWE) Improves Treatment Monitoring of Patients with Tendinopathies**

*Tuesday, Dec. 1 9:10AM - 9:20AM Location: E450A*

**Participants**
Timm Dimrichs, Aachen, Germany (Presenter) Nothing to Disclose
Christian K. Kuhl, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Valentin Quack, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Simone Schrading, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
It has been shown that SWE is useful for the evaluation of tendinopathies. Purpose of this prospective clinical study was to analyze the correlation between clinical symptoms and tendon stiffness in patients undergoing treatment of tendinopathies. Aim is to establish SWE as tool for monitoring tendon healing under therapy.

**METHOD AND MATERIALS**
Prospective study in 35 patients with 47 symptomatic tendons (17 Achilles, 15 patellar tendons and 15 humeral epicondylitis) who underwent a standardized multi-modality US protocol consisting of B-mode US, power Doppler (PD-US), and SWE, using a high-resolution linear 15 MHz probe (Aixplorer, Supersonic). All patients underwent this multi-modality US protocol three times: prior to any therapy, after 4 week of therapy and after 6 months of therapy. At each visit, patients were seen by an orthopedic surgeon who ranked the patients’ clinical symptoms by standardized orthopedic scores (VISA-A, VISA-P, DASH). Clinical scores of symptom severity were correlated with ultrasound findings by using the Spearman correlation.

**RESULTS**
Clinical scores revealed symptom relief in 46.8% (22/47) of patients after 4 weeks and in 68.0% (32/47) after 6 months. A change of structural tendon abnormalities as observable by B-mode US was detectable in one single patient after 4 weeks (1/22; 4.5%) as well as after 6 months (1/32; 3.1%). A decrease in neovascularization as observed by PD-US was detectable in 9 patients after 4 weeks (9/22; 40.9%) and in 13 patients after 6 months (13/32; 39.4%). An increase in tendon stiffness as determined by SWE was found in 18 patients after 4 weeks (18/22; 81.8%) and in 28 patients after 6 months (28/32; 90.6%). At quantitative analysis, the 32 patients whose clinical symptoms improved exhibited an increase of mean SWE values by 23 kPa (from 41.7 to 64.2 kPa) after 4 weeks and by 64 kPa (from 41.7 to 105.5 kPa) after 6 months. Clinical scores correlated poorly with findings at B-mode (r = 0.24), moderately with findings at PD-US (r = 0.59), and perfectly with findings made at SWE (r = 0.80).

**CONCLUSION**
Shear wave elastography correlates better with clinical symptoms and seems to display tendon healing better and earlier than B-mode and Power Doppler.

**CLINICAL RELEVANCE/APPLICATION**
Shear wave elastography appears to be useful to guide treatment and to develop new treatment approaches in patients with tendinopathies.

**RC304-04 Delayed Onset Muscle Soreness (DOMS) after Eccentric Resistance Training of the Elbow Flexor Muscles: Temporal Evolution of MRI, Diffusion Tensor Imaging and Ultrasound Shear-Wave Elastography Findings**

*Tuesday, Dec. 1 9:20AM - 9:30AM Location: E450A*

**Participants**
Christoph A. Agten, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Florian M. Buck, MD, Langnau am Albis, Switzerland (Abstract Co-Author) Nothing to Disclose
Linda Dyer, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Abstract Co-Author) Advisory Board, Siemens AG; Consultant, Medtronic, Inc
Andrea Reskojph, MD, Zurich, Switzerland (Presenter) Nothing to Disclose

**PURPOSE**
To evaluate the appearance of DOMS over time using fluid-sensitive and diffusion-weighted MRI sequences, diffusion-tensor imaging (DTI) and ultrasound (US) shear-wave elastography in healthy volunteers.

**METHOD AND MATERIALS**
Prospective study in 35 patients with 47 symptomatic tendons (17 Achilles, 15 patellar tendons and 15 humeral epicondylitis) who underwent a standardized multi-modality US protocol consisting of B-mode US, power Doppler (PD-US), and SWE, using a high-resolution linear 15 MHz probe (Aixplorer, Supersonic). All patients underwent this multi-modality US protocol three times: prior to any therapy, after 4 week of therapy and after 6 months of therapy. At each visit, patients were seen by an orthopedic surgeon who ranked the patients’ clinical symptoms by standardized orthopedic scores (VISA-A, VISA-P, DASH). Clinical scores of symptom severity were correlated with ultrasound findings by using the Spearman correlation.

**RESULTS**
Clinical scores revealed symptom relief in 46.8% (22/47) of patients after 4 weeks and in 68.0% (32/47) after 6 months. A change of structural tendon abnormalities as observable by B-mode US was detectable in one single patient after 4 weeks (1/22; 4.5%) as well as after 6 months (1/32; 3.1%). A decrease in neovascularization as observed by PD-US was detectable in 9 patients after 4 weeks (9/22; 40.9%) and in 13 patients after 6 months (13/32; 39.4%). An increase in tendon stiffness as determined by SWE was found in 18 patients after 4 weeks (18/22; 81.8%) and in 28 patients after 6 months (28/32; 90.6%). At quantitative analysis, the 32 patients whose clinical symptoms improved exhibited an increase of mean SWE values by 23 kPa (from 41.7 to 64.2 kPa) after 4 weeks and by 64 kPa (from 41.7 to 105.5 kPa) after 6 months. Clinical scores correlated poorly with findings at B-mode (r = 0.24), moderately with findings at PD-US (r = 0.59), and perfectly with findings made at SWE (r = 0.80).

**CONCLUSION**
Shear wave elastography correlates better with clinical symptoms and seems to display tendon healing better and earlier than B-mode and Power Doppler.

**CLINICAL RELEVANCE/APPLICATION**
Shear wave elastography appears to be useful to guide treatment and to develop new treatment approaches in patients with tendinopathies.
and maximal extension deficit was achieved after 2 days. Tension feeling started 15 min post-training and normalized after 7 days.

CONCLUSION

Muscles changes can be detected 15 minutes after eccentric resistance training using diffusion-MRI and US shear-wave elastography. FA correlates negatively with subjective pain symptoms in men. ADC shows changes earlier than fluid-sensitive-MR sequences.

CLINICAL RELEVANCE/APPLICATION

ADC and US-elastography are recommended when looking for very early muscle changes after eccentric muscle exercise.

RC304-05  Ultrasound of the Post-arthroplastic Hip

Tuesday, Dec. 1 9:30AM - 9:40AM Location: E450A

Participants
David Robinson, BSC, Hampton East, Australia (Presenter) Nothing to Disclose
Steven Lee, FRANZCR, Windsor, Australia (Abstract Co-Author) Nothing to Disclose
Paul Marks, FRANZCR, Box Hill, Australia (Abstract Co-Author) Nothing to Disclose
Michal Schneider, PhD, Clayton, Australia (Abstract Co-Author) Nothing to Disclose

PURPOSE

Ultrasound has been recommended as an imaging modality in the follow-up of hip replacement surgery. However, no descriptions of typical ultrasound appearances of the major pathologies that may afflict the hip replacement have been published to date. We set out to characterize ultrasound findings of the post-arthroplastic hip.

METHOD AND MATERIALS

Patients presenting to the department for routine follow-up imaging of their hip prosthesis were consecutively recruited. Ultrasound imaging was performed of the anterior and posterior prosthesis and of the iliopectos bursa and tendon.

RESULTS

Fifty two patients were prospectively recruited with a mean (±SD) age of 60.4 (±12) years. Twelve patients had bilateral hip prostheses, giving 64 hips for analysis. There were 45 Birmingham hip resurfacings (BHR), ten MITCH, five Articular Surface Replacement (ASR), three Total Hip Replacements (THR) and one ADEPT hip resurfacing. Mean age of the prosthesis in situ was 8.2 years. Ultrasound was able to reliably image the soft tissues of all hips. The average (±SD) maximal antero-posterior (AP) synovial thickness was 6.5 (± 7) millimeters and the AP Iliopsoas tendon measurement was 4.8 (± 0.94) millimeters. Forty four hips presented with normal ultrasonic appearances. There were 15 iliopsoas bursal effusions ranging from mild (a trace of fluid surrounding the ilipsoas tendon), to very large (fluid-filled masses anterosuperior to the prosthesis). Four hips showed enlargement of the prosthesis-to-bone "step" possibly indicating the process of osteolytic femoral neck thinning. One hip demonstrated mild synovial thickening at the anterior recess.

CONCLUSION

Ultrasound is able to detect and evaluate a range of soft tissue pathologies about the post-prosthetic hip, such as fluid or effusion of the iliopsoas bursa, iliopsoas tendon thickening and heterogeneity, synovial thickening of the anterior and posterior hip joint recesses. Ultrasound imaging has an important role to play in the follow-up of the post-prosthetic hip.

CLINICAL RELEVANCE/APPLICATION

Ultrasound of the post-prosthetic hip can demonstrate abnormalities during follow up and may serve as a useful tool in the management of patients with hip replacements.

RC304-06  Hip Ultrasound (Demonstration)

Tuesday, Dec. 1 9:40AM - 10:10AM Location: E450A

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Presenter) Consultant, General Electric Company Consultant, Siemens AG Consultant, Koninklijke Philips NV Stockholder, Koninklijke Philips NV Stockholder, General Electric Company Grant, Siemens AG Grant, General Electric Company
Kathy Quenneville, BS, RT, Commerce Township, MI, (kathyq@rad.hfh.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the osseous landmarks that guide the diagnostic work up of an adult hip. 2) Practice a step by step approach in the evaluation of anterior hip pain. 3) Rationalize the individual steps for the hip dynamic examination.

RC304-07  Ankle and Foot Ultrasound (Demonstration)

Tuesday, Dec. 1 10:20AM - 10:50AM Location: E450A

Participants
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Presenter) Speaker, General Electric Company; Equipment support, Siemens AG;

LEARNING OBJECTIVES

View learning objectives under main course title.

RC304-08  Semi-Quantitative Sonoelastography of Inflammatory Myopathies: Comparison with Clinical Examination, Magnetic Resonance (MR) Imaging, and Pathologic Finding

Tuesday, Dec. 1 10:50AM - 11:00AM Location: E450A
PURPOSE
To evaluate real-time sonoelastography (SE) in patients with inflammatory myopathies compared to clinical examination, MR imaging, and pathologic finding.

METHOD AND MATERIALS
The study was approved by the institutional review board, and informed consent was waived. Seventeen lesions of 16 consecutive patients with inflammatory myopathies (5 men, 11 women; mean age, 41 years; range, 11-67 years) were assessed with real-time SEL using Hitachi EUB-7500 ultrasound (US) system and software for elastography. Elastogram was obtained using freehand manipulation, compressing areas which were correlated with active inflammation on MR imaging. Using dedicated software for color information from the elastographic images, the relative strains for target muscle and reference muscle were measured. All lesions were underwent an US-guided percutaneous biopsy. The US and MR images were analyzed in conjunction with clinical symptom and biochemical data.

RESULTS
The strain ratio of target muscle was higher than adjacent muscle (mean 3.14; range, 0.95-5.93). There was no significant agreement between the strain ratios of the color parameters and the biochemical data. Sixteen of 17 specimens (94.1%) were confirmed by inflammatory myopathies. One lesion (5.9%) shows well preserved muscle fiber with few lymphocytes infiltration.

CONCLUSION
Muscle hardness as semi-quantitative measured by SEL, was increased in cases of inflammatory myopathies. The correlation between strain ratio from the elastographic images and the pathologic data suggest that SEL could be an important tool not only in the diagnosis but also in the management of the patients with inflammatory myopathies.

CLINICAL RELEVANCE/APPLICATION
High strain ratio could add knowledge regarding early development of inflammatory myopathy, which might have an impact on guidance before US-guided procedure to improve success rate for biopsy.

RC304-09 Real-time Sonoelastography Evaluation of the Achilles Tendon Following Ultrasound-guided Platelet-rich Plasma Injection for Re refractory Achilles Tendinopathy

Tuesday, Dec. 1 11:00AM - 11:10AM Location: E450A

Participants
Chin Chin Ooi, MMEdSc,BSc, Singapore, Singapore (Presenter) Nothing to Disclose
Michal Schneider, PhD, Clayton, Australia (Abstract Co-Author) Nothing to Disclose
Peter Malliras, Melbourne, Australia (Abstract Co-Author) Nothing to Disclose
David Connell, Melbourne, Australia (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the clinical feasibility of sonoelastography (SE) in depicting changes in Achilles tendon stiffness following platelet-rich plasma (PRP) injection for Achilles tendinopathy, and to correlate SE findings with clinical outcome at 12 months post-injection.

METHOD AND MATERIALS
Between January 2013 and January 2014, consecutive patients with unilateral refractory Achilles tendinopathy were enrolled. B-mode ultrasound (US), color Doppler (CD) and SE were performed at baseline, 4-6 weeks, 6 months and 12 months post treatment. The strain ratio (strain value between Achilles tendon and Kager's fat) during SE, and the proportion of tendons with intratendinous hypoehogenicities and neovascularities were documented. Clinical outcomes were assessed by the Victorian Institute of Sport Assessment-Achilles (VISA-A) questionnaire at all time points and correlated with the sonographic findings.

RESULTS
Forty-five Achilles tendons from 45 patients (33 males, 12 females, mean age 51, mean symptom duration 15.3 months) were examined. The clinical VISA-A improved significantly from 38.4 (±14.1) at baseline, 77.2 (±12.5) at 6 months (p <0.001) to 81.2 (±10.8) at 12 months (p <0.001). The mean strain ratio values were 2.16 (±1.42) at baseline, 2.03 (±0.67) at 4-6 weeks, 1.81 (±0.62) at 6 months and 1.19 (±0.34) at 12 months with a significant reduction observed at 6 months (p =0.006) and 12 months (p <0.001) whereas a significant change in the distribution of tendons with hypoehogenicities was only observed at 12 months in comparison to baseline (p <0.001). At 12 months evaluation, none of the tendons regained a normal echotexture despite improvement in VISA-A. Strain ratio demonstrated a significant moderate correlation with VISA-A (r =-0.610, p <0.001) while B-mode and CD US did not show a significant correlation (r =-0.041, p =0.817, and r =-0.116, p =0.514).

CONCLUSION
The treated Achilles tendons showed progressive stiffening, along with improvement in clinical findings up to one year follow-up. SE using strain ratio could be a promising supplementary tool for monitoring the progress of Achilles tendon healing after treatment.

CLINICAL RELEVANCE/APPLICATION
The supplementation of SE to conventional US may improve the specificity in routine monitoring of Achilles tendon healing and provide more objective data for safer return to activities.

RC304-10 Comparison of Ultrasound Guided Collagenase Clostridium Histolyticum Injections and Blinded Injections for the Treatment of Dupuytren’s Contracture
Collagenase clostridium histolyticum (collagenasa) injections have been proven an effective, safe treatment for Dupuytren disease, an alternative to fasciectomy. Our objective was to analyze the additional value of US guided injections and to study the effectiveness, however US is more variable.

CLINICAL RELEVANCE/APPLICATION
US has added value in targeting Dupuytren cords for injection of collagenase with better outcome and lower rate of complications especially for lateral cords on PIP contractions.

PURPOSE
To investigate if ultrasound(US)-guided platelet-rich plasma(PRP) injection is effective for treating moderate to severe refractory chronic plantar fasciopathy(PF) compared to standard of care corticosteroid(SOC) injection.

METHOD AND MATERIALS
Inclusion criteria were met, which required unilateral PF, failed conservative therapy, and VAS pain level of at least 5 of 10 for at least 6 months duration. 44 consecutive subjects were randomized into two groups, PRP and SOC. Subjects received either a single injection of autologous PRP or a single injection of triamcinolone 40 mg at week 0. VAS pain levels, validated clinical surveys (FAAM/SANE), and US changes of PF thickness, hypoechogenicity (grade 0-3), and hyperemia (grade 0-3) were obtained at injection of autologous PRP or a single injection of triamcinolone 40 mg at week 0. VAS pain levels, validated clinical surveys (FAAM/SANE), and US changes of PF thickness, hypoechogenicity (grade 0-3), and hyperemia (grade 0-3) were obtained at week 0 (pre-injection), week 16 and 32. Analysis of covariance was used for statistical analysis. Statistical significance was determined at p-value<0.05.

RESULTS
21 PRP subjects (mean age 47.8 yrs; range 30-64), M:F(4:17) and 23 SOC subjects (mean age 49.2 yrs; range 30-64), M:F(7:16) completed the 32-week study from March 2011-July 2014. No loss to follow-up. Baseline VAS pain levels were not significant (6.93 in PRP vs 6.63 in SOC; p=0.4). At week 16 and 32, both groups showed improvement in VAS pain levels compared to baseline, but PRP showed greater improvement than SOC over time (6.93 to 2.64 to 1.7; p=0.00). SOC pain level improved initially at week 16 but rebounded by week 32 (3.28 to 4.77; p=0.002). FAAM scores improved for both groups (p<0.001) but the PRP group improved by 12.6 more points by week 32 (p=0.02). SANE scores showed improving trend over time consistently favoring PRP (p=0.006). 132 US exams performed. Baseline US changes were not significant except for hypoechogenicity (2.80 in PRP vs 1.79 in SOC; p<0.002). PF thickness decreased (mean of 0.33 mm; p<0.001) in both groups but no difference between groups (p=0.74). PRP showed greater echotexture improvement than SOC over time (decrease of 0.42/visit, SD 0.13 in PRP vs 0.004/visit in SOC; p=0.003). Hyperemia did not change over time (0.86 for PRP vs 0.81 for SOC; p=0.80). There were no complications.

CONCLUSION
US-guided PRP injection may be an effective treatment option for refractory chronic PF compared to corticosteroid injection. Larger multi-armed studies are now needed to establish a new standard of care treatment algorithm.

CLINICAL RELEVANCE/APPLICATION
PRP is more effective than corticosteroid injection for the long-term treatment of refractory chronic plantar fasciopathy.
Ultrasound-guided Interventions

Tuesday, Dec. 1 11:30AM - 12:00PM Location: E450A

Participants
Kenneth S. Lee, MD, Madison, WI (Presenter) Research Consultant, SuperSonic Imagine; Consultant, Echometrix, LLC; Royalties, Reed Elsevier

LEARNING OBJECTIVES

View learning objectives under main course title.
SSG10-01  Musculoskeletal Keynote Speaker: MR Evaluation of the Hand-Technique and Application

Tuesday, Dec. 1 10:30AM - 10:50AM Location: E450B

Participants
Mary G. Hochman, MD, West Roxbury, MA (Moderator) Stockholder, General Electric Company; Stock options, Nomir Medical Technologies, Inc; Author, UpToDate, Inc
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Moderator) Nothing to Disclose

Abstract
To optimize MRI of fingers nine technical points should be especially checked: (1) the choice of the surface coil according to the clinical findings, (2) the gradient strength and the bandwidth, (3) the positioning and the contention, (4) a dedicated scout view, (5) the spatial resolution, (6) the slice thickness with a special attention to 3D millimetric slices, (7) the choice of a main slice plane according to the suspected lesion, (8) the suppression of motion artifacts and (9) the use of stress images if possible (collateral ligaments, pulleys, extensor tendon).

SSG10-03  MR Morphology of Triangular Fibrocartilage Complex: Correlation with Quantitative MR and Biomechanical Properties

Tuesday, Dec. 1 10:50AM - 11:00AM Location: E450B

Participants
Jean-Luc Drape, MD, PhD, Paris, France (Presenter) Nothing to Disclose
Thumanoon Ruangchaijatuporn, MD, Bangkoknoi, Thailand (Presenter) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Reni Biswas, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Betty Tran, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Won C. Bae, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

Purpose
Wrist pain may involve the triangular fibrocartilage complex (TFCC; Fig.A). The purpose of this study was to evaluate MR morphology of TFCC tissues, and relate it to regional quantitative MR (qMR) and biomechanical properties.

Method and Materials
Five cadaveric wrists (22 to 70 yrs) were imaged at 3T using morphologic (PD SE, Fig.AC; 3D SPGR, Fig.B) and quantitative (ME SE T2; UTE T2*; 2D SCMP T1rho; 3D MAPSS T1rho; UTE T1rho) MR sequences. In 8 geographic regions (Fig.B), morphology of TFCCdisc and the laminae were evaluated for pathology (Fig.BDE) and quantitative MR (qMR) values (Fig.F). Four of the samples were disarticulated, and biomechanical indentation testing was performed on the distal surface of the discs (Fig.C). Instantaneous (Indentation) modulus, taking into account tissue thickness, was determined.

Results
On PD SE images, pathology of TFCC disc included degeneration (Fig.BE) and tears (Fig.E), while that of the lamina included degeneration, degeneration with superimposed tear, and mucinous transformation (Fig.E). Calcifications were highly visible on 3D SPGR images (Fig.D). Calcifications were found only among pathologic regions, and disc pathology was found more frequently in the proximal than distal regions. In the disc (Fig.G), most qMR values were the lowest in normal samples, and increased significantly with degeneration or tear. Indentation modulus (Fig.G) showed an inverse trend, being the highest in normal samples and decreasing with pathologic changes. qMR properties also correlated moderately with indentation modulus. Laminae samples (Fig.H) were mostly pathologic, and requires additional normal samples to discern qMR changes.

Conclusion
These results show potential utility of morphologic, qMR, and biomechanical techniques to characterize pathology of the TFCC.

Clinical Relevance/Application
Quantitative MR techniques provide novel and sensitive means of evaluating tissues of TFCC, which compliment conventional techniques.

SSG10-04  Accessory Tendon Slips of the Extensor Carpi Ulnaris: MRI Findings and Association with Tendon Abnormalities

Tuesday, Dec. 1 11:00AM - 11:10AM Location: E450B

Participants
Anatomic variants are common in the wrist and hand, and some of them may be the triggering factor of tendon disorders. The purpose of this study was to report the MRI findings of accessory tendon slips arising from the extensor carpi ulnaris (ECU), and evaluate their association with ECU tendon abnormalities.

METHOD AND MATERIALS

All wrist MRI scans performed over a 1-year period in two university hospitals were retrospectively reviewed. Patients with prior ulnar-sided wrist surgery and MRI scans without at least axial T1-weighted and T2-weighted sequences were excluded. Two musculoskeletal radiologists independently assessed the presence of accessory tendon slips arising from the ECU, as well as ECU tendinosis, partial or complete tears, and tenosynovitis. The origin and insertion of the accessory tendon slips were noted, and their diameter and the cross-sectional area of the ECU tendons were measured.

RESULTS

A total of 254 wrist MRI scans from 257 patients (139 men, 115 women; mean age, 46 years) were included. The prevalence of accessory tendon slips arising from the ECU was 23% (58/254). Surgical correlation was available in 12% (7/58) of cases. Their long-axis diameter was 1.1 ± 0.2 mm. Their origin was always visible, while their insertion on the fifth metacarpal or extensor digiti minimi tendon was seen in 33% (19/58) of cases. Patients with accessory tendon slips had statistically significantly more ECU tendon abnormalities and tenosynovitis than patients without the anatomic variant (14% vs. 6%, and 46% vs. 11%, respectively; p ≤ 0.02). The prevalence of accessory tendon slips was statistically significantly higher in patients with ulnar-sided wrist pain (23% vs. 14%, p = 0.01).

CONCLUSION

Accessory tendon slips arising from the ECU are common and frequently associated with ECU tendon abnormalities. They are frequently found in patients with ulnar-sided wrist pain.

CLINICAL RELEVANCE/APPLICATION

Accessory tendon slips arising from the ECU are important to recognize because they represent a diagnostic pitfall and may also play a role in the pathogenesis of ECU tendon abnormalities.

PURPOSE

To evaluate the computer-based method using temporal subtraction in carpal joints of rheumatoid arthritis (RA) patients, which can detect the difference in joint space between two images as the joint space difference index (JSDI).

METHOD AND MATERIALS

Twenty-seven rheumatoid arthritis patients (24 females and 3 males, mean age 60 years) on Tocilizumab were enrolled. Radiographs were obtained at baseline and at 1 year. The joint space narrowing (JSN) of a total of 229 carpal (3rd carpometacarpal, 5th carpometacarpal, scaphoid-trapezium, scaphoid-capitate, and radius-scaphoid) joints on bilateral hand radiographs was assessed by our computer-based method, setting the Sharp/van der Heijde method as the gold standard. We performed three examinations to confirm that the JSDI reflects the chronological change in joint space width. We compared the JSDI of joints with JSN progression (increase in Sharp/van der Heijde score) in the follow-up period with those without JSN progression. In addition, we examined whether there is a significant difference in JSDI in terms of laterality or topology of the joint.

RESULTS

The JSDI of joints with JSN progression was significantly higher than those without JSN progression (Mann-Whitney U test, p < 0.001). There was no statistically significant difference in the JSDI between left and right carpal joints, which was analyzed for 5 different joints altogether and each joint separately (Mann-Whitney U test, p > 0.05 respectively). There was no statistically significant difference in JSDI among different joints (Kruskal-Wallis test, p = 0.155). In all examinations, the results of the computer-based method were consistent with those of the Sharp/van der Heijde method as the gold standard.

CONCLUSION

These results suggest that our computer-based method may be useful to recognize the joint space narrowing progression on radiographs in carpal joints.

CLINICAL RELEVANCE/APPLICATION

The computer-based temporal subtraction method can detect the joint space narrowing progression in the wrist, which is the single most predilection site for rheumatic diseases.
RESULTS

We studied 400 MPJs of 40 subjects (17 women, 23 men), with mean age of 33 years (range, 18-63). In comparing 10 non-KC subjects (with 0 "crack-years") versus 30 KC subjects (with "crack-years" ranging from 16 to 800), there was no significant difference in sex, age, QuickDASH score, grip strength, or Beighton score. In 62 of the 400 MPJs, there was an audible "crack" during manual distraction. Range of motion was noted to significantly increase in these 62 MPJs with respect to active and passive flexion, and passive extension between pre and post KC (p<0.05). With US, blinded readers had a good sensitivity (R1, 75%; R2, 80%) and excellent specificity (R1, 94%; R2, 95%), with a very good inter-observer reliability of 0.87 (p<0.0005). A brilliant hyperechoic flash that was simultaneous with the KC event and arose over approximately 115 msec was highly characteristic.

CONCLUSION

US examination during movement of the MPJs can show distinctive findings of KC with relatively high specificity and inter-observer reliability. US features corroborate the theory of cavitation as the etiology for sound generation in voluntary KC.

CLINICAL RELEVANCE/APPLICATION

Audible emissions may be associated with a broad array of (intraarticular and extraarticular) clinical conditions, but KC has a characteristic US appearance.

SSG10-07 Hand MRI: Quality of Fat Signal Suppression with Dixon versus CHESS and STIR Imaging

Tuesday, Dec. 1 11:30AM - 11:40AM Location: E450B

Participants

Thomas P. Kirchgesner, MD, Brussels, Belgium (Presenter) Nothing to Disclose
Vasiliki Perlepe, MD, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
Nicolas Michoux, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
Ahmed Larbi, MD, Nimes, France (Abstract Co-Author) Nothing to Disclose
Frederic E. Lecouvet, MD, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
Bruno C. Vande Berg, MD, PhD, Brussels, Belgium (Abstract Co-Author) Consultant, Bone Therapeutics SA

PURPOSE

To compare the quality of fat signal suppression and signal to noise ratio (SNR) obtained by the Dixon method in comparison to the CHESS (CHEmical Shift Selective) and STIR (Short Tau Inversion Recovery) sequences at hand MRI of healthy subjects.

METHOD AND MATERIALS

Both hands of 14 healthy volunteers were imaged with IDEAL T1 SE (Spin Echo), IDEAL T2 SE, FS (Fat Saturated) T1 SE, FS T2 SE and STIR on a 1.5T MR scanner. Both hands of 14 healthy volunteers were imaged with IDEAL T1 SE (Spin Echo), IDEAL T2 SE, FS (Fat Saturated) T1 SE, FS T2 SE and STIR on a 1.5T MR scanner. Slice thickness, slice spacing and imaging plans were kept constant between sequences. Water pure IDEAL T1 SE, water pure IDEAL T2 SE, FS T1 SE, FS T2 SE and STIR images were anonymized and archived by an independent operator in the picture archiving communication system. Three radiologists blindly and independently scored the quality of the fat signal suppression (1: absent; 2: partial; 3: complete) in bone marrow and adjacent soft tissues of 20 articulations. One radiologist calculated the SNR in 5 locations for each hand.

RESULTS

Scores for fat signal suppression were significantly higher in water pure IDEAL T1 SE than in FS T1 SE for the 3 readers (p<0.001). Scores for fat signal suppression were significantly higher in water pure IDEAL T2 SE than in FS T2 SE for the 3 readers (p<0.017). Scores for fat signal suppression were statistically and significantly higher in water pure IDEAL T2 SE than in STIR for 2 readers (p<0.022), and not statistically different for the third reader (p=0.109). SNR in water pure IDEAL T1 SE was significantly higher than SNR in FS T1 SE (p<0.001). SNR in water pure IDEAL T2 SE was statistically and significantly higher than SNR in STIR (p<0.001), but statistically and significantly lower than SNR in FS T2 SE (p<0.001).

CONCLUSION

Quality of fat signal suppression at hand MRI achieved with the Dixon method is superior to that obtained with fat selective
RESULTS

PT instability parameters measured on axial and sagittal images by two blinded-readers, independently: PT interval, PT angle and pisiform translation relative to triquetrum. The MR appearances of PT joint and ulnar-sided structures were also evaluated. The associations between PT instability and distal radius fracture, abnormality of ulnar-sided structures or osteoarthritic features of PT joint were calculated.

METHOD AND MATERIALS

To determine if there is an association between pisotriquetral (PT) instability and trauma history or internal derangements of the carpal joint by using three-dimensional (3D) dual echo steady state (DESS) imaging of 12 cadaver wrists was performed with Tomosynthesis in anterioposterior (ap) projection (50 kV at 40 mA; tube angle: 40°), conventional X-ray and multi-detector CT (70kV at 16mAs ref). Distal interphalangeal joint (DIP) II, DIP III, proximal interphalangeal joint (PIP) II, PIP III, first carpometacarpal (CMC) and scaphotrapezotrapezoidal joint (STT) were individually graded using the Osteoarthritis Research Society International (OARSI) score by two independent readers for the presence of osteophytes (0-3), joint space narrowing (0-3), subchondral sclerosis (0-1), lateral deformity (0-1), subchondral cysts (0-1) and erosion (0-1). Total scores range from 0-60. Inter-reader agreement (Cohen's k) was calculated. CT served as standard of reference.

RESULTS

Comparing Tomosynthesis and conventional X-ray to CT, the agreement was of 69.64% vs. 63.89% for the presence of osteophytes; 80.56% vs. 56.94% for joint space narrowing; 69.44% vs. 68.1% for subchondral sclerosis; 94.44% vs. 91.67% for lateral deformity; 97.22% vs. 80.56% for subchondral cysts; and 100% vs. 97.22% for erosion. While Tomosynthesis showed no significant difference (p=0.846) in OARSI score grading to CT (mean OARSI-score CT: 16.8, SD=10.64 vs. mean OARSI-score Tomosynthesis: 16.25, SD=9.56), conventional X-ray had significant lower mean OASIS scores (mean OARSI-score X-ray: 11, SD=8.33; p=0.037). Inter-reader agreement for OARSI scoring was excellent (k= 0.83).

CONCLUSION

Tomosynthesis depicts more lesions than conventional X-ray compared to CT.  

CLINICAL RELEVANCE/APPLICATION

The mean OARSI score of Tomosynthesis is not significantly different from CT.

SSG10-09  
Assessment of Pisotriquetral Instability with 3D Dual Echo Steady State (DESS): Is It Associated with Trauma or not?

Tuesday, Dec. 1 11:50AM - 12:00PM Location: E450B

Participants
Hee-Dong Chae, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Hye Jin Yoo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ja-Young Choi, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Sung Hwan Hong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine if there is an association between pisotriquetral (PT) instability and trauma history or internal derangements of the carpal joint by using three-dimensional (3D) dual echo steady state (DESS)

METHOD AND MATERIALS

We evaluated 44 patients with distal radius fracture (patient) and other 44 patients without previous trauma history (control), who underwent 3T magnetic resonance (MR) imaging including 3D DESS sequence. To analyze PT instability, three parameters were measured on axial and sagittal images by two blinded-readers, independently: PT interval, PT angle and pisiform translation relative to triquetrum. The MR appearances of PT joint and ulnar-sided structures were also evaluated. The associations between PT instability and distal radius fracture, abnormality of ulnar-sided structures or osteoarthritic features of PT joint were calculated.

RESULTS

PT instability parameters measured by two radiologists showed good or excellent agreement (ICC=0.628-0.965). Proximal translation of pisiform in relation to triquetrum was reduced in the patients with distal radius fracture (P<0.028). However, there was no difference of other instability parameters between the two groups. ECU tendinopathy was associated with larger PT interval (P=0.01) and with wider opening of sagittal PT angle (P=0.021). Triangular ligament tear was also related to reduced proximal translation of pisiform (P=0.031). Osteoarthritic features of PT joint and triangular fibrocartilage tear were not associated with PT instability.
CONCLUSION

Only pisiform translation was associated with distal radius fracture. Other instability parameters were not affected by distal radius fracture. ECU tendinopathy and triangular ligament tear were associated with PT instability.

CLINICAL RELEVANCE/APPLICATION

Knowledge of PT instability and its relation to other carpal abnormality and traumatic disorder will facilitate early diagnosis of PT instability preventing symptomatic degenerative change of PT joint.
**Purpose**
To compare the rate of culture positivity among 3 different methods of spine biopsy (transpedicular, disk, and paraspinal approaches) in patients with suspected osteodiskitis. A transpedicular approach has been advocated by some as it samples the subchondral bone where osteodiskitis begins, however culture positivity rates for osteomyelitic bone samples elsewhere in the body have been shown to be low.

**Method and Materials**
Patient charts and imaging from a five year period were retrospectively reviewed. We included only patients who had a high probability of osteodiskitis based on MRI and clinical findings. The transpedicular (TP) approach was categorized as an approach across the pedicle sampling predominantly subchondral bone with a variable amount of disk material obtained. The disk approach was defined as advancement of the needle directly into the disk from a posterolateral approach for aspiration and/or core biopsy. The paraspinal (PS) approach was defined as advancement of the needle into the abnormal paraspinal soft tissues adjacent to the abnormal level for aspiration and/or core biopsy. In patients where multiple access routes were used, the culture results from each route were isolated and evaluated separately. Fisher's exact test was used to compare the culture positivity rates among different approaches.

**Results**
54 CT guided biopsy procedures (in 52 patients) were performed. Culture positivity rates for the different approaches were 6/27 (22%) for TP, 3/16 (19%) for disk, and 7/11 (64%) for PS. The positive culture rate was significantly better for PS compared to the TP ($p=0.0244$) or disk ($p=0.0402$) approach. No significant difference was seen in culture positivity between the TP and disk approaches ($p=1.0$).

**Conclusion**
The PS approach in our data set yielded the highest proportion of positive culture results, statistically different than the other methods. This contradicts earlier suggestions that the paraspinal soft tissues are usually sterile.

**Clinical Relevance/Application**
Physicians treating patients with osteodiskitis often request biopsy for cultures and sensitivity in order to provide targeted antibiotic therapy; sampling the abnormal paraspinal soft tissues adjacent to suspected osteodiskitis may have a higher chance of producing positive culture results when compared to sampling bone or disk.

**Purpose**
To see if the simultaneous evaluation of Hill-Sachs lesions and glenoid bone loss on MRI with the On-Off track (OOT) method can be used to predict engagement during arthroscopy.

**Method and Materials**
Seventy-five consecutive patients (60 males, 15 females) with a history of prior anterior shoulder instability who underwent preoperative MRI of the shoulder and arthroscopy at our institution were reviewed. A total of 76 MRIs were included (one patient had bilateral MRIs and arthroscopy). Two readers reviewed the MRI of each patient blindly and independently, using the OOT method to predict engagement. The OOT method consisted of estimating the Hill-Sachs index and glenoid track using 2D MR imaging; no 3D imaging was used. If the Hill-Sachs index was larger than the glenoid track, then the patient was considered on-track and at increased risk for engagement. If the Hill-Sachs index was smaller than the glenoid track, then the patient was considered off-track and at no increased risk for engagement. These results were compared to the findings related to engagement seen during arthroscopy, performed by one of seven orthopaedic surgeons. Statistical analysis included Fisher exact test, logistic regression and receiver operating characteristic (ROC), and intra-class correlation coefficients (ICC).
RESULTS
Using the OOT method on MRI, 13 of the 18 engaging (off track) lesions (72.2%; sensitivity) were predicted correctly. Of the 58 shoulders that did not engage (on-track), 51 (87.9%; specificity) were predicted correctly. Overall, the accuracy for the OOT method was 84.2% with a positive predictive value of 65% and negative predictive value of 91.1%.

CONCLUSION
Our study has demonstrated that the On-Off track method can be used on MRI to accurately assess the bipolar bone loss seen in the patient with anterior shoulder instability in terms of predicting engaging/off-track lesions.

CLINICAL RELEVANCE/APPLICATION
The On/Off track status can be used in the preoperative setting to help guide the type of stabilization procedure performed on the patient with anterior shoulder instability.

MK344-SD-TUA3  MR, Arthroscopic, and Cadaveric Correlation of Articular Cartilage of the Femoral Condyles - Identifying the Hidden Zones of the Far Posterior Cartilage Not Visible during Routine Arthroscopy

PURPOSE
Our study aims to identify femoral condylar articular cartilage seen via routine arthroscopy compared to MRI. Arthroscopy has been used as gold standard for MR cartilage research, yet no standardized nomenclature for cartilage localization has been established. The femoral condylar cartilage is visualized in its entirety on MRI. The same is not true for routine arthroscopy performed using standard portals with 90° of standard maximum range of flexion. We describe arthroscopically hidden areas of cartilage and provide an option for standardized terminology.

METHOD AND MATERIALS
Six cadaveric specimens were scoped using the standard portals in flexion ranging from 30° to 120°. Suture anchors were inserted into the femoral condyles for MR correlation. The specimens were then scanned with multiplanar T1 and T2 sequences including 3D acquisitions on a 3.0 T magnet in extension. After imaging, the specimens were dissected for measurements. Distances between the suture anchors were made using all three methods. Anatomic landmarks and angles on MRI were also recorded.

RESULTS
All six specimens demonstrated that routine arthroscopy show only a small portion of the articular cartilage proximal (superior) to the menisci. The average distances of the 90° anchors to the posterior margins of the cartilage were 38.4 mm and 32.4 mm on dissection and 35.2 mm and 28.7 mm on MR, medial and lateral respectively. Only an additional 5.8 mm medially and 6.8 mm laterally were visible beyond the 90° anchors arthroscopically. This indicates that 85.8% of the medial and 80.8% of the lateral cartilages seen on MR proximal to the menisci are not visible. Arthroscopy with additional flexion to 120° decreases the hidden areas to 53.7% medially and 43.7% laterally. On MR, most of the 90° and 120° anchors lie between the landmarks of the posterior margins of the cartilage proximally and the menisci distally.

CONCLUSION
Our study shows that >80% of the articular cartilages seen on MRI proximal to the menisci are not visible on routine arthroscopy. We propose this posterior articular cartilage be called the "hidden zone".

CLINICAL RELEVANCE/APPLICATION
Routine arthroscopy fails to visualize >80% of the posterior articular cartilages proximal to the menisci. Cartilage research using arthroscopy as gold standard should exclude these hidden zones.

MK345-SD-TUA4  Reliable Measurement of the Femoral Head-neck Alpha Angle Utilizing Ultrasound

PURPOSE
The femoral head-neck alpha angle is a method of quantifying the degree of femoral head asphericity in patients suspected of cam-type femoroacetabular impingement. The measurement was first performed using Magnetic Resonance Imaging (MRI), and more recently, three-dimensional Computed Tomography (3DCT). We set out to determine if the alpha angle could be reliably measured using ultrasound of the anterosuperior femoral head-neck junction.

METHOD AND MATERIALS
Volunteers were recruited among patients presenting for three-dimensional computed tomography (3DCT) of the hip. Alpha angles were calculated following the departmental protocol by institutionally-accredited radiographers. Patients were then imaged using ultrasound and the alpha angle calculated from the ultrasound image by a sonographer blinded to the 3DCT result. Statistical comparison of the two methods was performed with the Bland-Altman test using SPSS (version 21.0, Chicago, USA) and a p < 0.05
RESULTS

Twenty-three patients were recruited. Eight patients were bilateral examinations, providing 31 hips for analysis. Average patient age was 40 years (19-74 years). The difference between CT and Ultrasound measured alpha angles was not statistically different (p=0.243). Mean (± SD)(range) measurements for CT and Ultrasound were 61.31 (± 14.58) (37.7 - 90.9) and 64.69 (± 12.53) (44.4 - 101.6) respectively. The mean difference between the two methods was -3.38 degrees (95%CI -9.2 - 2.4 degrees).

CONCLUSION

Ultrasound imaging can provide an accurate quantitative measure of femoral head asphericity, in the absence of 3DCT imaging.

CLINICAL RELEVANCE/APPLICATION

Ultrasound can reliably calculate the femoral head-neck alpha angle when 3DCT is not indicated or not available.

PURPOSE

To evaluate the computer-based method using temporal subtraction in carpal joints of rheumatoid arthritis (RA) patients, which can detect the difference in joint space between two images as the joint space difference index (JSDI).

METHOD AND MATERIALS

Twenty-seven rheumatoid arthritis patients (24 females and 3 males, mean age 60 years) on Tocilizmab were enrolled. Radiographs were obtained at baseline and at 1 year. The joint space narrowing (JSN) of a total of 229 carpal (3rd carpometacarpal, 5th carpometacarpal, scaphoid-trapezium, scaphoid-capitate, and radius-scaphoid) joints on bilateral hand radiographs was assessed by our computer-based method, setting the Sharp/van der Heijde method as the gold standard. We performed three examinations to confirm that the JSDI reflects the chronological change in joint space width. We compared the JSDI of joints with JSN progression (increase in Sharp/van der Heijde score) in the follow-up period with those without JSN progression. In addition, we examined whether there is a significant difference in JSDI in terms of laterality or topology of the joint.

RESULTS

The JSDI of joints with JSN progression was significantly higher than those without JSN progression (Mann-Whitney U test, p < 0.001). There was no statistically significant difference in the JSDI between left and right carpal joints, which was analyzed for 5 different joints altogether and each joint separately (Mann-Whitney U test, p > 0.05 respectively). There was no statistically significant difference in JSDI among different joints (Kruskal-Wallis test, p = 0.155). In all examinations, the results of the computer-based method were consistent with those of the Sharp/van der Heijde method as the gold standard.

CONCLUSION

These results suggest that our computer-based method may be useful to recognize the joint space narrowing progression on radiographs in carpal joints.

CLINICAL RELEVANCE/APPLICATION

The computer-based temporal subtraction method can detect the joint space narrowing progression in the wrist, which is the single most predilection site for rheumatic diseases.

PURPOSE

To quantify microcirculation alteration in the calf muscle of type 2 diabetes mellitus (T2DM) rhesus monkey by new noncontrast skeletal muscle MR perfusion and oximetry techniques.

METHOD AND MATERIALS

7 adult T2DM rhesus monkeys without peripheral artery disease (HbA1c = 7.75 ± 2.95%)and 2 normal adult rhesus monkeys (14±3 years old; male 7) were examined. The skeletal muscle blood flow (SMBF) and oxygen extraction fraction (SMOEF) measurements were performed with an air-cuff protocol (4 min at rest, 4 min inflation, and 4 min deflation periods) on a 3.0T Siemens Trio scanner. The cuff was placed on the mid-thigh above the right knee. One section was centered at the largest cross-section of the calf for SMBF measurements, but 22 sections in the calf muscle was measured for the SMOEF measurements. The SMBF
(mL/min/100g) was measured using an arterial spin labeling method only during the recovery period for hyperemic flow with a temporal resolution of 20 sec. The SMOEF maps were measured using a susceptibility-based MRI technique with a temporal resolution of 4 min. A region of interest was placed on the triceps surae muscle of the maps for quantitative SMBF and SMOEF measurements.

**RESULTS**

Elevated flow was clearly visualized in the SMBF maps within one minute immediately after the cuff deflation. This hyperemic SMBF in diabetes monkeys were significantly lower than in normal monkeys (40.4±7.7 vs. 73.1±27.6 mL/min/100g, P<0.05), indicating significantly impaired blood supply. Due to some bulk motion artifacts, SMOEF data from 5/7 diabetes and 1/2 normal monkeys was used for analysis. The SMOEFs in one normal monkey were 0.55 at rest, 0.77 during inflation, and 0.49 during deflation periods. In contrast, respective mean SMOEF in 5 diabetes monkeys were 0.48 ± 0.05, 0.51 ± 0.1, and 0.43 ± 0.08. Therefore, the changes in SMOEF from resting to cuff in the normal monkey was 39.4%, which is much larger than 6.6% in diabetes monkeys, indicating impaired oxygen metabolism (Figure).

**CONCLUSION**

Non-contrast MRI microcirculation mapping techniques can quantitatively demonstrated that the peripheral perfusion and oxygenation were significantly impaired in T2DM rhesus monkeys without peripheral artery disease.

**CLINICAL RELEVANCE/APPLICATION**

New noncontrast skeletal muscle MR perfusion and oximetry techniques can noninvasively quantify the impaired microcirculation during a cuff exercise in T2DM without peripheral artery disease.

**MK348-SD-TUA7**

**Vertebral Bone Marrow Fat Content Measured by MRI is Associated with Bone Mineral Density: A Cadaveric Study Using Micro-CT**

Station #7

Participants

Miyuki Takasu, MD, Hiroshima, Japan (Presenter) Nothing to Disclose
Yuji Akiyama, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Ryuuji Akita, RT, MS, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazushi Yokomachi, RT, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Masatoshi Honda, Tokyo, Japan (Abstract Co-Author) Employee, Koninklijke Philips NV
Kazuo Amai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo
Chihiro Tani, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Yoko Hiroshi, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Magnetic resonance spectroscopy (MRS) has shown a negative correlation between marrow fat and bone mineral density (BMD). The purpose of this study was to validate the relationships of vertebral marrow fat obtained by a clinically available fat-quantification method with BMD and bone strength in a cadaveric study.

**METHOD AND MATERIALS**

Fresh human L1 and L2 vertebral bodies were obtained from 10 adult cadavers. Vertebrae were scanned by 3-T MRI (Ingenia; Philips Healthcare) and micro-CT (TOSCANER-30000; Toshiba IT Systems Co.). Tissue BMD (tBMD) was obtained from micro-CT using a bone mineral reference phantom. Single-voxel MRS was acquired in vertebral bodies using a stimulated-echo acquisition mode sequence (TR, 2000 ms; TE, shortest). Two peaks (water at 4.67 ppm; fat at 1.3 ppm) were fitted and from the area under each peak, bone marrow fat fraction (FF by 1H MRS) was defined as fat/(fat + water) × 100 (%). Axial images for a six-echo mDIXON sequence (flip angle, 3°; TR/ΔTE=12/1.25 ms). The mDIXON fat fraction (FF by mDixon) was defined as fat/(fat + water) × 100 (%) using mDIXON-Quant software. Finite element modeling (FEM) using micro-CT data was performed using a 3D image analysis system. Correlations between FF by mDixon and 1H MRS, and relationships between tBMD, failure load, and FF by mDixon and 1H MRS were evaluated.

**RESULTS**

Values of FF assessed with mDIXON correlated with those from 1H MRS. Fat fractions were negatively associated with micro-CT-derived tBMD (p = -0.521, p = 0.04 for mDIXON; p = -0.550, p = 0.03 for 1H MRS). Micro-CT/FEM-derived failure load was positively associated with FF from mDIXON (p = 0.600, p = 0.01).

**CONCLUSION**

This study demonstrated that a higher level of marrow fat was associated with lower tBMD in the cadaveric spine, and that this relationship can also be assessed by the less time-intensive mDIXON technique in addition to 1H MRS. Compressive strength positively correlated with FF by mDIXON.

**CLINICAL RELEVANCE/APPLICATION**

We observed significant correlations between BMD, failure load and marrow fat content in the cadaveric spine. Measuring bone marrow fat by mDIXON may be useful for BMD and bone strength assessment.

**MK119-ED-TUA8**

**Where is this Muscle Pain? MRI Imaging of Unusual Muscle Strains at the Level of the Pelvis**

Station #8

Participants

Pablo Schwartzman, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Salgado Diego, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Flavio Olmos Cantarero, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
TEACHING POINTS

Hip pain is particularly frequent in both professional and amateur athletes. There are a significant number of muscle injuries at this region considered infrequent that may be overlooked by ultrasonography mainly because of its depth. There are even difficult to individualize in a conventional MRI causing an important source of impaired function in active individuals. The goal of this exhibit is to educate the radiologist about the complex anatomy of the pelvis in order to learn to recognize the clinical presentation and imaging findings of the muscle strains at this level.

TABLE OF CONTENTS/OUTLINE

Introduction. MRI protocols. Pictoral and imaging anatomy of the pelvis. Review of 3T MRI cases collected for the last 5 years in our institution with original pictorial illustrations. Detailed pathologic diagnosis with mechanism of injury and clinical presentation. Examples include: Strains of iliopectineus, pectineus, obturator Internus, externus, gracilis, piniformis, quadratus femoris, gluteus medius and gluteus minimus. Briefly discuss about typical muscle tears of the pelvis. Differential diagnosis. Conclusion.

Participants
Rammohan Vadapalli, MD, Hyderabad, India (Presenter) Nothing to Disclose
Meena Ak, MD, DPhil, Hyderabad, India (Abstract Co-Author) Nothing to Disclose
Abhinav Sriram S. Vadapalli, Pune, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To elucidate Imaging biomarkers of Sciatic Neuropathy. Clinical EMNG and MR neurography features of Sciatic neuropathy. Common and Uncommon causes of Sciatic Neuropathy are highlighted.

TABLE OF CONTENTS/OUTLINE

1. Sciatic nerve Compression and Etiologies of Extra spinal Sciatica at a Glance
   EXTRANEURAL
   A) INTRAPELVIC (neural foramina to Greater sciatic notch) B) EXTRA PELVIC (distal greater sciatic notch)
   INTRANEURAL
   A) TUMOR B) FIBROSIS C) TRAUMA D) DIABETIC AMYOPTHROPHY
   EXTRA PELVIC CAUSES
   GLUTEAL ARTERY ANEURYSM, PSEUDOANEURYSM, GLUTEAL ABSCESS, TUMOR, PINIFORMIS SYNDROME
   AVULSION FRACTURE OF ISCHIAL TUBERTOSITY
   MIGRATION OF BROKEN TROCHANTERIC WIRES AFTER TOTAL HIP ARTHROPLASTY
   Intra pelvic causes
   Tumor
   Hematoma in the psoas muscle
   Endometriosis
   Tubo-ovarian abscess
   Intruterine device after uterine perforation
   Anorectal abscess above the levator
   Aneurysm (abdominal aortic aneurysm)
2. MR Neurographic techniques commonly used for visualizing sciatic nerve Pathologies
3. case based Pictorial essay with clinical imaging EMNG and Pathological correlation.

Participants
Connie Y. Chang, MD, Boston, MA (Presenter) Nothing to Disclose
Susan V. Kattapuram, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ambrose J. Huang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Metabolic Bone Disease is a disorder of bone strength, and bone strength arises from two properties: bone mass/mineralization and architecture.
2. Imaging findings of metabolic bone disease are related to the mechanical and micro-anatomic features of bone.

TABLE OF CONTENTS/OUTLINE

1. Overview
2. Osteoporosis
3. Disorders of mineralization: Rickets, Osteomalacia, Hyperparathyroidism, and Renal Osteodystrophy
4. Disorders of bone structure: Paget’s disease, Acromegaly, Marrow replacing disorders

Awards
Certificate of Merit

Participants
Patrick Kubes, DO, Manhasset, NY (Presenter) Nothing to Disclose
Amandeep Singh, MD, New Hyde Park, NY (Abstract Co-Author) Nothing to Disclose
John S. O’Donnell, MD, Douglaston, NY (Abstract Co-Author) Nothing to Disclose
Daniel M. Walz, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Michael Brown, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Helise R. Coopersmith, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Ralph A. Milillo, MD, Roslyn, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To review the anatomy of the posteromedial corner.
2. To stress the importance of frequently overlooked posteromedial corner injury and how it alters the treatment pathway.
MK349-SD-TUB1  Wrisberg Sign: Could be a Marker for High Grade PCL Instability?

Participants
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Moderator) Nothing to Disclose

Sub-Events

**PURPOSE**
The purpose of this article is to determine whether wrisberg signs on MRI are a marker for high grade (grade III) posterior cruciate ligament (PCL) instability.

**METHOD AND MATERIALS**
The study included 30 patients who had a knee injury and underwent both intraoperative posterior drawer test and arthroscopic surgery, between January 2011 to December 2014. All patients underwent 3-T MRI for the diagnosis of PCL injury. If MRI revealed ligament complete disruption (criterion 1) or adding the wrisberg sign to criterion 1 (criterion 2), the injury was considered to be high grade PCL instability. After MRI, knee arthroscopy was performed in all patients for a definitive diagnosis. MRI scans were independently reviewed by two experienced musculoskeletal radiologists (with 13 and 1 years of experience, respectively). Receiver-operating characteristic (ROC) curves were plotted to estimate their diagnostic performance in detecting PCL instability. Interobserver agreement was expressed as unweighted kappa value.

**RESULTS**
Arthroscopy showed complete disruption of PCL in 29 patients (intraoperative posterior drawer test, grade III) and partial tear of PCL in 1 patient (intraoperative posterior drawer test, grade II). When the MRI diagnosis was based on criterion 1, high grade PCL instability was diagnosed with a sensitivity of 20.7% and an accuracy of 23.3% in both of two readers. When the MRI diagnosis was based on criteria 2, high grade PCL instability was diagnosed with a sensitivity of 73.3% and an accuracy of 72.4% in both readers. By adding wrisberg sign to the criterion 1 (criterion 2), 15 additional patients with high grade PCL instability were diagnosed, most of whom exhibited a complete tear of PCL on arthroscopy and grade III on posterior drawer test. Significantly higher AUC for detecting PCL instability when criterion 2 was added to the diagnosis compared with criterion 1 in both readers (p<.05). The interobserver agreement rate for PCL instability using criterion 1 and criterion 2 were fair and substantial, respectively.

**CONCLUSION**
Whether partial or complete disruption of PCL on MRI, the morphological feature of wrisberg ligament embedded in the PCL (wrisberg sign) may assist to anticipate the high grade instability of PCL.

**CLINICAL RELEVANCE/APPLICATION**
Wrisberg sign may be used to evaluate the functional status of PCL deficient knee, thereby potentially assist the treatment decision and subsequently aid in patient care.

MK350-SD-TUB2  Bone Microarchitecture at the Femoral Attachment Posterior Cruciate Ligament (PCL) by Texture Analysis of Magnetic Resonance Image (MRI) in Patients with PCL Injury: Indirect Reflection of the Ligament Integrity

Participants
Young Han Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jin-Suck Suh, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seung Hyun Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seok Hahn, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
(1) To evaluate the trabecular pattern of the femoral attachment of posterior cruciate ligament (PCL) on magnetic resonance images (MRI) of patients with a history of PCL injury, (2) to analyze bone microarchitecture at the femoral attachment of PCL by applying gray level co-occurrence matrix (GLCM)-based texture analysis, and (3) to determine if there is significant relation of the bone microarchitecture with posterior instability in patients with PCL tears by comparing the texture values between acute and chronic injury groups.

**METHOD AND MATERIALS**
Ninety-six patients who have PCL tear and underwent knee MRI were included January 2010 and February 2015, and trabecular patterns on conventional T2-weighted MRI were evaluated by musculoskeletal radiologist qualitatively and by GLCM-based texture analysis.
It is recognized that finger joints with positive synovial vascularity (SV) under clinical low disease activity (CLDA) may cause

RESULTS
The trabecular pattern at the femoral attachment posterior cruciate ligament (PCL) were apparent thick prominent anisotropic trabeculae in 57 patients of within-normal limit or acute injury \( (n=57/61; 93.4\% \) and were not prominent in 31 patients of chronic injury with posterior instability \( (n=30/35; 85.7\% \). Grades of posterior draw tests and the degree of posterior stress radiograph were not correlated with texture parameters. However, the texture analysis parameters except entropy were significantly different between the two groups \( (all\ are\ P<0.05\).

CONCLUSION
The trabecular pattern and texture analysis parameters are useful to predict posterior instability in patients with PCL injury. The bone microarchitecture resulted from altered biomechanics could be made an advancement in the understanding of PCL function and in the improvement detection of PCL injury.

CLINICAL RELEVANCE/APPLICATION
The trabecular pattern and texture analysis parameters are useful to predict posterior instability in patients with PCL injury.

MK352-SD-Shear-Wave Ultrasound Elastography Evaluation of the Supraspinatus Tendon

TUB4

Station #4

Participants
Stephanie Hou, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
James S. Babb, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alexander N. Merkle, MD, New York, NY (Presenter) Nothing to Disclose
Robert McCabe, Babylon, NY (Abstract Co-Author) Nothing to Disclose
Soteros Gyftopoulos, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ronald S. Adler, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To demonstrate that the sonographic morphology of the supraspinatus tendon correlates with elasticity.

METHOD AND MATERIALS
This retrospective study included 36 patients who underwent sonographic evaluation of one or both shoulders on one or multiple dates from June 2013 through October 2014. A shoulder was excluded if the supraspinatus tendon contained calcifications or was postsurgical. Each sonographic evaluation of each shoulder was regarded as a separate data point. The morphology of the proximal and distal supraspinatus tendon was graded \( (1 = normal\ or\ mild\ tendinosis\ without\ a\ tear,\ 2 = moderate\ or\ severe\ tendinosis\ without\ a\ tear,\ 3 = partial\ tear, 4 = full-thickness tear)\), and sample volumes were placed randomly within the tendon, viewed in the longitudinal axis, to obtain shear wave velocities. Sample volumes also were placed randomly within the deltoid muscle to obtain shear wave velocities. Spearman rank correlations assessed the association between morphology grade and shear wave velocities. Mann-Whitney tests compared shear wave velocities between scans grouped by symptoms or morphology grade. Bootstrap resampling procedures accounted for lack of statistical independence among scans of the same patient.

RESULTS
The morphology grade and shear wave velocities were correlated in both the proximal \( (p < 0.001\) and distal \( (p = 0.002\) tendon. Comparing between grade 1 and \( \geq 2 \) morphology, shear wave velocities differed significantly in both the proximal \( (p = 0.001\) and distal \( (p = 0.012\) tendon. Comparing between grade \( \leq 2\) and \( > 2\) morphology, shear wave velocities also differed significantly in both the proximal \( (p = 0.002\) and distal \( (p = 0.004\) tendon. Interestingly, deltoid muscle shear wave velocities also were associated with the morphology grade of the proximal \( (p = 0.004\) and distal \( (p = 0.007\) supraspinatus tendon; this measurement also differed significantly based on symptoms \( (p = 0.001)\).

CONCLUSION
The sonographic morphology of the supraspinatus tendon correlates with mechanical properties, as assessed by shear-wave ultrasound elastography. Correlation of deltoid muscle elasticity with supraspinatus tendon morphology and symptoms may be related to the two muscles being a force couple. Further research should correlate elasticity with intraoperative evaluation of tendon quality.

CLINICAL RELEVANCE/APPLICATION
Shear-wave ultrasound elastography can provide a preoperative objective evaluation of tendon elasticity.

MK353-SD-X-ray Temporal Subtraction Analysis of Finger Joint Space Narrowing with Ultrasonographic Synovitis in Rheumatoid Patients with Long-term Sustained Clinical Low Disease Activity

TUBS

Station #5

Participants
Taichi Okino, BS, RT, Sapporo, Japan (Presenter) Nothing to Disclose
Tamotsu Kamishima, MD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Kenneth Sutherland, Hokkaido, Japan (Abstract Co-Author) Nothing to Disclose
Jun Fukae, MD, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Kazuhide Tanimura, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
It is recognized that finger joints with positive synovial vascularity (SV) under clinical low disease activity (CLDA) may cause
High tibial osteotomy (HTO) is an effective therapy to delay joint replacement in patients with early stage knee osteoarthritis. Quantitative biochemical MRI techniques are increasingly used in osteoarthritis research to study therapeutic effects on cartilage composition and to accurately compare different treatment strategies. An important challenge for the application of these techniques in the context of HTO is the presence of metal fixation devices after the procedure, causing artifacts and an unknown influence on quantitative MRI outcomes. Our purpose was to assess the influence of titanium fixation devices on the outcomes of T2-mapping, a widely used quantitative MRI technique to measure collagen content in cartilage.

**METHOD AND MATERIALS**

Five human cadaveric knee joints underwent T2-mapping with a 3D fast spin-echo T2 mapping sequence with 5 echo times (3, 13, 27, 40, 68 ms) at 3T before and after implantation of a fixation device. A titanium plate widely used for HTO was fixated to the medial side of the proximal tibia using titanium screws by an experienced orthopaedic surgeon according to a typical HTO procedure. The actual osteotomy was not performed. Mean T2 relaxation times were calculated in 6 cartilage regions (located in the medial and lateral weight-bearing and posterior cartilage of the femoral condyles and tibial plateaus). Corresponding slices with different regions were: femur posterior lateral 50.5 vs. 52.7 ms (p=0.23); femur posterior medial 57.8 vs. 59.5 ms (p=0.41); femur weight-bearing lateral 61.1 vs 58.7 ms (p=0.30); femur weight-bearing medial 58.4 vs. 56.3 ms (p=0.54); tibia weight-bearing lateral 62.6 vs. 58.9 ms (p=0.07); tibia weight-bearing medial 58.0 vs. 54.0 ms (p=0.13).

**RESULTS**

The JSDI of the RA patients was significantly different between joints with and without JSN progression for MP/PIP joints (Mann-Whitney U test, p < 0.001). There was no statistically significant difference in the JSDI between left and right MP/PIP joints (Mann-Whitney U test, p = 0.14). The JSDI of MP/PIP joints with positive SV was significantly higher than those with negative SV (Mann-Whitney U test, p = 0.01).

**CONCLUSION**

The computer-based quantification of joint space using temporal subtraction can recognize the interval difference in MP/PIP joint space on radiographs objectively.

**CLINICAL RELEVANCE/APPLICATION**

The computer-based quantification of joint space width difference using temporal subtraction can objectively detect slight JSN changes on radiographs in clinically inactive rheumatoid patients.

---

**Titanium Fixation Devices do not Influence T2 Relaxation Times of Knee Articular Cartilage after High Tibial Osteotomy: A Human Cadaver Study**

**Participants**

Joost Verschuuren, MD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Duncan E. Meuffels, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Esther E. Bron, MSc, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Stefan Klein, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Gert-Jan Kleinrensink, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Jan Verhaar, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Sita Biema-Zeinstra, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
Piotr A. Wielopolski, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Max Reijman, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Edwin H. Oei, MD, PhD, Palo Alto, CA (Presenter) Nothing to Disclose

**PURPOSE**

Opening the Windows: The Diagnostic Value of Soft Tissue Window Settings in Musculoskeletal CT

**METHOD AND MATERIALS**

Despite the presence of a titanium fixation device, our results suggest that it is still possible to perform T2 mapping of cartilage composition after high tibial osteotomy.
**Awards**

**Certificate of Merit**

**Participants**

Brandon Bachert, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose  
Christopher E. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose  
Tetyana A. Gorbachova, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose  
Thomas J. Reilly JR, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

1. Discuss technical considerations for improving visualization of soft tissue structures on CT including slice thickness, reconstruction algorithms, and knowledge-based iterative reconstruction models as well as volume and surface rendering reformattin techniques.  
2. Demonstrate utility of soft tissue window setting in maximizing fracture detection in osteopenic patients as well as aiding in the comprehensive evaluation of musculoskeletal trauma.  
3. Depict the bone marrow findings in osteomyelitis and bone tumors which can precede bone involvement.  
4. Illustrate the importance of soft tissue window evaluation in the detection of significant incidental findings.

**TABLE OF CONTENTS/OPTLINE**

1. Technical considerations to optimize soft tissue structure visualization on CT  
   - Reconstruction algorithm  
   - Slice thickness  
   - Knowledge-based iterative reconstruction  
   - Volume and surface rendering

2. Utility of soft tissue window setting in evaluation of trauma  
   - Optimizing fracture detection in osteopenic patients  
   - Comprehensive evaluation of musculoskeletal trauma  
   - Soft tissue injury and entrapment (tendons, cartilage, vascular)

3. Bone Marrow Evaluation on CT  
   - Osteomyelitis  
   - Malignancy

4. Significant incidental findings on MSK CT

**MK174-ED-007**

**Nontraumatic Palpable Lesions Related to Tendon Sheath in Hands and Feet: Imaging Findings**

**Participants**

Sung Moon Kim, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose  
Catherine J. Brandon, MD, Ann Arbor, MI (*Abstract Co-Author*) Stock options, VuCOMP, Inc  
Monica Kalume Brigido, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose  
Qian Dong, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose  
Gandikota Grish, MBBS, FRCR, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose  
Jon A. Jacobson, MD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ; ;  
Corrie M. Yablon, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

After reviewing this exhibit, the learner will be able to:  
1. List differential diagnoses of nontraumatic palpable lesions of the tendon sheath in hands and feet.  
2. Know about the characteristic imaging findings to suggest specific diseases of tendon sheath.

**TABLE OF CONTENTS/OPTLINE**

1. Plain radiography, ultrasonography, CT, and MRI will be included in imaging modalities of this exhibit. Differential diagnoses of nontraumatic palpable lesions of tendon sheath:  
   - Giant cell tumor of tendon sheath  
   - Fibroma of tendon sheath  
   - Fibromyxoma  
   - Synovial chondromatosis of tendon sheath  
   - Ganglion nodular hyperplastic synovium with fibrosis  
   - Tenosynovitis

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:  
[https://www.rsna.org/Honored-Educator-Award/](https://www.rsna.org/Honored-Educator-Award/)

Jon A. Jacobson, MD - 2012 Honored Educator

**MK226-ED-001**

**Appreciating MoM: Demystifying the Complications of Metal-on-metal Hip Articulations**

**Participants**

Phey M. Yeap, MBChB, FRCR, Dundee, United Kingdom (*Presenter*) Nothing to Disclose  
Jonathan Weir-McCall, MBChB, FRCP, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose  
Matthew J. Budak, MD, FRCR, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose  
Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose  
Ian A. Zealley, MD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose  
David Scott, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

Metal-on-metal (MoM) total hip arthroplasty and resurfacing is an alternative to traditional total hip replacement as it allows greater range of movement and has low dislocation rate. However it has been linked with serious complications and has consequently become the subject of controversy. Imaging plays a critical role in detecting many of these complications. The aims of this exhibit are:  
1. Review complications related to MoM hip prostheses  
2. Illustrate key imaging findings associated with MoM complications through example cases  
3. Discuss the utility and respective limitations of various imaging modalities when assessing for MoM complications

**TABLE OF CONTENTS/OPTLINE**
MK280-ED- TUB11

Ankle Trip: A Guided Tour of Common and Uncommon Trauma Findings on Radiographs

Station #11

Participants
Pavani Thotakura, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Bahram Kiani, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Maha Torabi, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Leon Lenchik, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Scott D. Wuertzer, MD, MS, Winston-Salem, NC (Presenter) Nothing to Disclose

TEACHING POINTS
1. Provide a search pattern, a "map", for ankle radiographs to improve image interpretation for junior residents. 2. Illustrate the value of this search pattern through commonly missed injuries.

TABLE OF CONTENTS/OUTLINE
1. Background
2. AP View - anatomy, pathology, and case examples
   1. Soft tissues over the malleoli
   2. Origin of extensor digitorum brevis
   3. Lateral process of talus
   4. Tip of fibula
   5. Mid to distal fibula
   6. Tibiofibular clear space
   7. Medial malleolus
   8. Tibial plafond
   9. Talar dome
3. Mortise View - anatomy, pathology, and case examples
   1. Soft tissues over the malleoli
   2. Origin of extensor digitorum brevis
   3. Lateral process of talus
   4. Tip of fibula
   5. Medial malleolus
   6. Tibial plafond
   7. Talar dome
4. Lateral View - anatomy, pathology, and case examples
   1. Anterior tibiotalar joint for an effusion
   2. Dorsal talar and navicular bones
   3. Base of the 5th metatarsal
   4. Anterior process of the calcaneus
   5. Lateral process of the talus
   6. Body of calcaneus
   7. Posterior tibiotalar joint and os trigonum
   8. Kager's fat pad
5. Summary
**MSES33**

**Essentials of Musculoskeletal Imaging**

Tuesday, Dec. 1 1:30PM - 3:00PM Location: S100AB

**Participants**

**Sub-Events**

**MSES33A  Introduction to Musculoskeletal Ultrasound**

Participants
Maha Torabi, MD, Winston Salem, NC, (mtorabi@wakehealth.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) List the indications, benefits, and limitations of musculoskeletal ultrasound. 2) Demonstrate proper transducer manipulation and system optimization to produce diagnostic images. 3) Recognize common pathology of the musculoskeletal system as seen at ultrasound.

**ABSTRACT**

Active Handout: Maha Torabi

http://abstract.rsna.org/uploads/2015/15001838/Active MSES33A.pdf

**MSES33B  MRI of Injuries in the High Performance Athlete**

Participants

**LEARNING OBJECTIVES**

1) Recognize patterns of injury in high performance athletes using MRI. 2) Be able to relate pathology to common injuries in the general population. 3) Realize implications of injury in females and adolescent athletes.

**MSES33C  Return to Play: Imaging the Athlete**

Participants
Bethany U. Casagranda, DO, Pittsburgh, PA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Define Return to Play. 2) Discuss social pressures and controversial dogma surrounding Return to Play. 3) Recognize imaging findings of common sports related injuries. 4) Discuss the radiologist's role in diagnosis of pathology and communication with referring physicians.

**ABSTRACT**

Athletes of all levels are encumbered by injury and the social stresses of returning to play (RTP). RTP is a broad topic describing the time it takes an athlete to return to their sport after sustaining an injury. This discussion will encompass various levels of play, several sports and position-specific injuries. The focus will be on common injuries as well as controversial topics. Overall, emphasis is on imaging and the role of the radiologist caring for athletes.
LEARNING OBJECTIVES

1) Review role of SBRT in the primary management of early stage NSCLC. 2) Review updates to the literature on SBRT including: a. Dose and schedule of SBRT. b. Comparison of SBRT to surgery.

ABSTRACT

Stereotactic Body Radiotherapy (SBRT) is an important treatment modality for patients with inoperable Non-Small Cell Lung Cancer. It provides effective local control of early stage Lung Cancers and is associated with minimal toxicity. In this presentation I will review this role and discuss the current literature comparing SBRT to observation and surgery.

RESULTS

We identified a total of 53 lung adenocarcinomas treated with lung ablation and which had genetic testing to identify both EGFR and KRAS mutations. Surgical or biopsy specimens were considered only if they were from the same site as the ablation (either pre- or post-ablation). A subset of the EGFR mutants were also tested for T790M mutation. Local recurrence was either biopsy proven or based on a combination of clinical and imaging parameters. Chi-square test was used to identify statistically significant association with local recurrence.

CONCLUSION

KRAS mutations are associated with statistically significant increased risk of local recurrence compared to WT. The local recurrence...
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying events.

1) Understand the most common adverse events related to lung ablation. 2) Learn how to prevent and treat some of these adverse events. 3) Illustrate some of the more severe adverse events (grade 3-5) with clinical examples.

**ABSTRACT**

Care of the patients with pulmonary metastases (PM) has evolved through the years to now include a larger group of patients who may benefit from metastasectomy. The two most consistent prognostic factors for overall survival remain disease free interval (DFI) and number of pulmonary nodules. The one consistent factor in all series is that only patients achieving a complete (R0) resection have a longer survival. Many series find the # of nodules is no longer a factor determining survival if R0 resection can be obtained, even repeated metastasectomy. We no longer view extra-PM as a disqualifier for resection, as long as the dz can be completely resected and controlled. Patients are typically referred for immediate surgery if they present with a single PM or have a limited # of mets and a long DFI. Those who develop metastatic dz early are treated initially with chemotherapy to determine the pace of dz progression, if any, on treatment. Patients responding to chemotherapy, those with stable dz, and those with slow progression are referred for resection while those with rapidly progressive metastatic dz receive alternative chemotherapy treatment. Adjuvant chemotherapy is continued only if there is evidence of clinical benefit from preoperative chemotherapy. CT scanning is routinely performed to monitor dz progression. The surgical approach should be individualized. As imaging improves our ability to localize smaller nodules, less invasive options become more appealing and may facilitate less difficult repeat metastasectomy. Ablation (SABR/SBRT or lung CT-guided ablation by cryoablation, radiofrequency ablation or microwave ablation) has been used to treat patients with PM, and our institution uses a lung ablation tumor board to review which lesions are best treated with each modality, focusing on R0 treatment, lung preservation, and location of the tumor. Lung preservation achieved by ablation is important in patients who have had previous resections or who have compromised pulmonary function or in whom a lobectomy would be required for nodule removal. More prospective studies are needed and are underway. Better understanding of the biology of the tumor and more developed histologic-specific nomograms may ultimately improve our ability to better select patients. As systemic therapy improves, treatment of local residual oligometastic dz will become an increasingly important consideration.

**LEARNING OBJECTIVES**

1) Define the role of surgical pulmonary metastasectomy. 2) Review the literature regarding surgical pulmonary metastasectomy. 3) Review advantages to minimally invasive surgical pulmonary metastasectomy. 4) Define future goals of a novel approach to combined multi-speciality approach to lung metastasectomy.

---

**Complications and Management after Lung Ablation**

**LEARNING OBJECTIVES**

1) Understand the most common adverse events related to lung ablation. 2) Learn how to prevent and treat some of these adverse events. 3) Illustrate some of the more severe adverse events (grade 3-5) with clinical examples.

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying events.
Morphological Appearance of Radiofrequency Ablated Stage I NSCLC in Medically Inoperable Patients as Related to Recurrence: Results from the ACOSOG Z4033 (Alliance Trial)

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S405AB

Participants
Lillian Xiong, MD, Providence, RI (Presenter) Nothing to Disclose
Erica S. Alexander, BS, Providence, RI (Abstract Co-Author) Nothing to Disclose
Shauna Hillman, MS, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Angelina D. Tan, BS, BA, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Grayson L. Baird, MS, Providence, RI (Abstract Co-Author) Nothing to Disclose
Hiran Fernando, MD, Boston, MA (Abstract Co-Author) Consultant, CSA Medical, Inc Research Consultant, Galil Medical Ltd Research Grant, Deep Breeze Ltd
Damian E. Dupuy, MD, Providence, RI (Abstract Co-Author) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

Purpose
This study evaluates tumor and ablation zone morphology as related to recurrence in medically inoperable patients with stage I NSCLC undergoing CT-guided RFA in a prospective multi-center trial.

Method and Materials
This prospective, multicenter group trial was approved by each institutional review board. 54 patients from 16 US sites were enrolled, of these, 50 patients (23 Men, 27 Women; mean age 75.3±7.5 years) met eligibility requirements. Patients were followed using CT; evidence of CT recurrence and pre- and post-ablation imaging characteristics were recorded. Characteristics evaluated included tumor/ablation zone shape (round, ovoid, bilobed, irregular), size, borders (smooth, speculated, lobulated), distance to large vessels/airway and distance to pleura.

Results
A difference was observed for months to recurrence between those with ablation zones greater than 3cm and less than 3cm (p=.0023). The median time of recurrence for those with ablation zones less than 3cm was 8.16 months, while the median time for those with zones greater than 3cm could not be determined. Recurrence free probability was 30% for those with ablation zones less than 3cm and 75% for those with zones greater than 3cm. No significant differences were found between those with and without recurrence for age (p=.47), performance score (p=.43), histology (p=.34), baseline tumor SUV (p=.91), tumor size (p=.59), peak power (p=.92), peak current (p=.63), max temp (p=.65), total time (p=.28), shape (p=.30), cavitation (p=.29), sphericity (p=.45), distance from tumor edge to large vessel (p=.62), and distance to pleura (p=.25).

Conclusion
Of those morphological characteristics considered, size of ablation zone appears to be most predictive of recurrence-free survival for those patients treated with RFA for early stage lung cancers.

Clinical Relevance/Application
Post-radiofrequency ablation zones greater than 3-cm were significantly less likely to be associated with recurrent disease, in a multi-institutional prospective study of 50 stage I NSCLC patients.
Bone fractures can result in significant pain and loss of function in cancer patients. Percutaneous screw fixation is a very new technique that consists in the insertion of screws in bone structures through a very small skin incision under imaging guidance. The indications are twofold for bone fracture: palliative and preventive. 1/ For patients suffering from pathological or non-pathological fracture the goal of the screw fixation is to achieve a stabilization of the fracture fragments that will result in pain palliation. Typically, the fractures that can be fixed are located in the sacrum, the iliac crest, the acetabulum roof, the pubic ramus and the proximal femur. Cementoplasty can be performed in association (augmented screw fixation) in order to improve the screw's tip anchorage. 2/ For patients with impending osteolytic metastases, the decision to perform percutaneous augmented screw fixation instead of cementoplasty alone is done by the fact the strength properties of the cement are strong in compression but weak for tensile or shear stresses. Typically, the impending osteolytic metastases that can be consolidate using percutaneous augmented screw fixation are located in the iliac crest, the acetabulum and in the proximal femur. Percutaneous screw fixation is a very effective tool that must be considered as a part of the therapeutic arsenal of the interventional radiologists. Firstly, because it is a minimally invasive procedure that avoids extensive surgical exposure and secondly because the accuracy provided by CT- or Flat panel- guidances results in high technical success and very low complication rate for the screw placement.

**VSIO31-10 Patient Selection and Outcomes with MRgFUS**

**Tuesday, Dec. 1 4:20PM - 4:40PM Location: S405AB**

**Participants**
Alessandro Napoli, MD, Rome, Italy, (alessandro.napoli@uniroma1.it) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To become familiar with the basic principles of HIFU and the potential of MR guidance. 2) To approach selection criteria in MRI screening examinations for accurate indications and identify contraindications and non-suitable patients. 3) To appreciate current results and potential therapy regimens. 4) To understand recent technical developments and their potential.

**ABSTRACT**
Bone metastases are common in patients with advanced cancer and are the greatest contributor to cancer-related pain, often severely affecting quality of life. Many patients with advanced cancer are undertreated for pain. Radiation therapy (RT), together with systemic therapies and analgesics, is the standard of care for localized metastatic bone pain, although up to two-thirds of patients have residual pain after RT, leaving them with limited treatment options. These include reirradiation, which results in temporary pain reduction in some patients, surgical intervention, and percutaneous cryoablation. More effective systemic therapies are prolonging survival of cancer patients with metastatic disease, resulting in an increased need for alternative therapies for painful bone metastases. Focused ultrasound is a minimally invasive technique that delivers acoustic energy to heat lesions focally to ablative temperatures of more than 65°C. The combination of focused ultrasound with magnetic resonance (MR) imaging enables physicians to perform precise localized tumor tissue ablation, while using MR thermometry for real-time temperature monitoring. Clinical studies on the use of MR-guided focused ultrasound surgery (MRgFUS) for palliation of painful bone metastases demonstrated excellent response rates and safety. Results of a randomized controlled trial will be reviewed to discuss safety and efficacy of MRgFUS for treating bone metastases in patients with persistent or recurrent pain after RT, or who were otherwise not candidates for RT, or who declined RT. MRgFUS has several advantages that may positively influence safety and effectiveness compared with other ablative therapies. These include high-resolution imaging of the targeted tumor and nontargeted normal anatomy, intraprocedural MR thermometry accurate within approximately 2° to verify adequate temperatures to achieve ablation while respecting normal tissue tolerances, and immediate post-treatment validation of the extent of ablation.

**VSIO31-11 Minimally Invasive Treatment of Osteoid Osteoma: Experience of a Single Center Using MR Guided Focused Ultrasound Surgery (MRgFUS) or Radiofrequency Ablation (RFA)**

**Tuesday, Dec. 1 4:40PM - 4:50PM Location: S405AB**

**Participants**
Francesco Arrigoni, Coppito, Italy (Presenter) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Silvia Mariani, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To evaluate effectiveness and safety of minimally invasive treatment of Osteoid Osteoma (OO) with ablation techniques: Magnetic Resonance guided Focused Ultrasound Surgery (MRgFUS) and Radiofrequency Ablation (RFA).

**METHOD AND MATERIALS**
From March 2011 to March 2014 we treated 40 OO, 18 with MRgFUS (ExAblate InSightech, Israel) and 22 with RFA (Needle Electrode, Boston Scientific-USA). For each patient we chose the less invasive treatment, when applicable. When the lesion could be easily reached with the US beam, the patient was treated with MRgFUS; otherwise, the patient was treated with RFA. Sixteen OO were treated with MRgFUS in the lower arm and 2 in the upper extremities, 2 in the upper ones and 2 in the vertebral body. They were treated in less than 100 min. The follow-up was performed by MRI and CT up to a maximum of two years; the clinical evaluation was performed using the visual analogue scale (VAS).

**RESULTS**
All patients, except one treated with MRgFUS and subsequently re-treated with RFA, showed a regression of painful symptomatology. After treatment, they no longer needed any pain medication. The mean hospitalization time was 2 days for patients treated with MRgFUS and 2.4 days for those submitted to RFA. The mean VAS value, 2 years after treatment, showed an overall improvement of 100% (from 8.2 to 0). At the first control at one week after the procedure, patients treated with MRgFUS showed a lower mean VAS value (0.5) as compared with that of RFA (0.8). The results of MRI and CT, 2 years after the treatment, showed in all cases the disappearance of both bone edema (MRI) and nidus with central calcification and peripheral osteosclerosis (CT), that are typical findings of the osteoid osteoma. In no case, major complications were observed.
CONCLUSION

Though based on a limited group of patients, our study demonstrates the safety and effectiveness of both techniques in the treatment of OO, by which it was possible to obtain an optimal clinical and imaging outcome. Compared with RFA, MRgFUS is less invasive, but to be successful, it is mandatory that the US beams properly reach the region of interest.

CLINICAL RELEVANCE/APPLICATION

To evaluate safety and efficacy of an innovative technique of ablation, MRgFUS, which promises to be even less invasive than RFA, which is currently the gold standard in the treatment of OO.

VSIO31-12 Spine Metastases Palliation-Ablation Stabilization

Tuesday, Dec. 1 4:50PM - 5:10PM Location: S405AB

Participants
Jonathan M. Morris, MD, Rochester, MN (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1. Learn the basics of ablative technologies available for use in the spine and sacrum. 2. Define current indications for percutaneous ablation in the Spine and Sacrum. 3. How we do it. Lessons learned and resources needed. 4. Define local control rates for the varied tumors treated. 5. Discuss our experience with palliative outcomes for pain relief. 6. Limitations of ablation in the neuroaxis. 7. Postablative kyphoplasty/vertebroplasty. 8. Discuss unique considerations for cervical, thoracic, lumbar spine and sacrum.

ABSTRACT

Oligometastatic disease involving the spine and sacrum is growing due to an aging population as well as improved survival rates of varied primary malignancies. 70% of all cancer patients will have metastatic disease with 40% involvement of the neuroaxis and 20% with epidural disease. While radiation therapy continues to be the primary treatment a subset of tumors are not radiosensitive and of those which are there are non responders. Starting in 2009 this clinical need led us to develop an ablation service dedicated to the spine and sacrum to aid in the treatment of oligometastastic disease. This talk will enable the attendee to learn the basics of ablative technologies in the spine and sacrum. Learn current indications for this technologies. Learn “how we do it” including lessons learned and resources need to perform this type of treatment. We will discuss the role of post ablative kypholplasty/vertebroplasty. Finally we will review our palliative pain relief results as well as local control rates in the increasing types of tumors treated.

VSIO31-13 Ablation is Front-line Therapy for Desmoid Tumors

Tuesday, Dec. 1 5:10PM - 5:30PM Location: S405AB

Participants
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose

Handout:Afshin Gangi


VSIO31-14 CT-guided Cryoablation as Single Treatment or Combined with Radiotherapy in the Management of Bone and Soft Tissue Lesions

Tuesday, Dec. 1 5:30PM - 5:40PM Location: S405AB

Participants
Francesco Arrigoni, Coppito, Italy (Presenter) Nothing to Disclose
Silvia Mariani, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Alice La Marra, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate safety and efficacy of percutaneous CT-guided cryoablation, performed with multiple cryoprobes (also in combination with Radiotherapy) in the treatment of bone and soft tissue lesions.

METHOD AND MATERIALS

Up to April 2015, we treated 27 patients with percutaneous CT-guided cryoablation. All patients but one had osteolytic bone metastases; one patient had a recurrence of aggressive fibromatosis of the shoulder. Prior to treatment, the patients were evaluated with the VAS questionnaire for pain which resulted in a mean value of 7.6. For a faster and more comfortable procedure, we employed three to six cryoprobes for each lesion under fluoroscopic guide. The area of cryoablation (iceball) and the position of the cryoprobes were controlled during the procedure with a wide-volume acquisition, employing 3D and MPR reconstruction. Follow-up studies at 3 and 6 months were performed with CT and VAS questionnaire. No major complications occurred during the procedures.

RESULTS

We observed a reduction of pain in all patients. The mean VAS value dropped from 7.6 to 1.6 one week after treatment and remained substantially unchanged until the end of follow-up (6 months). CT follow-up showed progression of the disease in no case. Only size reduction or stationary CT findings were observed.

CONCLUSION

Our results show the effectiveness of cryoablation, particularly in combination with RT, in terms of tumoral mass control and particularly of pain relief. Through thermoablation in fact it is possible to obtain a prompt relief of pain, and enhancement of the
quality of life immediately after the treatment. The main advantages are the possibility to treat the whole lesion at the same time with the use of multiple cryoprobes and to check in real time the treated volume; the main limitations are represented by the low number of patients recruited and by the length of the follow-up.

**CLINICAL RELEVANCE/APPLICATION**

To evaluate safety and effectiveness of cryoablation also in combination with RT in the management of painful bone and soft tissue lesions, with the aim of reducing tumoral mass and pain.

**VSIO31-15  Bone Metastases Tumor Board**

Tuesday, Dec. 1 5:40PM - 6:00PM Location: S405AB

Participants
Matthew R. Callstrom, MD, PhD, Rochester, MN (Moderator) Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd
**SSJ15**

**Muscloskeletal (Quantitative MR Applications)**

**Tuesday, Dec. 1 3:00PM - 4:00PM Location: E451A**

**Participants**

Martin Torniani, MD, Boston, MA (Moderator) Nothing to Disclose
Gregory Chang, MD, New York, NY (Moderator) Speaker, Siemens AG

**Sub-Events**

**SSJ15-01**  
Quantitative MRI Perfusion Analysis of Osteoid Osteomas Pre- and Post Microwave Ablation using an Open Source Software Tool (UMMPerfusion)

**Tuesday, Dec. 1 3:00PM - 3:10PM Location: E451A**

**Participants**

Michael Kostrzewa, MD, Mannheim, Germany (Presenter) Nothing to Disclose
Patrick Diezler, MD, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Henzler, MD, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Nils Rathmann, MD, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (Abstract Co-Author) Institutional research agreement, Siemens AG
Steffen J. Diehl, MD, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To quantitatively evaluate blood perfusion of osteoid osteomas prior and after percutaneous microwave (MW) ablation in time-resolved imaging with stochastic trajectories (TWIST) MRI sequences using an open source software tool.

**METHOD AND MATERIALS**

In 17 patients (11 males, 6 females, mean age 26y) with osteoid osteomas percutaneous, CT guided, MW ablation was performed (Medwaves, San Diego, California, USA). Lesions measured on average 5 ± 2mm in diameter. Lesion diameter dependent MW ablation parameters were: 16 Watts, 915MHz, 80°C for 45 to 160 seconds. Prior to and after MW ablation 3D dynamic contrast enhanced MRI imaging was performed with 3D TWIST gradient echo sequences (Siemens Healthcare). Mean plasma flow (PF, ml/100ml/min), mean volume of distribution (VD, ml/100ml) and mean transit time (MTT, sec) were measured within the lesion in the pre and post MW ablation MRI TWIST data using an open source software tool for quantitative MRI perfusion analysis (UMMPerfusion, OpossUMM, Germany).

**RESULTS**

16 patients were free of symptoms within one week after treatment, one patient had decreased but persisting symptoms after MW ablation. No minor or major adverse events were observed according to SIR criteria. Mean PF, VD and MTT were 253 ± 226ml/100ml/min, 63 ± 60ml/100ml and 17 ± 12sec after ablation respectively. In a paired t-test there was no statistically significant change in MTT prior to and after ablation (p>0.05), whereas PF (p=0.002) and VD (p=0.02) decreased significantly. In the patient with persisting symptoms continuously high values for PF (229ml/100ml/min) and VD (118ml/100ml) were found in the MRI after MW ablation in a small portion of the lesion, this was attributed to imprecise needle placement and to too short ablation time.

**CONCLUSION**

Treatment success of percutaneous MW ablation of osteoid osteomas can be reliably quantified by MRI perfusion analysis, especially by evaluating pre and post procedural PF and VD within the lesion. MRI perfusion analysis helps to identify small remnants of perfused osteoid osteoma tissue after MW ablation.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative MRI perfusion analysis is clinically valuable in the evaluation of treatment success of percutaneous MW ablation for osteoid osteomas.

**SSJ15-02**  
A Phase I Study to Assess the Feasibility of Quantitative Molecular Imaging of ACL Grafts

**Tuesday, Dec. 1 3:10PM - 3:20PM Location: E451A**

**Participants**

Katherine Binzel, PhD, Columbus, OH (Presenter) Nothing to Disclose
Robert Magnusen, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Wenbo Wei, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Melanie U. Knopp, Malibu, CA (Abstract Co-Author) Nothing to Disclose
David Flanigan, MD, Columbus, OH (Abstract Co-Author) Consultant, Vericel; Consultant, Smith & Nephew plc
Michael V. Knopp, MD, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Christopher C. Kaeding, MD, Columbus, OH (Abstract Co-Author) Consultant, Biomet, Inc

**PURPOSE**

Injury to the anterior cruciate ligament (ACL) commonly requires reconstruction with a graft to restore stability and function. The rate at which graft ligamentization occurs is not well delineated by magnetic resonance imaging (MRI). This initial study aims to...
Participants

SSJ15-03  **MRI Defined Ecologic Habitats in Extremity Soft Tissue Sarcomas: Characterization and Quantification of Tumor Heterogeneity and Potential Implications on Patient Outcomes-Early Experience**

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E451A

Participants

Meera Raghavan, MD, Tampa, FL (Presenter) Nothing to Disclose
Hamidreza Farhidzadeh, Tampa, FL (Abstract Co-Author) Nothing to Disclose
Lawrence O. Hall, PhD, Tampa, FL (Abstract Co-Author) Nothing to Disclose
Dmitry Goldgof, PhD, Tampa, FL (Abstract Co-Author) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (Abstract Co-Author) Nothing to Disclose
Robert A. Gatenby, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose

PURPOSE

We propose a novel computer-aided, spatially-explicit image analysis of magnetic resonance (MR) examinations to classify extremity STS based on radiologically defined spatial sub-regions, or "habitats." The identification of spatially distinct habitats can quantify and characterize the ecologic basis of intratumoral heterogeneity and may be helpful to guide targeted biopsy, tailor therapeutic options and offer prognostic information.

METHOD AND MATERIALS

T1-w gadolinium enhanced and fluid-sensitive MR images were assessed from pretreatment scans of 36 patients with extremity STS. There were three main steps: tumor segmentation based on pixel signal intensity; pixel and texture analysis within each distinctive habitat; and prediction of metastatic disease and histologic therapy response. Patient outcomes such as progression free survival (PFS), overall survival (OS), and presence of metastases were also assessed.

RESULTS

Habitat color maps (HCM) demonstrated spatially distinct intratumoral subregions (Fig. 1). Metastatic disease was classified correctly with 86.11% accuracy based on five texture features, and histologic necrosis with 75.75% accuracy based on four features. Specific subregions were also predictive for metastatic disease and histologic response to therapy. The post contrast T1 high/T2 low subregion was prognostic for overall survival (p= 0.036).

CONCLUSION

This technique can define distinct habitats within each STS based on MR imaging features and allows spatial variations to be assessed and quantified. We demonstrate the role of advanced clinical image analysis in providing critical insight into the evolutionary and ecologic landscape of STS. The preliminary results presented here show that distinct intratumoral subregions or habitats within STS can be identified and quantified and give useful clinical and prognostic information which can shape personalized and adaptive therapeutic regimens.

CLINICAL RELEVANCE/APPLICATION

Change in size alone does not accurately not reflect response to therapy and tumor biology of STS. We have developed an image analysis technique to non-invasively characterize and quantify tumor subregions on MR imaging. The identification of these radiologically defined habitats can give insight into the evolutionary and ecologic dynamics which are the basis of heterogeneity in STS. This can in turn offer more tailored personalized treatments to patients.
Clinical multidetector computed tomography (MDCT) has been used to evaluate bone quality. The purpose of this study was to determine the capability of conventional and UTE quantitative MR values to detect meniscal pathology in cadaveric meniscal samples.

**Clinical Relevance/Application**
Quantitative MR values may correlate with structural and biochemical meniscal alterations, complementing currently limited techniques in early diagnosis and postoperative evaluation of the meniscus.

**Results**
Overall mean Volume (liter) ± standard deviation for women/men: 20.8±5.2/19.5±6.3 (TAT) and 15.7±2.2/23.2±2.3 (LMT). TAT/height2 and LMT/height2 didn’t show any age dependency for women/men (p = 0.973/0.557 and p = 0.483/0.539, respectively) nor TAT/height2 and LMT/height2 differences among age subgroups for both gender. There was significant correlation between TAT/height2 and body mass index (BMI) for women/men (p < 0.001 both), but not between LMT/height2 and BMI (p = 0.276/0.634). LMT/height2 correlated with TAT/height2 (p = 0.038/0.005) and ASAT/height2 (p = 0.011/0.002), but not with VAT/height2 (p = 0.205/0.252).

**Conclusion**
Women had higher TAT and lower LMT than men, but without significant age dependence. LMT/height2 correlated with TAT/height2 and ASAT/height2, but not with BMI.

**Clinical Relevance/Application**
Normative values of LMT allow to determine muscular trophic in patients and might help to diagnose myopathy. Side Note for reviewer only please: Volunteers of this abstract are identical to Abstract number 15013444, but as the topic of fat quantification is very complex, we decided to put the data in two abstracts with the first dealing with the age dependent different fat volumes and the second abstract dealing with the correlation of the skeletal muscle volumes and the different fat volumes.

**Effect of Iterative Reconstruction Algorithms on Measurement of Trabecular Bone Microstructure with Clinical MDCT: A Cadaver Study Using Micro-CT as the Reference Standard**

**Participants**

- Anthony S. Tadros, MD, San Diego, CA (Presenter) Nothing to Disclose
- Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
- Karen G. Chen, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
- Won C. Bae, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
- Reni Biswas, San Diego, CA (Abstract Co-Author) Nothing to Disclose
- Betty Tran, San Diego, CA (Abstract Co-Author) Nothing to Disclose
- Jing Xu, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
- Eric Y. Chang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
- Christine B. Chung, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

**Purpose**
To test the correlation of age- and gender-dependent reference standards of MR normative values of total adipose tissue (TAT), abdominal subcutaneous adipose tissue (ASAT) with the corresponding lean muscle tissue (LMT).

**Method and Materials**
Fat and water MR whole body images were acquired with a 2-point mDIXON sequence (Repetition time/echo time, 4.2 msec/1.2 msec, 3.1 msec) at 3 Tesla (Ingenia, Philips) in 80 healthy volunteers with normal BMI (18.5 to 25.5 kg/m2) aged between 20 and 60 years (10 men/10 women per decade). Volumes were measured from TAT, ASAT and LMT by a semi-automatic segmentation algorithm allowing separate quantification of each compartment (Advanced MR Analytics, AMRA, Linköping, Sweden). Pearson and Spearman correlations between Volume and several body measures were calculated. ANOVA was used to test for Volume differences among age subgroups. Prospective IRB approved study with written informed consent.

**Results**
Overall mean Volume (liter) ± standard deviation for women/men: 20.8±5.2/19.5±6.3 (TAT) and 15.7±2.2/23.2±2.3 (LMT). TAT/height2 and LMT/height2 didn’t show any age dependency for women/men (p = 0.973/0.557 and p = 0.483/0.539, respectively) nor TAT/height2 and LMT/height2 differences among age subgroups for both gender. There was significant correlation between TAT/height2 and body mass index (BMI) for women/men (p < 0.001 both), but not between LMT/height2 and BMI (p = 0.276/0.634). LMT/height2 correlated with TAT/height2 (p = 0.038/0.005) and ASAT/height2 (p = 0.011/0.002), but not with VAT/height2 (p = 0.205/0.252).

**Conclusion**
Women had higher TAT and lower LMT than men, but without significant age dependence. LMT/height2 correlated with TAT/height2 and ASAT/height2, but not with BMI.
Clinical multidetector computed tomography (MDCT) has been used to evaluate bone quality. The purpose of this study was to determine the efficacy of iterative reconstruction (IR) for measuring bone architecture through a comparison with micro-computed tomography (micro-CT) as the gold standard.

METHOD AND MATERIALS

L1 and L2 vertebrae of 10 fresh human cadavers were scanned by 64-section MDCT (LightSpeed VCT; reconstruction kernel, BONEPLUS; IR, ASiR; collimation, 64×0.625 mm), 80-section MDCT (Aquilion One Vision Edition; FC30, ADIR3D, 80×0.5 mm), and micro-CT (TOSCANER). Reconstructed voxel sizes were 0.2 × 0.2 × 0.16 mm for MDCT and 0.052 × 0.052 × 0.072 mm for micro-CT. Images were reconstructed using standard filtered back-projection and IR algorithms. Four patterns of CT images were reconstructed: without IR (IR (0%)), with 25-30% of IR (weak), with 50% of IR (mild), and with high-dose protocol without IR (120kV and 250mAs, HD). Trabecular parameters and tissue bone mineral density (tBMD) of the central 10-mm-thick portion of the vertebrae were calculated. Relationships between MDCT- and micro-CT-derived trabecular indices were compared using Pearson's correlation coefficient.

RESULTS

Metric parameters and tBMD measured by 64-section MDCT correlated better with micro-CT values with IR (mild) (r=0.611-0.948) than with IR (0%) (r=0.703-0.945). The correlation coefficients were significantly different (p<0.05). Non-metric parameters showed better correlations with micro-CT values with IR (0%) (r=0.712-0.883) than by IR (30% and 50%) (r=0.694-0.871). For 80-section MDCT, five of seven morphological parameters and tBMD correlated better with micro-CT values with IR (0%) (r=0.698-0.914) than with IR (25% and 50%) (r=0.663-0.888, p<0.05). For three of eight parameters by 64-section MDCT and six out of eight parameters with 80-section MDCT, the correlation coefficients were lowest with the HD protocol.

CONCLUSION

IR improved the correlation between 64-section MDCT and micro-CT-derived metric parameters. In the assessment of trabecular microstructure, IR algorithms showed different strengths according to the vendor and category of trabecular parameters.

CLINICAL RELEVANCE/APPLICATION

To ensure the accurate measurement of trabecular bone microstructure by clinical MDCT, it is important to select the appropriate reconstruction algorithm and imaging protocol.
**SS16**

**Musculoskeletal (Bone Strength, Fragility and Stress Fractures)**

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E450B

Participants
Bruce B. Forster, MD, Vancouver, BC (Moderator) Travel support, Siemens AG; Travel support, Toshiba Corporation;
Leon Lenchik, MD, Winston-Salem, NC (Moderator) Nothing to Disclose

Sub-Events

**SS16-01** 3 T MRI-based Metrics of Proximal Femur Microarchitecture and Strength Can Discriminate between Subjects with and without Fragility Fractures When BMD Cannot

Participants
Hamza Alizai, MD, New York, NY (Presenter) Nothing to Disclose
Chamith Rajapakse, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Stephen Honig, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Cheng Chen, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Punam K. Saha, PhD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Gregory Chang, MD, New York, NY (Abstract Co-Author) Speaker, Siemens AG

**PURPOSE**

Dual-energy x-ray absorptiometry (DXA) measurement of areal bone mineral density (BMD) poorly discriminates between subjects with and without fragility fractures. We investigated whether magnetic resonance imaging (MRI)-derived proximal femur microarchitectural parameters can discriminate between these two groups.

**METHOD AND MATERIALS**

This study had institutional review board approval. We recruited 22 females with fragility fractures (mean age=67.1±6.1 years) and 22 healthy female controls without fracture (mean age=64.1±6.5 years). All subjects underwent high-resolution 3T MRI of the non-dominant hip. We performed digital topological and finite element analyses within 10x10x10 mm3 femoral neck volumes-of-interest to assess: trabecular number, thickness, plate-to-rod ratio, connectivity; and elastic modulus (metric of bone strength). All subjects underwent DXA of the same hip. We performed receiver operating characteristics (ROC) analyses to assess discriminatory performance.

**RESULTS**

For MRI, femoral neck elastic modulus, trabecular plate-to-rod ratio, and connectivity could discriminate between subjects with and without fractures (area under the curve (AUC)=0.75-0.87, p<0.05), but trabecular thickness and number could not (AUC=0.46-0.53, p>0.78). For DXA, femoral neck and total hip BMD T-scores could not discriminate between the two groups (AUC=0.47-0.49, p>0.80).

**CONCLUSION**

Metrics of proximal femur microarchitecture and strength may be able to detect high fracture risk individuals even when BMD cannot.

**CLINICAL RELEVANCE/APPLICATION**

MRI based analysis of bone microarchitecture and strength may provide better measures of bone quality than Dual-Energy x-ray absorptiometry (DXA)

---

**SS16-02** Long-term Radiographic Follow-up of Bisphosphonate-related Femur Fractures

Participants
Jennifer L. Favinger, MD, Seattle, WA (Presenter) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (Abstract Co-Author) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Alice S. Ha, MD, Seattle, WA (Abstract Co-Author) Grant, General Electric Company

**PURPOSE**

Although the initial appearance of atypical femur fractures associated with bisphosphonate use has been well documented, there are no prior studies evaluating long-term radiographic follow up of how these fractures change over time. It has been shown that bisphosphonates remain in bone for years after drug discontinuation, suggesting these fractures might not heal with the same pattern as normal bone.

**METHOD AND MATERIALS**

In this retrospective study, bisphosphonate-related fracture radiographs and CTs were reviewed by two radiologists for presence of a fracture line, callus, and the characteristic cortical beak. Indications of healing were defined as the fracture line or cortical beak appearing distinctly less conspicuous, though not necessary absent, compared to the prior study. Kaplan-Meier (KM) curves were used to analyze the time to first indication of healing. KM curves were compared between groups using the logrank test.
RESULTS

47 femurs with a bisphosphonate-related femur fracture were identified in 28 women, average age 65 years. 85% took a bisphosphonate for greater than 5 years, 59% for greater than 10 years. Median follow up time was 1.7 years with a median of 6 exams per femur. Median time to beak healing was 265 weeks. Median time to fracture line healing was 56 weeks in the 31 femurs with a baseline fracture. Healing rates of the beak (p = 0.03) and fracture line (p = 0.07) tended to be higher in those who discontinued bisphosphonate by 1 week after the initial exam compared to those who discontinued later. However, even in this group that discontinued earlier, only 53% demonstrated fracture line healing and 24% demonstrated beak healing at 6 months follow up.

CONCLUSION

Despite drug discontinuation, bisphosphonate-related fractures fail to show normal radiographic healing patterns in long-term follow-up, in keeping with recent pathology studies that showed persistent intrasosseous drug presence years after drug discontinuation. These fractures demonstrate abnormally long healing time with less than 5% of patients showing any form of fracture healing at 6 weeks, and less than 50% showing any healing at 26 weeks. Therefore, these patients remain at high risk for displaced fractures and non-union.

CLINICAL RELEVANCE/APPLICATION

Atypical femur fractures are associated with significant morbidity and demonstrate abnormal or incomplete healing even years after drug discontinuation.

SSJ16-03 Does Intravenous Contrast Administration Affect Bone Mineral Density Assessment Using Multi-detector Computed Tomography?

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E450B

Participants
Sabarish Narayanasamy, MBBS,MD, Aligarh, India (Presenter) Nothing to Disclose
Jitender Singh JR, MD, Aligarh, India (Abstract Co-Author) Nothing to Disclose
Saifullah Khalid, MD, Aligarh, India (Abstract Co-Author) Nothing to Disclose
Paul A. Sathiadoss, MBBS, Aligarh, India (Abstract Co-Author) Nothing to Disclose
Breethaa J. Selvamani, Aligarh, India (Abstract Co-Author) Nothing to Disclose
Mohd. Khalid, MBBS, MD, Aligarh, India (Abstract Co-Author) Nothing to Disclose

PURPOSE

The aim of our study was to evaluate whether contrast media administration has significant influence on Computed tomography (CT) derived bone density measurements by comparing the unenhanced and contrast enhanced CT examinations.

METHOD AND MATERIALS

89 patients (47 Males and 42 Females; Mean age ± SD, 53 ± 10.6) who underwent both unenhanced and contrast enhanced CT examinations in the same setting between January 2014 and January 2015 were retrospectively selected. The only exclusion criterion was patients less than 40 years of age. CT attenuation values in Hounsfield units were measured in the first lumbar (L1) vertebra (using simple non-angled ROI) in both the unenhanced and contrast enhanced examinations. Comparisons were made between the measurements using appropriate statistical methods.

RESULTS

The mean CT attenuation value in the contrast enhanced phase (Mean ± SD, 186.7 ± 49.7) was significantly higher as compared to the unenhanced phase (170.1 ± 52.2, p = 0.000). The mean CT attenuation values were higher in males as compared to females in both unenhanced (Males vs Females; 180.8 ± 52.1 vs 158.2 ± 50.1, p=0.04) and contrast enhanced phases (192.2 ± 50.9 vs 180.5 ± 48.1, p = 0.27). When a threshold of 160HU or less is used to define osteoporosis, measurements in the contrast enhanced phase resulted in 8% false negatives.

CONCLUSION

Our study demonstrates that intravenous contrast administration significantly affects the Bone Mineral density assessment using CT. This must be factored in, when CT is used as a screening tool for osteoporosis.

CLINICAL RELEVANCE/APPLICATION

There are significant differences in CT attenuation values depending on the phase of image acquisition and therefore standardized image acquisition protocols must be used for bone density assessment.

SSJ16-04 Multi-modality Imaging for Tumor Localization in Patients with Tumor-induced Osteomalacia: A Retrospective Analysis of Five Cases

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E450B

Participants
Kersten Peldschus, MD, Hamburg, Germany (Presenter) Nothing to Disclose
Thomas Branckhorst, Hannover, Germany (Abstract Co-Author) Nothing to Disclose
Christian Wisotzki, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Thorsten Derlin, MD, Hannover, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Michael Arning, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Stefan Breer, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

The purpose of this retrospective study was to evaluate imaging findings of patients with tumor-induced osteomalacia who underwent multi-modality imaging to localize the underlying tumor.
**METHOD AND MATERIALS**

Five patients who were successfully treated after suffering up to several years from tumor-induced osteomalacia and who underwent multi-modality imaging to localize the tumor were included in the analysis. All patients underwent 111In-octreotide scintigraphy and 68Ga DOTATATE PET/CT for somatostatin receptor imaging as well as MRI and additional CT (only 3 patients) of suspicious lesions from radionuclide imaging to further characterize the tumors for surgical treatment planning. Tumors were evaluated regarding tracer accumulation, size and contrast enhancement. Data sets were analyzed in consensus by experienced radiologists and nuclear medicine specialists.

**RESULTS**

Out of the five patients (50.4±7.3 y/o, 3 female, 2 male) 111In-octreotide scintigraphy revealed a suspicious lesion in 2 patients, whereas 68Ga DOTATATE PET/CT demonstrated tumor suspicious tracer enhancement in all 5 patients (mean SUVmax 14.9±10.0). Contrast-enhanced MRI could confirm tumors lesions (mean diameter 2.5±1.6 cm) in all cases. After surgical removal histopathological analysis revealed three mesenchymal tumors of mixed connective tissue variant and two odontogenic fibroma, endothelium rich type. On MRI the mean size of tumors identifiable with 111In-octreotide scintigraphy was 4.5±0.6 cm versus 1.2±0.1 cm for tumors detectable only with 68Ga DOTATATE PET/CT. Complete surgical removal was achieved in all patients, no recurrence was observed during 1-year follow-up.

**CONCLUSION**

In patients with tumor-induced osteomalacia 68Ga DOTATATE PET/CT was able to detect significantly smaller tumors than 111In-octreotide scintigraphy. Subsequent MRI (and CT) were required to further characterize the tumors for surgical treatment planning.

**CLINICAL RELEVANCE/APPLICATION**

In patients with suspected tumor-induced osteomalacia 68Ga DOTATATE PET/CT may allow the detection of small tumors that are negative on 111In-octreotide scintigraphy.

**SSJ16-05  The Effect of Body Mass Index on Bone Mineral Density and Trabecular Bone Score**

**Tuesday, Dec. 1 3:40PM - 3:50PM Location: E450B**

**Participants**

Cristian G. Monaco, MD, San Donato Milanese, Italy (Presenter) Nothing to Disclose
Carmelo Messina, MD, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Poloni, Milano, Italy (Abstract Co-Author) Nothing to Disclose
Giovanni Di Leo, San Donato Milanese, Italy (Abstract Co-Author) Travel support, Bracco Group
Lucia Maria Sconfienza, MD, PhD, San Donato Milanese, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Sandanelli, MD, San Donato Milanese, Italy (Abstract Co-Author) Speakers Bureau, Bracco Group Research Grant, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific

**PURPOSE**

Trabecular Bone Score (TBS) measured on lumbar spine dual energy x-ray absorptiometry (DXA) provides an indirect index of trabecular microarchitecture. According to proponents, TBS is adjusted to the patient’s body mass index (BMI). In obese patient, bone mineral density (BMD) is usually increased due to image noise related to soft tissue superimposition. Our aim was to investigate the effect of BMI on BMD and TBS.

**METHOD AND MATERIALS**

After ethics committee approval, we retrospectively reviewed the last 197 DXA examinations performed at our institution. For each patient, data on TBS, BMI, and BMD were registered. An experienced reader evaluated all examinations. TBS and BMD were automatically averaged from L1 to L4. T-score was categorized according the WHO criteria. The presence of osteoarthrosis was determined when a difference of more than a 1.0 T-score was found between two adjacent vertebrae, in agreement to the International Society for Clinical Densitometry guidelines. Correlation was estimated using the Pearson coefficient and multivariate regression using TBS as dependent variable. Data were presented as mean±standard deviation.

**RESULTS**

T-score diagnosis was normal in 54 patients (27.4%), osteopenia in 95 (48.2%), and osteoporosis in 48 (24.4%). Overall, BMI was 26±5 kg/m2; BMD 0.877±0.153 g/cm2; TBS 1.224±0.117 mm-1. Osteoarthrosis was evident in 55 (28%) patients. Bivariate correlation analysis between TBS and BMI was significant (r = -0.396, P<.001); this correlation was higher in patients with BMI≥30 kg/m2 (r = -0.501, P=.015) than in those with BMI<30 kg/m2 (r= -0.207, P=.006). The correlation between TBS and BMD was: r=0.313 (P<.001), overall; r=0.431 (P=.040), in patients with BMI≥30 kg/m2; r=0.408 (P<.001), in patients with BMI<30 kg/m2. Multivariate regression analysis confirmed that BMI and BMD are independently associated to TBS (P<.001), both overall and only in patients without osteoarthrosis.

**CONCLUSION**

The higher the BMI the lower the TBS. BMI and BMD were independent predictors of TBS.

**CLINICAL RELEVANCE/APPLICATION**

TBS evaluation may be impaired in patients with high BMI, especially when BMI≥30 kg/m2.

**SSJ16-06  Stress Fracture Diagnosis on Conventional Radiography and MRI: Variations Based on Fracture Location, Patient Age, and Time to MRI**

**Tuesday, Dec. 1 3:50PM - 4:00PM Location: E450B**

**Participants**

Gregory S. Matthews, MD, Winston-Salem, NC (Presenter) Nothing to Disclose
Scott D. Wuerzter, MD, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Maha Torabi, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Pushpender Gupta, MBBS, Winston-Salem, NC (Abstract Co-Author) Author, Reed Elsevier
PURPOSE
To determine if the diagnosis of stress fracture on conventional radiographs (CR) and MRI is influenced by fracture location, age of patient, and time between CR and MRI.

METHOD AND MATERIALS
Imaging studies of patients with suspected stress fractures over a five year period were evaluated. Only patients with CR and MRI studies less than 3 months apart were included. Stress fractures were categorized into three anatomic regions: 1) foot/ankle, 2) tibia/distal femur, 3) pelvis/proximal femur. Sensitivity and specificity of CR was determined by region. Odds ratios (95% CI) between patient age and positive CR and MRI diagnosis were determined. Also, odds ratio between days between CR and MRI and positive diagnosis of fracture was determined.

RESULTS
285 patients (mean age, 41 years; age range, 4-91 years) with clinical suspicion of stress fracture were evaluated with both CR and MRI. Based on CR, stress fractures were diagnosed (or highly suspected) in 61/295 (20.7%) of patients, including 25/144 (17.4%) in foot/ankle, 19/49 (38.8%) in tibia/distal femur, and 17/91 (18.7%) in pelvis/proximal femur. Based on MRI, stress fracture or stress reaction was diagnosed in 133/295 (45.1%) of patients, including 82/144 (56.9%) in foot/ankle, 26/49 (53.1%) in tibia/distal femur, and 25/91 (27.5%) in proximal femur/pelvis. Sensitivity of CR was 23% in foot/ankle, 31% in tibia/distal femur, and 12% in pelvis/proximal femur. Specificity of CR was 90% in foot/ankle, 52% in tibia/distal femur, and 79% in pelvis/proximal femur. For each decade of life, the odds of a positive CR diagnosis increased by 21% (OR: 1.21; 95% CI: 1.04,1.40], whereas the odds of a positive MRI diagnosis decreased by 14% (OR: 0.86; 95% CI: 0.76,0.97). There was no significant relationship between days between CR and MRI and positive diagnosis of fracture.

CONCLUSION
The diagnosis of stress fracture varies by fracture location and age of patient.

CLINICAL RELEVANCE/APPLICATION
Approach to imaging of stress fractures should take into account fracture location and age of patient.
LEARNING OBJECTIVES

1) Understand how variations in the macroscopic architecture of muscle relate to its physiological function, affect its risk of injury, and determine the pathoanatomy and imaging appearance following muscle strain. 2) Understand anatomy and histology of tendon, its normal and abnormal imaging appearances, and common patterns of tendon pathology based on anatomic location. 3) Review the anatomy of the tendon-entheseal unit with emphasis on the types of lesion that affect the region of the footprint, with emphasis on MR imaging.
**Nerve Ultrasound Based on a Regional Approach: Elbow to Hand (Hands-on)**

**Tuesday, Dec. 1 4:30PM - 6:00PM Location: E264**

*AMA PRA Category 1 Credits™: 1.50*

*ARRT Category A+ Credits: 1.50*

**Participants**

Carlo Martinoli, MD, Genova, Italy, (carlo.martinoli@unige.it) *(Moderator)* Nothing to Disclose

J. Antonio Boufard, MD, Detroit, MI *(Presenter)* Nothing to Disclose

Catherine J. Brandon, MD, Ann Arbor, MI *(Presenter)* Stock options, VuCOMP, Inc

Mary M. Chiavaras, MD, PhD, Ancaster, ON *(Presenter)* Nothing to Disclose

Joseph G. Craig, MD, Detroit, MI *(Presenter)* Nothing to Disclose

Michael A. DiPietro, MD, Ann Arbor, MI *(Presenter)* Nothing to Disclose

David P. Fessell, MD, Ann Arbor, MI *(Presenter)* Nothing to Disclose

Ghiyath Habra, MD, Royal oak, MI *(Presenter)* Nothing to Disclose

Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) *(Presenter)* Consultant, General Electric Company Consultant, Koninklijke Philips NV Stockholder, Koninklijke Philips NV Stockholder, General Electric Company Grant, Siemens AG Grant, General Electric Company

Rachel B. Hulen, MD, Novi, MI *(Presenter)* Nothing to Disclose

Marina Kislyakova, MD, Moscow, Russia, (mkislikova@yandex.ru) *(Presenter)* Nothing to Disclose

Joseph H. Introcaso, MD, Neenah, WI *(Presenter)* Nothing to Disclose

Jon A. Jacobson, MD, Ann Arbor, MI *(Presenter)* Consultant, BioClinica, Inc; Royalties, Reed Elsevier;

Kenneth S. Lee, MD, Madison, WI *(Presenter)* Research Consultant, SuperSonic Imagine; Consultant, Echometrix, LLC; Royalties, Reed Elsevier

Humberto G. Rosas, MD, Madison, WI *(Presenter)* Nothing to Disclose

Matthieu Rutten, MD, Hertogenbosch, Netherlands *(Presenter)* Nothing to Disclose

Courtney E. Scher, DO, Detroit, MI *(Presenter)* Nothing to Disclose

Alberto S. Tagliafico, MD, Genova, Italy *(Presenter)* Nothing to Disclose

Ximena L. Wortsman, MD, Santiago, Chile, (xworts@yahoo.com) *(Presenter)* Nothing to Disclose

Andrea Klauser, MD, Innsbruck, Austria *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Familiarize course participants with the ultrasound appearance of nerves and the scanning techniques used to image them in the distal upper extremity.

2) Emphasize the ultrasound anatomy of the median, ulnar, radial nerves and their divisional branches at the most common sites of entrapments, including the carpal tunnel and the cubital tunnel.

3) Learn the technique to image some minor nerves in their course throughout the distal upper extremity, such as the the lateral and the medial antebrachial cutaneous.

4) Outline the range of clinical conditions where ultrasound is appropriate as the primary imaging modality for nerve assessment.

**ABSTRACT**

In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound with a special focus on nerves of the distal upper extremity (elbow to hand). The standardized techniques of performing an adequate ultrasound study of the median, ulnar, radial and their divisional branches, lateral cutaneous of the forearm and medial cutaneous of the arm and the forearm will be illustrated. 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.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jon A. Jacobson, MD - 2012 Honored Educator
Musculoskeletal Wednesday Case of the Day

Wednesday, Dec. 2 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit™: .50

Participants
William F. Conway, MD, PhD, Charleston, SC (Presenter) Nothing to Disclose
Russell W. Chapin, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Robert H. Hazelrigg, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Thomas Britt, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Nathaniel Jones, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Kevin G. Garrett, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew R. Gilott, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew P. Brill, DO, Oklahoma City, OK (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.
**Imaging Diagnosis of Atypical Infection**

**Participants**
Mark D. Murphey, MD, Reston, VA (Presenter) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (Moderator) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Identify the typical imaging features suggesting atypical musculoskeletal infection. 2) Understand the pathological basis for the imaging patterns of atypical musculoskeletal infection. 3) Detect imaging features that allow differentiation of atypical musculoskeletal infection from neoplastic lesions and virulent infection.

**Honored Educators**
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mark D. Murphey, MD - 2015 Honored Educator

**MRI of Total Knee Arthroplasty: Synovial Patterns Predictive of Disease**

**Participants**
Angela E. Li, MBBS, MMed, New York, NY (Presenter) Nothing to Disclose
Darryl B. Sneag, MD, Chestnut Hill, MA (Abstract Co-Author) Nothing to Disclose
Harry G. Greditzer IV, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Christine C. Johnson, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Kara Fields, New York, NY (Abstract Co-Author) Nothing to Disclose
Douglas E. Padgett, MD, New York, NY (Abstract Co-Author) Consultant, Stryker Corporation;
Theodore T. Miller, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Hollis G. Potter, MD, New York, NY (Abstract Co-Author) Research support, General Electric Company

**PURPOSE**
To determine the sensitivity and specificity of various synovial appearances on MRI in patients with a painful total knee arthroplasty (TKA).

**METHOD AND MATERIALS**
With IRB approval, 101 consecutive patients who had knee MRI within 1 year prior to revision TKA were identified from our hospital registry of retrieved TKA implants. All MR scans were performed on a 1.5T magnet. Axial, coronal and sagittal PD, sagittal inversion recovery and MAVRIC PD MR images were retrospectively reviewed blinded to the ultimate diagnoses and the cases were categorized by the appearance of the synovium as one of the following: bulky hypertrophied synovium (suggestive of particle induced synovitis), lamellated and hyperintense (suggestive of infection), globally thickened and contracted (suggestive of arthrofibrosis), and mildly thickened with a homogenous effusion (suggestive of non-specific synovitis). The MR appearances were then compared with operative reports, microbiology, and pathology reports.

**RESULTS**
Bulky hypertrophied synovium had 69% sensitivity, 89% specificity and 94% PPV for particle induced synovitis with implant particles seen at histopathology, and 98% sensitivity and 100% PPV for an operative diagnosis of aseptic loosening, severe polyethylene wear, or osteolysis. Lamellated synovitis had 85% sensitivity, 99% specificity and 94% PPV for infection. A contracted and globally thickened synovium had 75% sensitivity, 98% specificity and 60% PPV for arthrofibrosis. A mildly thickened synovial appearance had 63% sensitivity, 93% specificity, and 79% PPV for stiffness, instability, and nonspecific pain as the reason for revision TKA.

**CONCLUSION**
In patients with a painful TKA, MRI appearance of the synovium can be used to differentiate between cases of particle induced wear, infection, arthrofibrosis and non-specific synovitis.

**CLINICAL RELEVANCE/APPLICATION**
MRI is predictive of various synovial pathologic conditions in TKA and may be valuable in the diagnostic workup of patients with a painful TKA.

**RC504-03 The Value of Simultaneous 18F-FDG-PET/MRI for the Detection of Spondylodiscitis: A Feasibility Study**

Wednesday, Dec. 2 9:05AM - 9:15AM Location: E451B

**Participants**
- Benjamin Friedrich, Leipzig, Germany (Abstract Co-Author) Nothing to Disclose
- Jeanette Fahnert, Leipzig, Germany (Abstract Co-Author) Nothing to Disclose
- Sandra Purz, MD, Leipzig, Germany (Abstract Co-Author) Nothing to Disclose
- Jens Gulow, Leipzig, Germany (Abstract Co-Author) Nothing to Disclose
- Thomas K. Kahn, MD, Leipzig, Germany (Abstract Co-Author) Nothing to Disclose
- Henryk Barthel, Leipzig, Germany (Abstract Co-Author) Consultant, Siemens AG Consultant, The Piramal Group; Travel support, Siemens AG Travel support, The Piramal Group; Speaker, Siemens AG Speaker, The Piramal Group
- Osama Sabri, MD, Leipzig, Germany (Abstract Co-Author) Research Consultant, The Piramal Group; Research Consultant, Siemens AG; Travel support, Siemens AG Travel support, The Piramal Group Speaker, Siemens AG Speaker, The Piramal Group
- Patrick Stumpp, MD, Leipzig, Germany (Presenter) Nothing to Disclose

**PURPOSE**
The diagnosis of infectious spondylodiscitis is often challenging. Alterations seen in MRI are quite sensitive, but lack specificity and the distinction from osteochondrosis is often difficult. The aim of the present study was to assess the diagnostic value of simultaneous 18F-FDG-PET/MRI in cases of suspected spondylodiscitis.

**METHOD AND MATERIALS**
in a prospective study 25 patients with suspected spondylodiscitis were enrolled. All patients underwent a simultaneous whole spine simultaneous 18F-FDG-PET/MRI scan including standard MRI sequences with/out contrast. Image datasets were evaluated by two radiological residents with 1-5 years experience and one board certified nuclear medicine physician independently and finally in consensus. For all suspected spinal discs as well as a healthy disc SUVmean and SUVmax were determined. The diagnostic certainty of MRI data was evaluated on a five-point Likert Scale. The consensus decision was dichotomized into spondylodiscitis - no spondylodiscitis.

**RESULTS**
The inter-rater agreement between the two radiologists in regard of the MRI scans was moderate with a weighted $\kappa=0.67$ and an absolute diagnostic certainty in just $10\%$. With addition of the PET data, the agreement between the radiologists rose to $\kappa=0.95$ and an absolute diagnostic certainty in $50\%$. In one case the diagnosis changed due to the additional PET data. The final histological analysis was in all cases identical with the imaging diagnosis. There was a strong correlation between the SUVmax ratio of healthy/sick disc and the 5-point MRI rating with $R^2=0.52$; $p<0.001$. In a ROC analysis a SUVmax ratio of $2.89$ had a $100\%$ specificity and sensitivity with an AUC of 1 for the correct diagnosis. Neither level of CRP nor leukocyte count could show a significant correlation to the spondylodiscitis diagnosis.

**CONCLUSION**
Simultaneous 18F-FDG-PET/MRI for the detection of Spondylodiscitis seems to be feasible and is increasing the diagnostic certainty in an often challenging imaging diagnosis.

**CLINICAL RELEVANCE/APPLICATION**
18F-FDG-PET/MRI can be safely used for the detection of Spondylodiscitis.

**RC504-04 Assessing the Effect of Football Play on Knee Articular Cartilage Using Delayed Gadolinium-Enhanced MRI of Cartilage (dGEMRIC)**

Wednesday, Dec. 2 9:15AM - 9:25AM Location: E451B

**Participants**
- Wenbo Wei, Columbus, OH (Presenter) Nothing to Disclose
- Becky Lathrop, Columbus, OH (Abstract Co-Author) Nothing to Disclose
- Guang Jia, PhD, Baton Rouge, LA (Abstract Co-Author) Nothing to Disclose
- David Flanigan, MD, Columbus, OH (Abstract Co-Author) Consultant, Verciel; Consultant, Smith & Nephew plc
- Aijit M. Chaudhari, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
- Michael V. Kopp, MD, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
- Alan Rogers, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
- Jason E. Payne, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Articular cartilage injuries are very common among NFL players. In retired NFL players, early onset of OA was found to be three times higher than the general population. Delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) has been shown to quantify regional variations of glycosaminoglycan (GAG) concentrations within the cartilage. The goal of this pilot study is to determine the cumulative effects of multiple years of play on cartilage microarchitecture assessed by GAG concentration variation using dGEMRIC.

**METHOD AND MATERIALS**
The MR images of both of each athlete's knee joints were acquired using an 8-channel knee coil at a 3T system (Achieva, Philips). dGEMRIC was performed at pre- and post-contrast injection periods using a set of five fast field echo pulse sequences with multiple flip angles ($4$, $8$, $12$, $16$, $20$ degrees). Sagittal slices were obtained with the imaging parameters as TR/TE = $6.3/3.2$ ms, resolution $= 0.37 \times 0.37$ mm², slice thickness $= 4$ mm, NSA $= 2$. The contrast agent Magnevist was injected intravenously at a standard dose of $0.2 \text{ mmol/kg body weight}$. To help the contrast efficiently diffuse into the cartilage, subjects were instructed to perform joint movement for $100$ minutes. The total procedure time was around $3.5$ hours.
RESULTS

Except the MTP of the right knee at the pre-season, subjects with more years of football play retained relatively higher volume of contrast at all cartilage compartments in both pre- and post-season. At the pre-season and post-season, one year collegiate football players presented pre-season with 0.116 mM and initial post session with 0.117 mM average contrast concentration. In players with more years of experience, the measurements were elevated to 0.139 mM and 0.140 mM, respectively, both with a 20% increase. The p-value generated from student t-test did not present any significant difference at the pre-season which is probably due to the limited sample size.

CONCLUSION

In conclusion, playing collegiate football for a longer period of time may lead to microstructural alterations, like GAG concentration changes within the knee cartilage. The decreased GAG concentration may be indicative of a higher risk factor for articular cartilage degradation and potential development of OA.

CLINICAL RELEVANCE/APPLICATION

dGEMRIC can be a quantitative imaging technique to identify micro-architectural changes in cartilage health that are not observed with standard cartilage MR sequences.

RC504-05 Use of Combined Dynamic and Quantitative MRI to Investigate the Influence of Cartilage Contact on Cartilage Morphology, Composition, and Ultra-Structure

Wednesday, Dec. 2 9:25AM - 9:35AM Location: E451B

Participants
Jarred Kaiser, Madison, WI (Abstract Co-Author) Nothing to Disclose
Fang Liu, Madison, WI (Abstract Co-Author) Nothing to Disclose
Darryl Thelen, Madison, WI (Abstract Co-Author) Nothing to Disclose
Richard Kijowski, MD, Madison, WI (Presenter) Nothing to Disclose

PURPOSE

To investigate the relationship between cartilage contact and cartilage morphology, composition, and ultra-structure using combined dynamic and quantitative MRI.

METHOD AND MATERIALS

Four young asymptomatic volunteers underwent combined dynamic and static MRI on a 3.0T scanner. Dynamic SPGR images were continuously acquired while the subjects actively flexed and extended their knee at 0.5 Hz for 5 minutes in a custom-made loading device. Static 3D-FSE and mcDESPOT bi-component T2 mapping sequences were also performed. Reconstructed kinematics were used to compute tibia contact maps which were defined as the maximum depth of penetration of the tibia cartilage mesh into the femoral cartilage mesh through the flexion-extension cycle. 3D-FSE was used to create tibia cartilage thickness maps, while mcDESPOT was used to create tibia cartilage single-component T2 relaxation time (T2) maps and cartilage fast relaxing water fraction (FF) maps, the latter of which is thought to represent water bound to proteoglycan. The maps were sub-divided into 10 equal-sized regions of interest (ROI) on the medial and lateral tibia. ROI-based Pearson correlation analysis was performed between cartilage contact and cartilage quantitative MRI parameters.

RESULTS

Cartilage contact was greater on the medial tibia than the lateral tibia for all subjects with larger areas of positive penetration of the tibia cartilage mesh into the femoral cartilage mesh and greater maximum depth of penetration. Higher FF values were also noted in the medial tibia in all subjects, while no visible differences in the cartilage thickness and cartilage T2 maps between the medial and lateral tibia could be identified. The degree of cartilage contact was positively correlated with cartilage thickness ($r=0.341$, $p=0.001$) and cartilage FF ($r=0.417$, $p=0.001$) and negatively correlated with cartilage T2 ($r=-0.211$, $p=0.04$).

CONCLUSION

Cartilage is a tissue well-adapted to withstand higher compressive forces with areas exposed to greater contact being thicker and having lower T2 (likely reflecting a thicker radial zone comprised of perpendicularly oriented collagen fibers) and higher FF (likely reflecting greater proteoglycan content).

CLINICAL RELEVANCE/APPLICATION

Combined dynamic and quantitative MRI may be useful for investigating how biomechanical factors within the knee joint influence normal cartilage physiology and cartilage degeneration in patients with osteoarthritis.

RC504-06 Functional Cartilage Imaging in Clinical Practice

Wednesday, Dec. 2 9:35AM - 10:00AM Location: E451B

Participants
Christine B. Chung, MD, San Diego, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Emphasize the biochemical composition of articular cartilage and its relationship to intrinsic MR property. 2) Describe the normal morphologic and quantitative MR signature of articular cartilage on various pulse sequences. 3) Describe MR and clinical cartilage grading systems. 4) Identify indications and appropriate MR protocols for cartilage evaluation, including primary chondral/ osteochondral evaluation versus cartilage evaluation as a surrogate for meniscal function.

RC504-07 Osteochondral Injuries

Wednesday, Dec. 2 10:10AM - 10:30AM Location: E451B

Participants
LEARNING OBJECTIVES

1) Describe the findings of imaging of acute bone injury including radiography and MRL. 2) Recognize the bone and marrow changes see on MRI in osteopenia and hyperemia. 3) Identify the imaging findings of osteonecrosis. 4) Accurately describe the entity typically referred to as "ostechondral lesion".

RC504-08  Grade 1 Cartilage Lesions in the Knee are Precursors of More Severe Cartilage Damage - Data from the Osteoarthritis Initiative

Wednesday, Dec. 2 10:30AM - 10:40AM Location: E451B

Participants

Benedikt J. Schwaiger, MD, San Francisco, CA (Presenter) Nothing to Disclose
Alexandra S. Gotting, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
John Mbapte Wamba, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Michael C. Nevitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (Abstract Co-Author) Instructor, F. Hoffmann-La Roche Ltd Expert Witness, Mallinckrodt plc Consultant, Mallinckrodt plc

PURPOSE

The significance of MR cartilage signal abnormalities with or without cartilage swelling (grade 1 lesions) is not well understood and previous reports in the literature are inconclusive. Purpose of our study was therefore to assess the natural evolution of different types of grade 1 cartilage lesions (G1CL) in subjects without radiographic evidence of knee osteoarthritis (OA) over 48 months in comparison to matched controls without lesions.

METHOD AND MATERIALS

Subjects from the Osteoarthritis Initiative (n=59; age 56.6±8.3; 56% women) with G1CL diagnosed on 3T MRIs of the right knee but without focal defects of cartilage and without radiographic evidence of OA (KL scores 0-1) were frequency matched for age, sex, baseline KL and BMI with 52 controls without any cartilage lesion (age 54.8±6.5; 58% women). Individual G1CL (n=76) on intermediate-weighted fast spine echo sequences were categorized into 4 subgrades: A=hypointense, B=inhomogeneous, C=hyperintense, D=hyperintense with swelling. After 48 months progression of cartilage and subchondral bone marrow changes was assessed. Fisher's exact test was used for group and subgroup comparisons.

RESULTS

At baseline G1CL were detected significantly more frequently in the patellofemoral than in the tibiofemoral joint (48 vs. 28, P=0.022), and subgrades A or B were more frequent than C or D (n=65 vs. 11, P<0.001). Across compartments, G1CL progressed in 48-67% to focal cartilage lesions, while only 2-6% of controls showed incidental focal lesions (patella: 48 vs. 6%, P<0.001; trochlea: 52 vs. 2%, P<0.001; medial femur: 67 vs. 2%, P<0.001; lateral femur: 50 vs. 2%, P=0.011; medial tibia: 50 vs. 2%, P<0.001; lateral tibia: 47 vs. 6%, P=0.001). No significant differences in progression were found between G1CL subgrades (P>0.05). Incidental bone marrow abnormalities were associated with G1CL lesions in the patella (39 vs. 2% in the controls, P<0.001), trochlea (36 vs. 2%, P<0.001) and lateral tibia (47 vs. 2%, P<0.001).

CONCLUSION

G1CL are precursors of more severe structural cartilage abnormalities. Reporting these signal abnormalities is therefore crucial to identify patients at risk for progressive cartilage degeneration and may impact patient management.

CLINICAL RELEVANCE/APPLICATION

Grade 1 cartilage lesions often progress to more severe cartilage degeneration, and diagnosis therefore may have an impact on patient management, including life style changes and cartilage repair.

RC504-09  MR Bone Morphometry Predicts Biomechanical Property

Wednesday, Dec. 2 10:40AM - 10:50AM Location: E451B

Participants

Betty Tran, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Reni Biswas, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Kyu-Sung Kwack, MD, PhD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Robert Healey, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Won C. Bae, PhD, San Diego, CA (Presenter) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Subchondral trabecular bone is often involved during knee injury and joint degeneration. MR evaluation of articular cartilage, as well as subchondral bone, would be useful clinically. Purpose of this study was to determine if MR morphometric measures of subchondral trabecular bone correlates with shear biomechanical failure.

METHOD AND MATERIALS

Nine 8.5-mm diameter osteochondral cores were harvested (Fig.A) from tibial plateau of cadaveric donors (age range 60 to 86 years old) and imaged at 3T (Fig.C) using 3D spoiled gradient echo without fat suppression at 200 micron isotropic resolution. Cores were cut axially, while recording force and displacement to determine shear energy (Fig.B). MR data was cropped to 1-mm thickness near each cut location, region of interest was selected to exclude artifacts, and standard bone morphometric analysis was performed (Fig.C). Total of 19 cut locations were analyzed.
RESULTS
From MR data, 3D structure of trabeculae could be discerned (Fig.C). Many of morphometric measures, including bone volume fraction, trabecular thickness, and structure model index, correlated significantly with biomechanical shear energy (Fig.D), suggesting that higher density, thicker, and plate-like properties of the trabeculae correlated with higher shear energy needed to cut through the sample.

CONCLUSION
High resolution MRI is a useful modality not only for soft tissue evaluation, but also for quantitative evaluation of trabecular bone, which may serve as a surrogate for bone strength.

CLINICAL RELEVANCE/APPLICATION
This study has implications for evaluation of human bone structure using non-ionizing MRI modality, with applications for conditions such as subchondral bone insufficiency fracture.

RC504-10 The Role of Mechanical Stress on the Vascularization of Subchondral Bone in the Femoral Head: A DCE-MRI Study

Wednesday, Dec. 2 10:50AM - 11:00AM Location: E451B

Participants
Jean-François Budzik, MD,PhD, Lille, France (Presenter) Nothing to Disclose
Guillaume Lefebvre, MD, Lille, France (Abstract Co-Author) Nothing to Disclose
Helene Behal, Lille, France (Abstract Co-Author) Nothing to Disclose
Sebastien Verlytte, MD, Marcq en Baroeul, France (Abstract Co-Author) Nothing to Disclose
Pierre Hardoun, Boulogne-Sur-Mer, France (Abstract Co-Author) Nothing to Disclose
Anne Cotten, MD, Lille, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the normal perfusion pattern of subchondral bone in the femoral head with Dynamic Contrast Enhanced (DCE)-MRI and to study the influence of mechanical stress.

METHOD AND MATERIALS
This prospective study was approved by our Institutional Review Board. Informed Consent was obtained. DCE-MRI of the right hip was performed in sixty adults (32 women, 28 men) between April and September 2014. Mean age was 37.5 (±12.5). Regions of interest (ROI) were deposed in the center and in subchondral areas of the femoral head. Semi-quantitative and pharmacokinetic parameters were calculated. Perfusion parameters were compared between ROIs using a linear mixed model. Associations of each perfusion parameter with age, sex, body mass index (BMI) were studied using analysis of covariance models; age and sex were systematically introduced into models.

RESULTS
Semi-quantitative and pharmacokinetic parameters were different between the center of the femoral head and supero-lateral, antero-superior and posterior subchondral zones (p≤0.028). Parameters in the inferior zone differed from those of the supero-lateral and antero-superior zones (p≤0.029). BMI was negatively correlated with Time To Peak in all zones (p≤0.041). BMI was positively correlated with Ktrans and Ve values in all zones except the inferior (p≤0.035). Ve values were inferior in women in every zone (p≤0.039). Ktrans and Ve values were negatively correlated with age in posterior and inferior zones (p≤0.039).

CONCLUSION
This study demonstrates that the perfusion of subchondral bone is not homogeneous within the femoral head. Our results suggest that mechanical stress influences the microvascular properties of subchondral bone marrow.

CLINICAL RELEVANCE/APPLICATION
The proposed role of mechanical stress on the microvascularization of subchondral bone offers new opportunities in osteoarthritis research.

RC504-11 Metatarsophalangeal Joint Instability

Wednesday, Dec. 2 11:00AM - 11:25AM Location: E451B

Participants
Hilary R. Umans, MD, Ardsley, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
Overview of lesser metatarsophalangeal joint (MPJ) plantar plate (PP) and capsular degeneration and tear and discuss how it relates to MPJ instability Lesser MPJ Anatomy Symptoms / Exam MPJ region pain Sub-metatarsal Tenderness, esp plantar lateral base toe proximal phalanx Webspace Toe deformity Deviation, esp tibial +/- splaying 2nd-3rd toes Hyperextension at MPJ Etiology of PP and Capsular ligament degeneration + tear Chronic stress >> common than acute trauma Hyperextension + Axial loading high heels Crowding narrow toebox HAV + 2nd metatarsal (MT) protrusion Synovitis stretches MPJ capsule, leading to laxity and MPJ instability degeneration at the phalangeal insertion of the MPJ PP Traumatic tear less common PP tear pattern esp 2nd toe MPJ esp lateral insertion Frequent accord ’d tear of the lateral capsule Clinical grading MPJ instability Vertical stress test Digital Purchase Paper pull-out test Toe deformity Deviation, splaying, hyperextension Natural history: worsening deformity and dysfunction Imaging MRI Without vs with IV gadolinium Bright T2 signal defect Normal midline Hi Signal zone up to 2.5 mm Elongation = pathologic US Tear = hypoechoic defect at insertion Normal midline hypoechoic zone = 2.5mm Widens with degeneration + tear MRI vs US MRI Static exam Global Overview Can evaluate the capsule More easily Ddx b/l pericapular reactive soft tissue thickening (fibrosis +/-edema) + web space neuropathy US Dynamic exam Assess focal tenderness + MPJ instability Technically challenging / learning curve Image incrementally from medial - lateral insertion Ddx pericapular fibrosis from webspace neuropathy US Pitfalls Mostly anisotropy due to non-parallel imaging Can mistake midline hypoechoic zone for tear Limitations Sensitive, Not specific Difficult to differentiate degeneration vs tear MPJ capsule

Wednesday, Dec. 2 11:00AM - 11:25AM Location: E451B

Participants
Hilary R. Umans, MD, Ardsley, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
Overview of lesser metatarsophalangeal joint (MPJ) plantar plate (PP) and capsular degeneration and tear and discuss how it relates to MPJ instability Lesser MPJ Anatomy Symptoms / Exam MPJ region pain Sub-metatarsal Tenderness, esp plantar lateral base toe proximal phalanx Webspace Toe deformity Deviation, esp tibial +/- splaying 2nd-3rd toes Hyperextension at MPJ Etiology of PP and Capsular ligament degeneration + tear Chronic stress >> common than acute trauma Hyperextension + Axial loading high heels Crowding narrow toebox HAV + 2nd metatarsal (MT) protrusion Synovitis stretches MPJ capsule, leading to laxity and MPJ instability degeneration at the phalangeal insertion of the MPJ PP Traumatic tear less common PP tear pattern esp 2nd toe MPJ esp lateral insertion Frequent accord ’d tear of the lateral capsule Clinical grading MPJ instability Vertical stress test Digital Purchase Paper pull-out test Toe deformity Deviation, splaying, hyperextension Natural history: worsening deformity and dysfunction Imaging MRI Without vs with IV gadolinium Bright T2 signal defect Normal midline Hi Signal zone up to 2.5 mm Elongation = pathologic US Tear = hypoechoic defect at insertion Normal midline hypoechoic zone = 2.5mm Widens with degeneration + tear MRI vs US MRI Static exam Global Overview Can evaluate the capsule More easily Ddx b/l pericapular reactive soft tissue thickening (fibrosis +/-edema) + web space neuropathy US Dynamic exam Assess focal tenderness + MPJ instability Technically challenging / learning curve Image incrementally from medial - lateral insertion Ddx pericapular fibrosis from webspace neuropathy US Pitfalls Mostly anisotropy due to non-parallel imaging Can mistake midline hypoechoic zone for tear Limitations Sensitive, Not specific Difficult to differentiate degeneration vs tear MPJ capsule

**ABSTRACT**

**Active Handout:** Hilary Ruth Umans


**RC504-12** Chronic Wrist Symptoms in Correlation with Abnormal Scapholunate Joint Kinematics in Four-Dimensional CT Examinations: Initial Clinical Experience

**Wednesday, Dec. 2 11:25AM - 11:35AM Location:** E451B

**Participants**

Nima Hafezi Nejad, MD, MPH, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

John N. Morelli, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

Uma Thakur, MD, Watchung, NJ (Abstract Co-Author) Nothing to Disclose

Scott D. Lifchez, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

Kenneth R. Means JR, MD, Baltimore, MD (Abstract Co-Author) Speakers Bureau, Auxilium Pharmaceuticals, Inc Faculty, Integra LifeSciences Holdings Corporation

Jaimie Shores, MD, Baltimore, MD (Abstract Co-Author) Consultant, AxoGen, Inc Stockholder, MDConnectME

Shadpour Demehri, MD, Baltimore, MD (Presenter) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation

**PURPOSE**

Using Four Dimensional CT scan (4D-CT) we aimed at showing abnormal kinematics of Scapholunate (SL) interval in symptomatic wrists with inconclusive radiographic findings, compared to 4D-CT examinations of asymptomatic contralateral wrists.

**METHOD AND MATERIALS**

This is an IRB approved, HIPPA complaint, retrospective study of wrist 4D-CT scans of patients who were referred for further evaluation of chronic wrist pain (> 3 months). In all, 12 symptomatic wrists (11 subjects) with chronic symptoms and inconclusive radiographs and 10 asymptomatic contralateral wrists were scanned using 4D-CT. SL interval was measured during three wrist motions: relaxed to clenched fist, flexion to extension, and radial to ulnar deviation. Change in SL interval measurements after each motion was recorded using double-oblique multiplanar reformation technique.

**RESULTS**

We extracted the normal limits of SL interval during active motion in symptomatic and asymptomatic wrists. While the SL interval is expected to be smaller than 1 mm in asymptomatic wrists (except for the clenched fist: 0.51 - 1.34 mm), symptomatic wrists present with SL interval of larger than 1 mm. In fact in clenched fists (2.53 ± 1.19 mm), or during extension (2.54 ± 1.48 mm) or ulnar deviation (2.06 ± 1.12 mm), average expected SL interval in symptomatic wrists is more than 2 mm. No change in SL interval measurements was detected during all the three wrist motions in asymptomatic contralateral wrists. In contrast, SL intervals increased while moving from relaxed to clenched (0.70; 0.24 - 1.16 mm; p= 0.01), from flexion to extension (1.04; 0.26 - 1.81 mm; p= 0.01) and from radial to ulnar deviation (0.48; - 0.03 - 1.00 mm; p= 0.06). There was a moderate correlation between SL interval change and presence/absence of symptoms (Spearman Rho: 0.45 - 0.65)

**CONCLUSION**

Compared to asymptomatic wrists, SL interval measurements significantly increase during active motion in symptomatic wrists with inconclusive plain radiographs using 4D-CT examination.

**CLINICAL RELEVANCE/APPLICATION**

4D CT of the wrist is suitable and clinically feasible to detect subtle motion abnormality suggestive of SLIL insufficiency in patients with chronic wrist pain. This study shows how SL motion abnormalities is associated with presence of symptoms. Moreover, it reports different SL interval limits that are expected in asymptomatic and symptomatic wrists.

**RC504-13** Dynamic Ultrasound of Upper Extremity

**Wednesday, Dec. 2 11:35AM - 12:00PM Location:** E451B

**Participants**

Mary M. Chiavaras, MD, PhD, Ancaster, ON (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

To understand indications, learn technique, and review associated anatomy for dynamic ultrasound imaging of the shoulder, elbow, wrist, and hand.
Techniques of Musculoskeletal Interventional Ultrasound (Hands-on)

Wednesday, Dec 2 8:30AM - 10:00AM Location: E263

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

Participants
Veronica J. Rooks, MD, Honolulu, HI (Moderator) Nothing to Disclose
Peter L. Cooperberg, MD, Vancouver, BC (Presenter) Nothing to Disclose
Aida F. Cossi, MD, Boston, MA (Presenter) Nothing to Disclose
Nathalie J. Bureau, MD, MSc, Montreal, QC, (nathalie.bureau@umontreal.ca) (Presenter) Equipment support, Siemens AG
James W. Murakami, MD, Columbus, OH (Presenter) Nothing to Disclose
Michael A. Mahlon, DO, Tacoma, WA (Presenter) Nothing to Disclose
Paolo Minafra, MD, Pavia, Italy, (paolominafra@gmail.com) (Presenter) Nothing to Disclose
Paula B. Gordon, MD, Vancouver, BC (Presenter) Stockholder, OncoGenex Pharmaceuticals, Inc; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, RealImaging
Hollins P. Clark, MD, MS, Winston Salem, NC (Presenter) Nothing to Disclose
Mabel Garcia-Hidalgo Alonso, MD, Madrid, Spain (Presenter) Nothing to Disclose
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Horacio M. Padua JR, MD, Boston, MA (Presenter) Nothing to Disclose
Hollins P. Clark, MD, MS, Winston Salem, NC (Presenter) Nothing to Disclose
Carmen Gallego, MD, Madrid, Spain (cgallego@salud.madrid.org) (Presenter) Nothing to Disclose
Patrick Warren, MD, Columbus, OH (Presenter) Nothing to Disclose
Stephen C. O'Connor, MD, Boston, MA (Presenter) Nothing to Disclose
Sara E. Smolinski, MD, Springfield, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography, with specific focus on musculoskeletal applications.
2) Define and discuss technical aspects, rationale, and pitfalls involved in musculoskeletal interventional sonographic care procedures.
3) Successfully perform basic portions of hands-on US-guided MSK procedures in a tissue simulation learning module, to include core biopsy, small abscess coaxial catheter drainage, cyst and ganglion aspiration, soft tissue foreign body removal, and intraarticular steroid injection. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional MSK sonographic learning opportunities.

ABSTRACT
Ultrasound Guided Foreign Body Removal: Simulation Training and Clinical implementation Outcomes
Purpose: USFBR can be taught to radiologists to generate competency, and radiologists can apply the technique in the patient setting to remove foreign bodies. Materials and Methods: Proof of concept was performed by a radiologist and surgeon removing nine 1-cm foreign bodies using the USFBR method (P) and traditional surgery (S) with and without wire guidance (W) on the cadaver model. Next, USFBR was taught to 48 radiologists at 4 hospitals. Training included didactic and hands-on instruction covering 7 components: instrument alignment, hand/transducer position, forceps use, foreign body definition, forceps grasp, recognition of volume averaging, and oblique cross cut artifact. Pre-training testing assessed single toothpick removal from turkey breast in 15 minutes. Post-training evaluation consisted of 5 toothpick removals. Ongoing clinical implementation data of USFBR by trained radiologists are being collected. Parameters including age of patient, which radiologist, removal success, type and size of foreign body, incision size, foreign body retention time, reason for removal, symptoms, modalities used in detection, wound closure, and sedation are recorded. Data analyzed using chi-squared and Fisher's exact tests for categorical outcomes and analysis of variance for continuous outcomes. Results: USFBR technique shows a higher success rate and smaller incision size in comparison to surgical technique alone in the cadaver. Removal success: P 100%, S 78%, and W 89%. With USFBR training, radiologists' scores improved from 21-52% pre-training to 90-100% post-training (p<0.001 for each component). In the clinical setting to date, USFBR has been 100% successful in 7 of 25 expected patients, ages 9-73 years, by four radiologists. Parameters included; length 4 to 30 mm, retention 2 to 864 days, incision, 2 to 8 mm, 1 suture closure, 1 sedation. Conclusion: USFBR is superior to non-guided surgical technique. The USFBR approach taught in simulation improves radiologist technique and removal outcomes. A radiologist who completes simulation training can remove a variety of imbedded foreign bodies.
Participants

Sub-Events

RC551A  MRI of Arthroplasty: How to Do It

Participants
Hollis G. Potter, MD, New York, NY (Presenter) Research support, General Electric Company

LEARNING OBJECTIVES
1) To become familiar with different patterns of abnormal synovial response around implants. 2) To become familiar with protocols using standardized and newer sequences which optimize tissue contrast and provide accurate diagnosis.

ABSTRACT
MRI characteristics of adverse local tissue reactions, periprosthetic infection, and component loosening will be reviewed. Characteristics of osteolysis will also be discussed, as well as additional complications of joint arthroplasty.

Active Handout: Hollis G. Potter

RC551B  MRI of Bone Marrow: What’s Normal What’s Not?

Participants
Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Differentiate normal variations in MRI appearance of bone marrow from malignant marrow infiltrative disorders. 2) Become familiar with the MRI appearance of age-related and post-treatment changes of bone marrow.

ABSTRACT
MRI characteristics of normal bone marrow will be reviewed, including changes related to aging and therapy. Imaging examples of benign and malignant disorders affecting bone marrow will be reviewed including pitfalls in MRI interpretation of bone marrow.

RC551C  Tumors and Tumor-like Lesions of the Musculoskeletal System: Pearls and Pitfalls for the General Radiologist

Participants
Behrang Amini, MD, PhD, Houston, TX, (bamini@mdanderson.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Become familiar with the imaging appearance of common and uncommon presentations of benign and malignant musculoskeletal lesions. 2) Know how to manage indeterminate focal bone and soft tissue abnormalities.

ABSTRACT
Radiologists are often challenged by the overlap in the imaging appearance of benign and malignant musculoskeletal lesions. The imaging appearance of challenging bone and soft tissue lesions will be reviewed. Suggestions will be made for management with the aim of balancing patient safety with the burden of further investigation or intervention.
**LEARNING OBJECTIVES**

1. Identify anatomic structures which can impinge or move abnormally in the hip and ankle 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 hip and ankle respecting ergonomics.

**ABSTRACT**

This course will demonstrate standardized techniques of performing the dynamic examination of hip and ankle lesions that are only or best demonstrated dynamically. These include the snapping hip, peroneal tendon subluxation/dislocation, flexor hallucis longus impingement, and ankle ligament instability. 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 hip and ankle joint 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.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jon A. Jacobson, MD - 2012 Honored Educator
**SSK12**

**ISP: Musculoskeletal (Spine)**

Wednesday, Dec. 2 10:30AM - 12:00PM Location: E353C

**MK**

**MR**

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

FDA Discussions may include off-label uses.

**Participants**

Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Moderator) Advisory Board, Siemens AG; Consultant, Medtronic, Inc
Jung-Ah Choi, MD, Hwaseong, Korea, Republic Of (Moderator) Nothing to Disclose

**Sub-Events**

**SSK12-01** Musculoskeletal Keynote Speaker: Spine MRI-From Technique to Clinical Application

Wednesday, Dec. 2 10:30AM - 10:50AM Location: E353C

**Participants**

Lawrence N. Tanenbaum, MD, New York, NY (Presenter) Speaker, General Electric Company; Speaker, Bracco Group; Speaker, Bayer AG; Speaker, Siemens AG; Speaker, Guerbet SA

**SSK12-04** Imaging of Cervical Disc Degeneration in 3D Ultrashort Echo Time MR Imaging Comparing with Conventional T2 Weighted Spin Echo Sequences; An in Vivo Preliminary Study

Wednesday, Dec. 2 11:00AM - 11:10AM Location: E353C

**Participants**

Yeo Ju Kim, Incheon, Korea, Republic Of (Presenter) Nothing to Disclose
Jang Gu Cha, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sangwoo Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Researcher, General Electric Company
Michael Carl, Menlo Park, CA (Abstract Co-Author) Researcher, General Electric Company
Mi Young Kim, MD, Incheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Youn Jeong Kim, MD, Incheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ha-Young Lee, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Soon Gu Cho, MD, Incheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the image findings of cervical disc degeneration in 3 dimensional ultrashort echo time MR imaging (3D UTE) according to disc degeneration in conventional T2 weighted spin echo sequences (T2 SE).

**METHOD AND MATERIALS**

A total of 315 discs of 63 patients (36 men and 27 women; mean age 53.62 years, age range - 19-85) were imaged with sagittal T2 SE (repetition time msec/time to echo msec, 2800/90) and sagittal 3D UTE (16.1/0.028, 4.4, echo-subtraction). In T2 SE, disc degenerations were evaluated from C2-3 to C6-7 using a grading system proposed by Pfirrmann et al. In 3D UTE, discs were classified as follows, according to the morphology of the cartilaginous endplate (CEP), and the signal intensity of the nucleus purposes (NP): type I (smooth thin CEP; low signal intensity of the NP), type II (mild irregular CEP; low signal intensity of the NP), type III (irregular and thickened CEP with or without high signal intensities in some portion of the NP), and type IV (an irregular and thickened CEP with high signal intensities in nearly all of the NP). Each type of disc in the UTE was compared with grades of disc degeneration in T2 SE and analyzed by a linear- by-linear association.

**RESULTS**

In mild degeneration (grade 2, n=127), type I discs (107/127, 84.3%) were most frequently seen but none of the type IV discs were found in 3D UTE. In cases of severe degenerations (grade 4, n= 11), type IV discs (6/11, 54.5%) were most frequently found but none of the type I discs were seen in 3D UTE. There was a statistically significant tendency between the types of disc in UTE and grades of disc degeneration in T2 SE and analyzed by a linear- by-linear association.

**CONCLUSION**

The degenerative cervical discs showed thick irregular CEPs and increased prevalence of high signal intensity at the NP in 3D UTE.

**CLINICAL RELEVANCE/APPLICATION**

The change of cartilaginous endplates and increased amount of short T2 components in a nucleus pulposus according to degeneration in 3D UTE may help to understand and diagnosedisc degeneration.

**SSK12-05** T1rho and T2 Mapping of Lumbar Intervertebral Disc: Correlation with Degeneration and Morphologic Changes

Wednesday, Dec. 2 11:10AM - 11:20AM Location: E353C

**Participants**

Min A Yoon, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Suk-Joo Hong, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
In Seong Kim, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Baek Hyun Kim, MD, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seun Ah Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
PURPOSE
To evaluate correlation between T1ρ (T1ρ), T2 values and disc degeneration and morphologic changes in the lumbar intervertebral discs.

METHOD AND MATERIALS
Twenty-two subjects (M:F=8:14; mean age 55.5 years; range 26-84 years) with 109 lumbar intervertebral discs (from L1-2 to L5-S1) were examined at 3.0T MRI. Disc degeneration was evaluated using the 5-level Pfirrmann grading system and the disc morphology was categorized into five groups: normal, bulging, annular tear, protrusion, extrusion. For T1ρ and T2 quantification, regions of interest (ROIs) were drawn on the three mid-sagittal images at nucleus pulposus (NP), posterior annulus fibrosus (AF), and junction of the NP and posterior AF for each disc on T1ρ and T2 maps. Quantitative measurements for hemiated discs were made within the protruded or extruded portion. Statistical analysis was performed using Spearman rank correlation and partial correlation.

RESULTS
The Pfirrmann grades showed strong correlations with the T1ρ values at the NP (r=0.800, p<.001), T2 values at the NP (r=0.792, p<.001), and T2 values at the junction (r=0.784, p<.001). Disc morphology was moderately correlated with T2 values at the junction (r=0.603, p<.001), T2 values at the NP (r=0.578, p<.001), and T1ρ values at the NP (r=0.509, p<.001). After correction for effects of patient age and disc level, there was strong to moderate correlation between the Pfirrmann grades and T1ρ values at the NP (r=0.750, p<.001 after correction of age effect and r=0.697, p<.001 after correction of disc level effect).

CONCLUSION
T1ρ and T2 mapping, especially T1ρ values at the NP and T2 values at NP and junction, provided quantitative measurements of the progression of the intervertebral disc degeneration with strong correlations. T2 values at the junction proved good relationship in the assessment of the disc morphologic changes.

CLINICAL RELEVANCE/APPLICATION
T1ρ and T2 mapping provide quantitative measurements for disc degeneration and morphologic changes, which can be used as a synergistic modality for evaluation of lumbar degenerative disc disease.

Spin Echo Based T2-weighted Modified Dixon (mDixon) Images for Detection of Vertebral Metastasis: Can T1-weighted MR Images Be Replaced by Fat Images of T2 mDixon?

Participants
Seok Hahn, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Han Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Seung Hyun Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jaemoon Yang, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin-Suck Suh, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate diagnostic performance of spin echo based T2-weighted mDixon MR images and to compare with T1-weighted MR images for detection of vertebral metastasis.

METHOD AND MATERIALS
From April to September 2014, we found 124 patients who underwent whole spine MRIs with spin echo mDixon for the evaluation of vertebral metastases. We obtained conventional T1-weighted images, mDixon images including water and fat images of T2 mDixon, and contrast-enhanced water images of T1 mDixon. We found 23 bone metastases of 12 patients by inclusion criteria: 1) patients with a record of a bone metastasis diagnosis as the primary or secondary diagnosis and 2) Positron emission tomography-computed tomography (PET-CT) scan within one month. The lesion at same level on PET-CT scan was utilized as a reference. Two radiologists reviewed fat and water images of T2 mDixon and contrast enhanced water image of T1 mDixon in random order separately. We calculated sensitivities, specificities, accuracies, positive and negative predictive values, inter-observer agreements.

RESULTS
Of 23 metastatic lesions, the reviewer 1 detected 16 on T1-weighted images, 16 on water images, 15 on fat images of T2 mDixon, 20 on contrast enhanced water images of T1 mDixon. And the reviewer 2 detected 19, 18, 18 and 22, respectively. Contrast-enhanced water images of T1 mDixon showed higher sensitivity than other images (76.1% vs. 73.9% vs. 71.7% vs. 91.3%). Specificities, accuracies, positive and negative predictive values of three spin echo based mDixon images were similar values to conventional T1-weighted images (98.9% vs. 98.0% vs. 98.8% vs. 98.1%; 97.2% vs. 96.2% vs. 96.7% vs. 97.7% vs. 95.4% vs. 75.6% vs. 82.5% vs. 80.8%; 98.0% vs. 97.8% vs. 97.7% vs. 99.3%). The kappa values of inter-observer agreement were moderate degree (0.712, 0.679, 0.679 and 0.790, respectively).

CONCLUSION
The spin echo based T2-weighted mDixon MR images show good diagnostic performances in sensitivity, specificity, accuracy, positive and negative predictive values compared with T1-weighted MR images for detection of vertebral metastasis.

CLINICAL RELEVANCE/APPLICATION
Using spin echo based T2-weighted mDixon technique, we can obtain water and fat images with single scan, which have similar diagnostic performances to conventional T1-weighted images for the detection of vertebral metastases. And fat images of T2 mDixon can be used for detection of vertebral metastasis instead of T1-weighted images.
In conclusion, a better understanding of the CT manifestations of spinal lesions in SAPHO patients may support clinical diagnosis in patients with synovitis, acne, pustulosis, hyperostosis and osteitis (SAPHO) syndrome.

METHOD AND MATERIALS
Between October 1992 and January 2012, 13 patients (10 women, 3 men; median age at first MR imaging: 33 years) with SAPHO syndrome involving the spine underwent 2 MR examinations of the spine after an interval of at least 3 months. Three musculoskeletal radiologists reviewed MR spinal images in consensus. Erosions of vertebral bodies defined lesional foci. Lesional foci separated by one or more normal vertebral corner were analyzed as distinct lesions. Cortical bone erosions, vertebral signal intensity (SI) alterations compared with normal vertebral body SI, soft-tissue involvement, intervertebral disk SI and disk height compared with the other disks and osseous bridges were evaluated.

RESULTS
27 lesional foci were identified in the 13 patients on initial MR images. Extension of the erosions was seen in 20 foci (74%) and 3 new lesional foci appeared. During follow-up, 31 of the 75 (41%) initial erosions spread by degrees within a single vertebra to the adjacent vertebral parts and to the vertebral corner of the adjacent vertebrae. Changes in SI of the vertebral body were seen in 21 of the 27 (78%) initial foci. In 8 (30%) of the 27 initial lesional foci, a soft tissue involvement at the anterior or lateral paraspinal region was noted. Thickness of this involvement progressed compared to initial examinations in 3 of the 27 foci (11%). A decrease in disk space height was observed on follow-up MRI in 10 of the 27 initial foci (37%) and was associated with high SI on T2-weighted images or gadolinium enhancement of the disk space in 3 (11%), further mimicking disk space infection. Bony bridges over the disk space increased in 3 lesional foci (11%) and appeared in 2 (7%) during follow-up.

CONCLUSION
During the course of the SAPHO syndrome, vertebral involvement spread by degrees within a single vertebra to the adjacent cortices as well as to the vertebral corner of the adjacent vertebrae.

CLINICAL RELEVANCE/APPLICATION
The gradual local spread of the vertebral disease process strongly suggests SAPHO syndrome in the appropriate clinical context.

SSK12-07 Vertebral Involvement in SAPHO Syndrome: A Follow-up Study of 13 Cases Using MR Imaging

SSK12-08 CT Manifestations of Spinal Lesions in SAPHO Syndrome
the absence of characteristic signs.

**CLINICAL RELEVANCE/APPLICATION**

A deep understanding of the CT manifestations of spinal lesions in SAPHO patients may support clinical diagnosis in the absence of cutaneous disorders and typical anterior chest wall involvement.

**SSK12-09  Evaluation of T2-weighted WARP Sequences in Patients with Spinal Prosthesis**

Wednesday, Dec. 2 11:50AM - 12:00PM Location: E353C

Participants
Shun Qi, Xi'an, China (Presenter) Nothing to Disclose
Ying Liu, MD, PhD, Xian, China (Abstract Co-Author) Nothing to Disclose
Panli Zuo, Beijing, China (Abstract Co-Author) Nothing to Disclose
Hong Yin, MD, PhD, Xi'an, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

MRI is an important modality for imaging the spine as it allows assessment of the spinal cord, adjacent soft tissues and osseous structures. In this study, we compared images quality and diagnostic sensitivity between WARP with standard TSE sequences in interbody fixation patients with titanium screws.

**METHOD AND MATERIALS**

30 patients (11 males and 19 females; age range, 35-72 years) who were clinically examined discomfort after interbody fixation surgery with titanium screws were scanned at a 1.5T MR scanner (MAGNETOM Aera, Siemens). The T2-weighted sagittal and axial images were acquired using a standard TSE sequence and a WARP TSE sequence implemented the SEMAC and VAT techniques as well as increased bandwidth for radiofrequency and readout pulses. SEMAC factor was 6 for all WARP imaging. The cumulative area of signal void was measured on the axial image, which was defined as the area without discernible anatomic information for both low and high-signal-intensity artifacts induced by the prosthesis (Fig. 1A). Length of spinal canal obscuration on the sagittal image was also measured (Fig. 1B).

**RESULTS**

On axial T2-weighted images, the area of signal void at the level of the prosthesis (mean ± standard deviation) was 10.4 cm² ± 4.5 for WARP and 26.6 cm² ± 10.2 for standard TSE images (Fig. 1C). On sagittal T2-weighted images, the length of spinal canal obscuration at the level of the prosthesis was 1.8 cm ± 0.3 for WARP and 5.4 cm ± 1.2 for standard TSE images (Fig. 1D). Visualizations of all periprosthetic anatomic structures were significantly better for WARP compared with standard imaging. Interobserver agreement for visualizations of anatomic structures was good for both WARP (k = 0.73) and standard (k = 0.71) imaging. The number of abnormal findings noted on WARP images (28 findings) was significantly higher than the number of findings detected on standard images (10 findings) with all abnormal imaging findings detected on standard images were also noted on WARP images.

**CONCLUSION**

MR images with WARP sequences significantly reduced metal-related artifacts and improved delineation of the prosthesis and periprosthetic region therefore increased the diagnostic sensitivity in patients with clinical abnormalities.

**CLINICAL RELEVANCE/APPLICATION**

WARP sequences significantly reduced metal-related artifacts
A New Classification System for Knee Fat Pad Impingement Syndrome

PURPOSE

Fat pad impingement syndrome of the knee is a frequent cause for anterior knee pain and increasingly being recognised by radiologist on reading MRI scans. Definitive diagnosis will aid in management. We describe a simple classification system for describing fat impingement syndrome and how it influences management.

METHOD AND MATERIALS

Systematic review of MRI examinations of the knees frequently reveal findings of fat pad impingement. Supralateral Hoffa fat pad impingement and quadriceps fat pad impingement appeared to be the most frequent findings. On review of 200 MRI examinations of the knee we have developed a classification system for describing fat pad impingement syndrome based on signal characteristic criteria seen on the T1 and PD fat sat images. This has an implication on management of this common condition.

RESULTS

Review of the MR examination revealed three patterns for fat pad impingement. Stage I reveals normal signal characteristics on T1 W images and patchy increase signal on the fat suppressed fluid sensitive sequences. Stage II disease reveals abnormal low signal on the T1 W images and increase signal intensity on the fat suppressed fluid sensitive sequences. Stage III disease reveals nodular fatty pad impingement with uniform low signal on T1 W and diffuse high signal on the T2 W images. The significance of these findings are that stage I disease is typically with physical therapy treatment. Stage II disease has also reversible with physical therapy and may benefit from steroid injection therapy. Stage III disease which is the nodular hypertrophic form requires surgical excision as it typically interferes with the normal dynamics of the knee joint during flexion and extension.

CONCLUSION

Fat impingement is a frequent cause of anterior knee pain in the young patient. Identifying the stage of the disease is essential in the appropriate management of fat pad impingement syndrome. The Manchester model for the management of Fat pad impingement based on the grades shall be discussed.

CLINICAL RELEVANCE/APPLICATION

Fat pad impingement syndrome is commonly overlooked by the reporting radiologist. We identify the salient findings on MR examinations and provide a grading system and its potential influence on the management of this frequent cause of anterior knee pain.

Evaluation of Muscle Function of the Lower-leg Using Simultaneous Acquisition of Transvers Relaxation, Perfusion, and Diffusion Information

PURPOSE

Transverse relaxation rate (R2), blood flow (MBF), and water diffusion of the lower-leg muscle under stress such as plantar flexion exercise are useful to assess the muscle functions. However, it is difficult to obtain all of them at one examination because skeletal muscle function after exercise changes quickly. Therefore, to simultaneously acquire information on R2, MBF, and restricted water diffusion in the lower leg under stress, we devised a method using spin-echo diffusion echo-planar imaging (SE-diffusion-EPI) with different echo times (TE), and compared these values before and after the exercise.

METHOD AND MATERIALS
On a 3.0-T MRI, we obtained transverse diffusion-weighted images of the lower leg using SE-diffusion-EPI before and after plantar flexion exercise at one time per second for one minute in healthy volunteers (n=12). The SE-diffusion-EPI was consecutively performed using TE of 39.2 ms with b value of 0 s/mm², and TE of 61.2 ms with b values of 0 to 800 s/mm² (0, 10, 30, 50, 100, 200, 300, 400, 500, 600, 700, and 800 s/mm²). We then calculated R2 from different TE images with b value of 0 s/mm² in each lower-leg muscle. Moreover, we also calculated the restricted diffusion coefficient (ADCr), perfusion-related diffusion coefficient (ADCr: corresponding to MBF), and its fraction (Fp) from biexponential signal decay curves in each muscle.

RESULTS
R2, ADCr, ADCp, and Fp of the tibialis anterior of the lower-leg muscle after the exercise were significantly higher than those before the exercise. On the other hand, there was no significant correlation among R2, ADCr, ADCp, and Fp of the tibialis anterior, indicating these values do not necessarily provide the same kind of information.

CONCLUSION
Our method makes it possible to simultaneously obtain R2, MBF, and restricted water diffusion in lower leg under stress, thereby increasing amount of the muscle functional information.

CLINICAL RELEVANCE/APPLICATION
Our method makes it possible to simultaneously obtain R2, MBF, and restricted water diffusion in lower leg under stress, thereby increasing amount of the muscle functional information.

MK359-SD-WEA4  SIFK (SONK): Grading, Risk Factors and Outcome
Station #4

Participants
Felix Gonzalez, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Mika T. Nevalainen, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Johannes B. Roedl, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To propose an MRI grading system for SIFK (subchondral insufficiency fracture of the knee, formerly SONK). To predict outcome and assess risk factors based on the grading system.

METHOD AND MATERIALS
A retrospective study of 32 patients with SIFK on their initial MRI and with follow-up MRI within 6 - 12 months. All grades had substantial bone marrow edema (BME) surrounding the SIFK lesion involving more than 25% of the affected femoral condyle or tibial plateau. Grade 1 represented contusion of subchondral bone plate, but no fracture (fx); Grade 2: subchondral fx; Grade 3: subchondral fx with cystic change and Grade 4: subchondral fx with early osteonecrosis. Associations between SIFK grade, lesion size, associated BME, meniscal tears, chondrosis, age and weight were assessed with Chi-Square and Mann-Whitney tests.

RESULTS
A mean age of 57.3 ±12.5 years (range 35-89) was found, 18 male and 14 female. Grade 1 SIFK was seen in 25% (8/32), grade 2 in 28% (9/32), grade 3 in 22% (7/32) and grade 4 in 25% (8/32) of patients (pts). Pts with high-grade (HG) SIFK (grades 3 and 4) had a higher age (63.1 years ±13 vs. 52.2 years ±9.8; p=0.03) and weight (230.2 lbs ±22.4 vs. 165.5 lbs ±27.9; p<0.001) compared to low-grade SIFK (grades 1and 2). In 67% (10/15) of pts with HG SIFK (grades 3 and 4) medial meniscal tears at the posterior root attachment and associated meniscal extrusion were seen compared to 24% (4/17) in pts with low-grade SIFK (p=0.036, Chi-Square). 86% (12/14) of pts with HG SIFK had at least grade 2 chondrosis, compared to 24% (4/17) in pts with low-grade SIFK. All patients had substantial BME associated with the SIFK lesion. Patients with low-grade SIFK on the initial MRI had substantial improvement of the SIFK lesion size and associated edema in 77% (13/17) of cases and no change in 23% (4/17) of cases. None of patients with low-grade SIFK had progression of the lesion or of the edema. In contrast, patients with HG SIFK on the initial MRI had progression on the follow-up MRI in 53% (8/15) of cases, no change in 33% (5/15) and improvement in 14% (2/15) of cases.

CONCLUSION
A novel SIFK grading system for MRI is introduced. Meniscal root tears with extrusion, associated chondrosis, increased age and weight appear to be associated with HG SIFK. Low-grade SIFK substantially improves or resolves in 77% of cases on follow-up imaging, HG SIFK further progressed in 53% of patients.

CLINICAL RELEVANCE/APPLICATION
A SIFK grading system for MRI is introduced

MK360-SD-WEA5  The Presence of MRI Findings in the Posterior Joints of the Spine Does Not Distinguish Diffuse Idiopathic Skeletal Hyperostosis (DISH) from Axial Spondyloarthropathy (SpA) but the Pattern of Involvement may be Characteristic
Station #5

Participants
Robert G. Lambert, MB BCH, Edmonton, AB (Presenter) Research Consultant, Abbott Laboratories
Matthew J. Budak, MD, FR CR, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Warner P. Maksymowycz, MD, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Anthony S. Russell, FR CPC, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Ulrich Weber, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess diagnostic utility of MRI evidence of involvement of the posterior joints of the spine for differentiating diffuse idiopathic skeletal hyperostosis (DISH) from axial spondyloarthropathy (SpA).

**METHOD AND MATERIALS**

A total of 28 patients with persistent back pain for more than 3 months were divided into three cohorts: cohort A) clinical and imaging diagnosis of DISH (n=14), cohort B) clinical and imaging diagnosis of SpA (n=8), and a control cohort C) non-specific low back pain (n=6). Blinded to clinical and radiographic data, MRI scans of the entire spine and sacroiliac joints were individually read in random order. The presence/absence of DISH or SpA was recorded and 35 specific observations included bone marrow edema, bone marrow fat metaplasia and ankylosis in costovertebral (CVJ) or costotransverse joints (CTJ) and ankylosis in facet joints. MRI diagnoses were then cross-referenced with clinical diagnoses.

**RESULTS**

Involvement of a posterior articulation was common and was seen in 6 (43%) cases of DISH and 5 (63%) cases of SpA. Facet joint ankylosis was seen more often in DISH (29%) than SpA (13%) but the pattern of facet joint ankylosis was similar in both conditions. In the CVJ, abnormalities were more common in SpA (63%) than DISH (36%) and extensive bone marrow edema was only seen in SpA while large CVJ osteophytes were only seen in DISH. CVJ bone marrow fat metaplasia was also seen in both conditions but was uncommon.

**CONCLUSION**

The presence alone of MRI abnormalities in the small posterior joints of the spine does not help to distinguish between DISH and SpA. However when abnormal, the pattern of involvement of the CVJ may be distinct with large osteophytes only seen in DISH and extensive bone marrow edema only seen in SpA.

**CLINICAL RELEVANCE/APPLICATION**

In older patients with persistent back pain, MRI abnormalities are commonly seen in the posterior joints of the spine in both DISH and SpA but when costovertebral joints are involved, the pattern of MRI findings may help to distinguish between these two entities.

**MK361-SD-WEA6**  
**Metal Artifact Reduction in the Musculoskeletal System with Dual Energy CT and Spectral Imaging. Comparison of Polychromatic and High Energy Monochromatic Images**

**Station #6**

**Participants**

Maria Gonzalez Vazquez, Vigo, Spain (Presenter) Nothing to Disclose  
Maria Costas Alvarez, Pontevedra, Spain (Abstract Co-Author) Nothing to Disclose  
Raquel Prada, MD, Vigo, Spain (Abstract Co-Author) Nothing to Disclose  
Noelia Silva, MD, Vigo, Spain (Abstract Co-Author) Nothing to Disclose  
Gonzalo Tardaguila de la Fuente, MD, Vigo, Spain (Abstract Co-Author) Nothing to Disclose  
Carmen Trinidad, MD, Vigo, Spain (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare metal artifact reduction and image quality in Dual Energy Computed Tomography (DECT) using polychromatic and high energy monochromatic images.

**METHOD AND MATERIALS**

39 patients with metallic implants in extremities who underwent DECT were included in this study. Polychromatic images with 80, 120 and 140 kV and postprocessing high energy monochromatic images at 110, 130 and 150 keV were used. Qualitative evaluation of the artifact and image quality were performed by two musculoskeletal radiologists using Likert scale, artifact was graded on a four points (0: absence of artifacts, 1: minimal artifacts, 2: moderate artifacts, 3: massive artifacts) and five points for the image quality (0: excellent, 1: good, 2: fair, 3: regular and 4 poor). We use Spearman's Rho (rs) for inter-observer correlation. Artifact severity was assessed quantitatively.

**RESULTS**

Higher metallic artifact and worse image quality are seen at 80 kV and both decreases by increasing the kilovoltage. The best results being obtained at 140 kV as well as in monochromatic series. The interobserver agreement was (artifact rs = 0.73- 0.95 and quality image rs = 0.77 -0.93).Artifact severity (Artifact Index): 14.16 (80 kV), 11.01 (120 kV), 7.74 (140 kV), 6.36 (110 keV), 5.5 (130 keV) and 4.94 (150 keV).All results presented statistical significant differences (p <0.05), except for 130 and 150 keV which had comparable results.

**CONCLUSION**

Metal artifact reduction and image quality were rated superior in high energy monochromatic compared with polychromatic images and, within these, 140 kV was better than 80 and 120 kV.

**CLINICAL RELEVANCE/APPLICATION**

Metal artifacts have been an important limitation for musculoskeletal CT interpretation for postoperative studies of patients with implants after osteosynthesis and joint replacement surgery. With the advent of dual energy equipment and monoenergetic reconstructions new strategies to reduce metal artifact are provided. The images are less affected by beam-hardening artifact and provide more accurate data than standard single-energy CT images do.

**MK125-ED-WEA7**  
**Skin Lesions: An Ultrasonographic Approach for a Multidisciplinary Management**

**Station #7**

**Participants**

Marta Drake Perez, MD, Santander, Spain (Presenter) Nothing to Disclose  
Rosa Maria A. Landeras, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
TEACHING POINTS

To review the sonoanatomy of the skin. To define high-frequency ultrasound features of benign and malignant skin lesions, correlating them with the pathological findings. To emphasize the utility of ultrasounds in the diagnosis, the medical or surgical treatment planning, and the recurrence prevention of many skin conditions.

TABLE OF CONTENTS/OUTLINE

1. Sonoanatomy of the skin
2. What has to be included in the report
3. Focal benign lesions
   - Epidermal inclusion cyst
   - Pilonidal cyst
   - Skin adnexal derived: Trichilemmal cyst, Pilomatricoma, Hidradenitis, Dermal eccrine cylindroma, Eccrine hidradenoma Pyoderma gangrenosum
   - Dermatofibroma
   - Glomus tumor
   - Leiomyoma
   - Neurofibroma
   - Vascular malformations
   - Traumatic lesions: Fat necrosis, Hematomas
   - Others: Hyperkeratosis vs papilloma, Piezogenic pedal papules, Chondrodermatitis nodularis helicis
4. Malignant tumors
   - Basal cell carcinoma
   - Squamous cell carcinoma
   - Malignant melanoma
   - Merkel cell carcinoma
   - Dermatofibrosarcoma protubersans
   - Kaposi's sarcoma
   - Vascular tumors
   - Cutaneous metastases
   - Hematologic disease: Cutaneous lymphoma, leukemia
5. Diffuse conditions
   - Psoriasis
   - Scleroderma
6. Exogenous components: Foreign bodies, implants, hyaluronic acid...

Participants

Lana H. Gimber, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Shivani Ahlawat, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Carol Morris, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (Presenter) Nothing to Disclose

TEACHING POINTS

1. Myxoid soft tissue tumors are a heterogeneous group that have variable biologic behavior, ranging from completely benign lesions, to those with a tendency to be locally aggressive and those with metastatic potential. 2. Since imaging features include hyperintensity on fluid-sensitive sequences that may mimic a cyst, post-contrast T1 weighted imaging as well as functional sequences (dynamic contrast enhancement, diffusion weighted imaging) provide important clues to the diagnosis. 3. Categorizing these lesions with imaging is not possible in all cases, but radiologists should be aware of important features to clinical management.

TABLE OF CONTENTS/OUTLINE

1. Overview of myxoid lesions
   a. Benign
   b. Locally Aggressive
   c. Malignant
2. Important histologic features
   a. Round cell vs spindle cell types
3. Imaging features
   a. Anatomic sequences (T1, Fluid-sensitive, static post-contrast T1 imaging)
   b. Functional sequences (Diffusion weighted imaging/ADC mapping, Dynamic contrast-enhanced sequences)
4. Clinical presentation and prognosis

Participants

Jeffrey D. Poot, DO, Hamburg, PA (Presenter) Nothing to Disclose
Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (Abstract Co-Author) Consultant, Medical Metrics, Inc
Eric A. Walker, MD, Hershey, PA (Abstract Co-Author) Research Consultant, Medical Metrics, Inc
Stephanie A. Bernard, MD, Hershey, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Describe preoperative planning, indications, and postoperative assessment of shoulder arthroplasty. Describe important measurements with CT and MRI related to shoulder arthroplasty. Describe role of ultrasound for evaluation of post replacement tears.

TABLE OF CONTENTS/OUTLINE

Describe the preoperative assessment of shoulder arthroplasty to include the condition of the glenoid, glenoid version measurements, as well as location of both anterior and posterior maximum glenoid bone loss. Discuss indications, postoperative appearance, and related complications of anatomic total shoulder arthroplasty, reverse total shoulder arthroplasty, humeral head resurfacing, hemiarthroplasty, and nonprosthetic glenoid resurfacing. Discuss role of ultrasound for post replacement tears.
Can Cartilage Compensate? How Severity of Hip Dysplasia Alters Cartilage Thickness

PURPOSE

Patients with developmental hip dysplasia suffer significant morbidity in part due to the instability of the hip joint. It is thought that the body compensates for this instability through hypertrophy of the articular cartilage, similar to that seen at the labrum. We aim to evaluate the relationship of cartilage thickness to the severity of hip dysplasia to better understand functionality in such patients.

METHOD AND MATERIALS

331 patients at our institution were evaluated for hip pain. Weight-bearing pelvic view radiographs were obtained for all patients from which the lateral center edge angle was computed. Each patient was then placed in one of four groups: dysplastic, borderline dysplastic, normal and acetabular overcoverage. An MRI was also obtained for each of these patients. Two diagnostic radiologists independently reviewed the images and calculated the cartilage thickness at the weight-bearing zone for each patient. The average joint spacing was computed for each of the 4 groups.

RESULTS

Cartilage thickness at the weight-bearing zone of the hip is associated with the severity of dysplasia. Patients with a lateral center edge angle of less than 20 degrees had an average cartilage thickness of 3.9 centimeters whereas patients with acetabular overcoverage, lateral center edge angle greater than 40 degrees had a cartilage thickness of only 2.7 centimeters.

CONCLUSION

Cartilage thickness appears to be strongly associated with the degree of hip dysplasia and likely acts as a compensatory mechanism to increase stability in a manner similar to labral hypertrophy. The effects of these findings on outcome after hip preservation warrant further exploration.

Disproportionate Fluid Sign: Usefulness in Diagnosis of High Grade Bursal-Sided Supraspinatus Tendon Tear Misinterpreted As Full-thickness Tear

PURPOSE

To determine the usefulness of the disproportionate fluid sign in diagnosing high grade bursal-sided partial-thickness supraspinatus tendon tear misinterpreted as full-thickness tear on conventional MRI.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and waived the requirement for informed consent. This study included 231 patients with arthroscopically confirmed high-grade bursal-sided tears (n=85) and full-thickness tears (n=146) who underwent preoperative shoulder MRI from October 2007 to October 2013. The disproportionate fluid sign was defined as the prominent subdeltoid or subacromial-subdeltoid bursal fluid distension with a relative paucity of effusion in the glenohumeral joint. Two readers independently reviewed MR images twice, 4 weeks apart, for the presence of high grade bursal-sided tear by using tear depth alone and in combination with disproportionate fluid sign. The sensitivity, specificity, accuracy, and the area under the receiver operating characteristic curve(AUCs) were calculated. The McNemar test for comparison and the \( \kappa \) statistic for inter/intra-observer reliability was used.
RESULTS
The disproportionate fluid sign was found in 80 (34.6%) of 231 shoulders, including 69 (81.2%) of 85 bursal-sided tears and 11 (7.5%) of 146 full-thickness tears. For each reader, both the sensitivity and accuracy of the diagnoses were significantly higher in combination with the disproportionate fluid sign compared with using tear depth alone (p < .001). Interobserver agreement for the diagnosis of a bursal-sided tear was excellent (κ = .832, p < .001). The AUCs of both readers were significantly higher in combination with the disproportionate fluid sign (reader 1: 0.859 to 0.936, p = .003; reader 2: 0.943 to 0.974, p = .032).

CONCLUSION
The disproportionate fluid sign was a common finding on shoulder MRI revealing a high grade bursal-sided supraspinatus tendon tear compared with a full-thickness tear. The disproportionate fluid sign could be an indication of the presence of a high grade bursal-sided tear mimicking a full-thickness tear and significantly improved the diagnostic performance, being especially helpful for less experienced radiologists and orthopedic surgeons.

CLINICAL RELEVANCE/APPLICATION
Disproportionate fluid sign as an indication of the presence of a high grade bursal-sided tear mimicking a full-thickness tear could be helpful for even less experienced radiologists and orthopedic surgeons.

MK364-SD-WEB3  
Rotator Cable Morphologic Parameters at MRI in Patients with Symptomatic Full-thickness Rotator Cuff Tears: Correlation with Functional Outcomes and Health-related Quality Of Life

Participants
Maguy Deslauriers, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Marianne Lepage-Saucier, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Patrice Tetreault, MD, MSc, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Dominique Rouleau, MD, MSc, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Nicola Hagneister, Montreal, QC (Abstract Co-Author) Research collaboration, Emovi Inc Research Grant, Emovi Inc
Nathalie J. Bureau, MD, MSc, Montreal, QC (Presenter) Equipment support, Siemens AG

PURPOSE
Determinants of functional impairment in patients with rotator cuff tears (RCT) remain incompletely elucidated. Our primary aim was to correlate rotator cable (RC) morphologic parameters at MRI with functional and health-related quality of life outcomes in patients with full-thickness RCT.

METHOD AND MATERIALS
This study was IRB approved. Two MSK radiologists reviewed in consensus, 57 shoulder MRI studies from 57 patients (mean age 57 ± 6.5 years; 58% men) with RCT and 30 shoulder studies from 30 asymptomatic subjects (56 ± 7.3 years; 57% men). These parameters were evaluated: supraspinatus (SS) and infraspinatus (IS) tear dimensions (length, width, thickness); SS and IS myotendinous junction retraction; RC dimensions (width, thickness) and distance from the greater tuberosity (RC position); integrity of anterior and posterior RC attachments; markers of shoulder function (SS atrophy, SS and IS fatty infiltration). A physical therapist administered the Constant, QuickDASH and SF12-v2 questionnaires. Univariate analyses were performed using appropriate tests according to the nature of the combined variables. Stepwise logistic or linear regression models were then performed to identify the best combination of parameters predicting each variable. Threshold of alpha significance was set at p < 0.05.

RESULTS
Univariate analyses showed that RC position was significantly associated with SS atrophy (p < 0.001) and fatty infiltration (p < 0.001). Intensity of anterior RC attachment correlated inversely with SF12 physical score (p = 0.048) and SS atrophy (p = 0.009), whereas integrity of posterior RC attachment was inversely associated with SF12 physical score (p = 0.024) and IS fatty infiltration (p = 0.006). RC parameters did not demonstrate a significant effect in the regression models. On average, the RC was significantly narrower (p < 0.001) and thicker (p = 0.008), and the distance between the RC and the greater tuberosity was greater, in RCT patients (p < 0.001).

CONCLUSION
RC parameters do not appear to be preponderant factors of functional and health-related quality of life outcomes in patients with full-thickness RCT. Full-thickness RCT promotes medial RC displacement and alters significantly its morphology.

CLINICAL RELEVANCE/APPLICATION
Our results suggest that the status of the rotator cable as assessed in this study, is not a preponderant determinant of shoulder function.

MK365-SD-WEB4  
Assessment of Synovitis with FLAIR-FS Imaging (Fluid-attenuated Inversion Recovery Sequence with Fat-suppression): A Comparative Study against Contrast-enhanced MRI

Participants
Hye Jin Yoo, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Sung Hwan Hong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ja-Young Choi, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Hye Yeon Oh, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee-Dong Chae, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare fat-suppressed fluid-attenuated inversion recovery sequence (FLAIR-FS) with contrast-enhanced MRI for knee synovitis assessment.
METHOD AND MATERIALS

Twenty one individuals with knee pain underwent a 3-T MRI scanner. The protocol consisted of routine clinical sequences followed by the FLAIR-FS sequence (axial acquisition; TR/TE 9000/85~150; inversion time 2200 msec; matrix 320x224; field of view 16 cm; slice thickness 3mm; acquisition time 4 minutes 50 seconds) and contrast-enhanced (CE) T1-weighted imaging (axial acquisition; TR/TE 500-790/13; matrix 448 x 269; slice thickness 3mm; acquisition time 3 minutes 50 seconds). FLAIR-FS and CE MRI images were analyzed independently by a musculoskeletal radiologist. At 5 joint sites, the synovial thickness was measured and severity of synovitis was graded on a scale from 0 to 2 using a whole-joint semiquantitative scoring system. Then, sum scores of synovitis were calculated at patient level. Diagnostic performance statistics were calculated on the site and patient levels using CE MRI as a reference standard. The summed synovitis scores and synovial thickness of FLAIR-FS were correlated with those of CE MRI.

RESULTS

With CE MRI as the reference standard, FLAIR-FS showed good to excellent diagnostic performance for the detection of synovitis of any severity (sensitivity, specificity and accuracy of 76, 97 and 91% respectively on site level; and 83% 100% and 95% respectively on patient level). Excellent correlation was found between FLAIR-FS and CE MRI in the assessment of summed synovitis scores and synovial thickness (Spearman's rank correlation coefficient 0.886 (p<0.001), and Pearson's correlation coefficient 0.928 (p<0.001), respectively).

CONCLUSION

Our results suggest that knee synovitis could be reliably diagnosed on FLAIR-FS sequence without the need for contrast agents.

CLINICAL RELEVANCE/APPLICATION

FLAIR-FS sequence may be a useful sequence to assess the synovial pathology with reduced risks and scan time compared to CE-MRI.

PURPOSE

To explore the feasibility of quantitative evaluation of lumbar intervertebral cartilage endplate using three dimensional multi-echo ultrashort echo time pulse sequence MR imaging.

METHOD AND MATERIALS

The images of lumbar cartilage endplate (CEP) were obtained from twenty one young volunteers by using multi-echo ultrashort echo time pulse sequence, and the image quality were evaluated from grade I to grade III in the order from poor to excellent. The T2* values of both upper and lower CEPs were measured at the lumbar artificial color maps from L1/L2 to L5/S1.

RESULTS

The 210 CEP images were graded as grade III. The average T2* value of upper and lower CEP was 19.76±8.41, and 30.17±17.25, respectively. The difference of CEP T2* value between upper and lower was statistically significant (t=-5.56, P<0.01).

CONCLUSION

Three dimensional multi-echo ultrashort echo time pulse sequence MR imaging provides an effective approach for the quantitative study of lumbar CEP.

CLINICAL RELEVANCE/APPLICATION

Three dimensional multi-echo ultrashort echo time pulse sequence MR imaging could be utilized in non-invasively observing the pathological process of human lumbar CEP degeneration.

PURPOSE

To investigate the image quality of CT-images of a metal hip prosthesis when using model-based iterative reconstruction (IMR) combined with an orthopaedic metal artefact reduction algorithm (O-MAR) at up to 80% radiation dose reduction.

METHOD AND MATERIALS

A water-filled phantom was used made of PMMA using the most commonly used metal hip prosthesis configuration surrounded by 18
Ultrasonography (US) is an excellent diagnostic tool for the depiction of subcutaneous lesions. It is a time-saving and cost-effective technique, is well tolerated by patients and was repeatedly demonstrated to have a good accuracy in the diagnosis of incidentally detected subcutaneous nodules. We illustrate ultrasonographic features of subcutaneous nodules including benign, malignant and non-neoplastic lesions. Practical hints concerning dynamic US, Color Doppler and Power Doppler imaging are given.

**Advantages and disadvantages of US in the characterization of these lesions are discussed.**

**RESULTS**

IMR shows lower noise levels at ultra-low dose compared to high-dose FBP acquisitions. Mean HUs remain constant and CNRs of unaffected pellets are higher at a radiation dose reduction of 80\% relative to current clinical practice, using iDose4. O-MAR reduces metal artefacts (p<0.005) and is most effective when combined with IMR. At the ultra low dose of 4 mGy IMR level 1, 2 and 3 show respectively 83\%, 89\% and 95\% lower values in noise compared to standard FBP reconstructions while maintaining constant HU values.

**CONCLUSION**

In current clinical practice, an average CTDIvol of 20 mGy in radiation dose is used. Thus, based on the results of this phantom study, we can conclude that with the use of IMR and O-MAR acceptable image quality parameters regarding mean HU, noise and CNR are maintained at a reduction in radiation dose of 80 \% relative to the standard reconstructions technique FBP in the CT-imaging of metal hip prostheses. However, an extensive clinical study is essential, since the actual capabilities in dose-reduction cannot be determined based on this phantom study only.

**CLINICAL RELEVANCE/APPLICATION**

Reducing radiation dose with 80\% relative to our clinical practice, IMR and O-MAR in CT-imaging of metal hip prostheses opens possibilities for more cross sectional imaging in orthopaedic implants.

**TABLE OF CONTENTS/OUTLINE**

**Long Head Biceps Tendon Injuries of the Shoulder: Injury Biomechanics, and the Role of Imaging in Clinical Management**

Station #7

**Awards**

**Magna Cum Laude**

**Participants**

Scott Sheehan, MD, Madison, WI (Presenter) Nothing to Disclose

Humberto G. Rosas, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

Jason W. Stephenson, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

1) Review the anatomy and biomechanics of the long head biceps tendon and its role in shoulder stability, utilizing 3D modeling and animation.

2) Identify the common imaging findings and associated injury mechanisms of long head biceps tendon pathology, with arthroscopic correlation.

3) Describe a simplified treatment algorithm for biceps tendon pathology, emphasizing discriminating imaging features of long head biceps tendon injuries which direct conservative and surgical approaches.

**TABLE OF CONTENTS/OUTLINE**

Anatomy: Long head biceps tendon (LHBT) and rotator interval Biomechanics LHBT as a noncontractile sliding tendon Role of LHBT in shoulder stability Pathophysiology and MRI and Ultrasound imaging findings of LHBT injuries, with arthroscopic correlation Tenosynovitis Tendinosis Partial tears Rupture Dislocation Imaging pitfalls and mimics of LHBT injuries Treatment approaches Significance of associated labral tears and rotator cuff tears Conservative versus surgical treatment indications and approaches Imaging guided interventions: corticosteroid injections Simplified treatment algorithm Case-based review of imaging findings and their impact on treatment

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Scott Sheehan, MD - 2014 Honored Educator

**Ultrasonography of Subcutaneous Nodular Lesions**

Station #8

**Participants**

Maximilian Rauch, Bonn, Germany (Presenter) Nothing to Disclose

Gerd Stuckmann, MD, Winterthur, Switzerland (Abstract Co-Author) Nothing to Disclose

Hans H. Schild, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose

Holger M. Strunk, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

• Ultrasonography (US) is an excellent diagnostic tool for the depiction of subcutaneous lesions. It is a time-saving and cost-effective technique, is well tolerated by patients and was repeatedly demonstrated to have a good accuracy in the diagnosis of incidentally detected subcutaneous nodules. • We illustrate ultrasonographic features of subcutaneous nodules including benign, malignant and non-neoplastic lesions. • Practical hints concerning dynamic US, Color Doppler and Power Doppler imaging are given.

**Advantages and disadvantages of US in the characterization of these lesions are discussed.**

**TABLE OF CONTENTS/OUTLINE**

• US technique and normal ultrasonic appearance of the skin and subcutaneous tissues• Dynamic US, Color Doppler and Power
Doppler imaging in the characterization of cutaneous and subcutaneous lesions • Benign mesenchymal tumors o Lipoma o Leiomyoma • Fibrous lesions o Nodular fasciitis o Superficial fibromatosis • Synopsis of malignant subcutaneous tumors • Non-neoplastic lesions o Fat necrosis o Hematoma o Foreign body granuloma o Suture granuloma o Injection sites o Epidermoid cyst o Rheumatoid nodule • Advantages and disadvantages of US in the characterization of subcutaneous nodules

**MK228-ED-WEB9**  **Bridging Knowledge on Tarsal Coalitions**

Station #9

Participants
Jeffrey D. Poot, DO, Hamburg, PA (Presenter) Nothing to Disclose
Eric A. Walker, MD, Hershey, PA (Abstract Co-Author) Research Consultant, Medical Metrics, Inc
Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (Abstract Co-Author) Consultant, Medical Metrics, Inc

**TEACHING POINTS**

Describe the radiographic, CT, and MR findings of congenital tarsal coalition. Illustrate less common forms of congenital tarsal coalition. Describe treatment for tarsal coalition.

**TABLE OF CONTENTS/OUTLINE**

- Tarsal coalition types
  - Congenital osseous, cartilaginous or fibrous connection between two bones
  - Associated clinical findings, such as rigid pes planus
  - Talocalcaneal Coalition
    - Radiographic Findings
    - Cross sectional findings to include CT and MR
  - Treatment
- Calcaneonavicular Coalition
  - Radiographic Findings
  - Cross sectional findings to include CT and MR
  - Treatment
- Other less common forms of congenital tarsal coalition
  - Talonavicular
  - Calcaneocuboid
  - Cubonavicular
  - Navicular-first cuneiform

**MK299-ED-WEB10**  **Hoffa’s Fat Pad: Anatomy, Pathology, and Imaging Findings**

Station #10

Participants
Diego F. Lemos, MD, Shelburne, VT (Presenter) Nothing to Disclose

**TEACHING POINTS**

1. To review the anatomy and pathology of the infrapatellar fat pad of Hoffa.
2. To discuss the wide spectrum of intrinsic and extrinsic conditions that can affect Hoffa’s fat pad.
3. To develop a reasonable differential diagnosis based on imaging when pathology involves Hoffa’s fat pad.

**TABLE OF CONTENTS/OUTLINE**

1. Objectives
2. Introduction
3. Anatomy
4. Pathology
  a. Intrinsic conditions affecting the fat pad primarily
  b. Extrinsic conditions affecting the fat pad secondarily
5. Imaging Findings
6. Differential Diagnosis
7. Conclusion
8. References
Participants
Ken L. Schreibman, PhD, MD, Madison, WI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To get a better understanding of 3 common fracture patterns in the foot/ankle: a. Ankle twisting injuries and the Weber staging system. b. Fracture/dislocations of the Lisfranc joint c. Fractures of the proximal 5th metatarsal, distinguishing between avulsion and Jones fractures.

Active Handout: Ken L. Schreibman
SSM15

**Musculoskeletal Keynote Speaker: MR Imaging Around Metal-Technique and Clinical Implementation**

Wednesday, Dec. 2 3:00PM - 3:20PM Location: E450A

Participants
Hollis G. Potter, MD, New York, NY (Moderator) Research support, General Electric Company
Siegfried Trattnig, MD, Vienna, Austria (Moderator) Nothing to Disclose

SSM15-03

**Particle Induced Synovitis on MRI and Correlation with Polyethylene Surface Damage at Retrieval Analysis**

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E450A

Participants
Hollis G. Potter, MD, New York, NY (Presenter) Research support, General Electric Company

Awards
Trainee Research Prize - Fellow

Participants
Angela E. Li, MBBS, MMed, New York, NY (Presenter) Nothing to Disclose
Christine C. Johnson, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Darryl B. Sneag, MD, Chestnut Hill, MA (Abstract Co-Author) Nothing to Disclose
Chelsea N. Koch, BS, New York, NY (Abstract Co-Author) Nothing to Disclose
Kara Fields, New York, NY (Abstract Co-Author) Nothing to Disclose
Timothy M. Wright, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Theodore T. Miller, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Douglas E. Padgett, MD, New York, NY (Abstract Co-Author) Consultant, Stryker Corporation;
Hollis G. Potter, MD, New York, NY (Abstract Co-Author) Research support, General Electric Company

**PURPOSE**

To determine if a correlation exists between degree of polyethylene surface damage in total knee arthroplasty (TKA) tibial components and the severity of synovitis, osteolysis, and capsular thickness on MRI.

**METHOD AND MATERIALS**

With IRB approval, 62 patients who had an MRI within 1 year prior to revision arthroplasty were consecutively selected from our hospital registry of retrieved TKA implants. The MR images were retrospectively graded for particle induced synovitis based on the percentage of bulky hypertrophied synovium filling the joint. Capsular thickness and volume of osteolytic lesions were calculated. The articular surfaces of the retrieved tibial inserts were visually inspected, blinded to the MR appearances, and subjectively assigned damage scores by two independent observers using an established grading system. Inserts were graded for: deformation, embedded debris, scratching, burnishing, delamination, pitting, and abrasion. The MRI scores and measurements were compared to the articular surface damage scores using the Spearman correlation coefficient.

**RESULTS**

A positive correlation was found between the MRI grade of particle induced synovitis and the damage score (rs=0.423, p<0.01, or rs=0.450, p<0.01 when the synovitis grade was corrected for the degree of capsular distention). The volume of osteolytic lesions correlated with the damage score (rs=0.335, p<0.01). Capsular thickness did not correlate with damage scores (rs=-0.097, p=0.5). The synovitis grade strongly correlated with the volume of osteolytic lesions (rs=0.579, p<0.01). The length of implantation of the TKA correlated with both the synovitis grade and damage score (rs=0.396, p<0.01 and rs=0.487, p<0.01, respectively). The mean length of implantation was 6.7 years (range 1-30, SD 6.1 years).

**CONCLUSION**

Polyethylene surface damage in TKA correlates with the severity of particle-induced synovitis and volume of osteolytic lesions on MRI.

**CLINICAL RELEVANCE/APPLICATION**

The association between MRI findings and retrieval analysis of polyethylene damage suggests a link between wear debris and subsequent synovial reactions around failed TKAs.

**Metal Artifact Reduction (MAR) on a Sliding Gantry CT-scanner: Evaluation of a MAR Algorithm Based on Two Compartment Physical Modelling in Patients with Hip Implants**

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E450A

Participants
**PURPOSE**

The aim of this study was to evaluate the impact of a novel metal artifact reduction (MAR) algorithm on image quality compared to standard filtered back projection (FBP) on a CT scanner with sliding gantry in patients with metallic hip implants.

**METHOD AND MATERIALS**

Twenty two patients with 25 metallic hip implants were included in this retrospective study. All patients underwent abdominopelvic computed tomography on a 64 row scanner with sliding gantry (Definition AS+ sliding gantry, Siemens, Germany). Axial images were reconstructed using FBP and five increasing MAR levels (M30-34). Objective artifact reduction was assessed by ROI measurements in localization of the strongest artifact (SIart) and in osseous structures without artifacts (SInorm). Differences between both measurements served as a measure for objective artifact strength (OAS: SIart-SInorm). Two blinded, independent reader evaluated subjective IQ regarding metallic hardware, delineation of bone, adjacent muscle and pelvic organs on a five point scale (1: non diagnostic - 5: excellent IQ, no artifacts). In addition, new artifacts due to MAR were recorded.

**RESULTS**

OAS values were 153.2±48.3 HU for M34; 261.0±241.6 HU for M33; 328.7±228.8 HU for M32; 393.2±225.9 HU for M31; 446.8±224.2 HU for M30 and 528.9±227.7 HU for FBP. OAS values were significantly lower for M32-34 compared to FBP (p<0.05). Subjective image quality was 2.0±0.2 for FBP, 2.3±0.4 for M30, 2.6±0.5 for M31, 3.0±0.6 for M32, 3.5±0.6 for M33 and 3.8±0.4 for M34 (p<0.05 for M31-M34 vs. FBP, respectively). Increasing strength of the MAR level resulted in new artifacts in up to 16%.

**CONCLUSION**

The MAR algorithm leads to a significant reduction in artifacts from metallic hip implants. The highest MAR-level allows for the maximal artifact reduction but may also induce new artifacts.

**CLINICAL RELEVANCE/APPLICATION**

High levels of a MAR algorithm lead to a significant improvement of image quality in patients with hip implants.

**SSM15-05 Contrast Enhanced MRI Adjacent to Metal Interfaces**

**Wednesday, Dec. 2 3:40PM - 3:50PM Location: E450A**

Participants

Rajeev Mannem, MD, Milwaukee , WI (Presenter) Nothing to Disclose
Suryanarayanan Kaushik, PhD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Scott J. Erickson, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Mark D. Hohenwalter, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Kevin M. Koch, PhD, Waukesha, WI (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Metal-induced susceptibility artifacts in MRI can be greatly reduced using Three-Dimensional Multi-Spectral Imaging methods (3D-MSI). A variety of previous studies have demonstrated preliminary clinical utility of 3D-MSI (i.e. "MAVRIC SL" and "SEMAC/Advanced WARP") in assessing complications near metal implants. Here, we present preliminary analysis of 3D-MSI utility in contrast-enhanced (CE) MRI at a field strength of 1.5T. Susceptibility-artifacts near metal implants introduce unique challenges to CE MRI. In particular, the hyperintense 'pileup' artifacts that are present in conventional fast/turbo spin-echo sequences often confound assessment of CE near metal implants. Use of T1w 3D-MSI for CE MRI reduces the footprint of these hyperintensity artifacts.

**METHOD AND MATERIALS**

MAVRIC SL 3D-MSI was implemented using modified pulse-sequencing software that allowed for shorter TR periods than the commercially available sequence. 3D-MSI images were acquired pre-and post contrast in at least one scan plane for each case. In addition conventional 2D-FSE images were acquired for each case for qualitative comparison of artifact reduction. Imaging data was acquired on a variety of implants including total hip-replacements, spinal fusion hardware, fixation screws, and support rods. All subjects were consented into a research study approved by the local ethics committee.

**RESULTS**

CE T1-weighted 3D-MSI at 1.5T enables uptake assessment in the immediate vicinity of metallic instrumentation. For assessments of painful total hip replacements CE aided in tissue differentiation in cases of adverse local tissue reaction. Contrast-enhanced 3D-MSI enabled improved assessments of early tumor recurrence. Assessment of failed back surgery syndrome also showed potential benefit from CE 3D-MSI, where contrast uptake in the immediate vicinity of pedicle screws was consistently observed. In addition, assessment epidural fibrosis and infection in the immediate vicinity of spinal hardware was enabled using contrast-enhanced 3D-MSI.

**CONCLUSION**

New 3D-MSI metal artifact reduction techniques can be used effectively to assess contrast uptake in the immediate vicinity of metallic hardware.

**CLINICAL RELEVANCE/APPLICATION**

These methods allow the freedom to assess common pathological conditions as if the hardware were absent and encourages future studies characterizing disease processes due to the hardware itself.

**SSM15-06 Usefullness of Slice Encoding Metal Artifact Correction (SEMAC) for Reducing Metal Artifacts after Total Knee Arthroplasty**

**Wednesday, Dec. 2 3:40PM - 3:50PM Location: E450A**

Participants

Kevin M. Koch, PhD, Milwaukee, WI (Presenter) Nothing to Disclose
Lino Sawicki, MD, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Rotem S. Lanzman, MD, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Christoph Schleisch, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Patic Kroepil, MD, Duesseldorf, Germany (Presenter) Nothing to Disclose

**PURPOSE**

These methods allow the freedom to assess common pathological conditions as if the hardware were absent and encourages future studies characterizing disease processes due to the hardware itself.
To compare metal artifact reduction after total knee arthroplasty in MRI at 1.5 T using novel MRI sequence strategies.

METHOD AND MATERIALS

Two sequences were compared for the imaging of metal implants after total knee arthroplasty on a 1.5 T MR system: a slice encoding sequence for metal artifact correction (SEMAC) and a standard TSE sequence. 15 patients with titanium implants were evaluated. Degree of artifact reduction was assessed quantitatively and qualitatively by both, artifact measurements and a blinded read. The images were ranked by the following parameters: artifact size, distortion, and the ability to differentiate bone marrow, cortex and soft tissue. The images were also evaluated in respect of the visibility of crucial and collateral ligaments and the patellar tendon. The Insall-Salvati-Index was measured as well. The SEMAC technique was compared directly to the TSE standard sequence.

RESULTS

In comparison to standard sequences artifact size was 59% less utilizing SEMAC. In terms of bone marrow, bone cortex and soft tissue visualization SEMAC was ranked superior to the corresponding standard sequence. Distortion was less with SEMAC. For the evaluation of blur, the standard images were ranked superior to the corresponding SEMAC sequence. In terms of overall image quality, SEMAC was ranked superior to the standard sequence. For all terms of clinical relevance SEMAC was ranked superior to the corresponding standard sequence.

CONCLUSION

SEMAC effectively reduces artifacts caused by metallic implants after total knee arthroplasty relative to standard imaging.

CLINICAL RELEVANCE/APPLICATION

SEMAC sequences allow for better visualisation of crucial anatomic structures after total knee arthroplasty thus improving evaluation of postoperative result and detection of postoperative complications.
RSNA Diagnosis Live™: Neuro and MSK

Wednesday, Dec. 2 4:30PM - 6:00PM Location: E451B

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

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (Presenter) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated
Gregory L. Katzman, MD, Chicago, IL (Presenter) Nothing to Disclose
Neety Panu, MD, FRCPC, Thunder Bay, ON (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.
Musculoskeletal Thursday Case of the Day

Thursday, Dec. 3 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
William F. Conway, MD, PhD, Charleston, SC (Presenter) Nothing to Disclose
Russell W. Chapin, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Robert H. Hazelrigg, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Thomas Britt, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Nathaniel Jones, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Kevin G. Garrett, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew R. Gilott, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Matthew P. Brill, DO, Oklahoma City, OK (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.
Participants
Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes that affect the muscles, shoulder, elbow, wrist and hand. 2) Illustrate using case examples of several important disease processes that affect these regions, using several imaging methods and emphasizing the value of each. 3) Present the major teaching points and differential diagnostic considerations for each of the chosen cases and, when appropriate, clarify the importance of early accurate diagnosis.

ABSTRACT
Accurate diagnosis of many disorders that affect muscles, shoulder, elbow, wrist and hand can be accomplished with basic or advanced imaging methods, or both. A series of cases will be used to illustrate a few of these disorders, with attention to the most appropriate imaging protocol, the salient imaging findings, the anatomic and pathophysiologic factors that explain the findings, and the important differential.

Sub-Events
MSCS51A  Muscle

Participants
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Presenter) Speaker, General Electric Company; Equipment support, Siemens AG;

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCS51B  Shoulder

Participants
Jenny T. Bencardino, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Handout: Jenny T. Bencardino

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jenny T. Bencardino, MD - 2014 Honored Educator

MSCS51C  Elbow

Participants
Kathryn J. Stevens, MD, Menlo Park, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCS51D  Wrist and Hand

Participants
Leon Lenchik, MD, Winston-Salem, NC, (rlenchik@wakehealth.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
Participants
Theodore T. Miller, MD, New York, NY (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) Apply the technique for MR imaging of hip and knee replacements. 2) Recognize and describe the MR appearances of complications related to these joint replacements.

ABSTRACT
MR imaging of hip and knee replacements requires adjustment of scanning parameters, such as using fast spin echo sequences with long echo train length, maximum receiver bandwidth, thin slices, and a high frequency-encoding matrix, to minimize intravoxel dephasing and misregistration artifacts. Proprietary techniques such as MAVRIC (multi-acquisition variable resonance image combination) and SEMAC (slice-encoding metal artifact correction) can also reduce metal-related artifacts. Complications encountered on MR imaging of hip and knee replacements will be discussed, including adverse reactions to metal debris, polymeric wear, infection, osteolysis, component loosening, stress reaction and fracture, and tendon tears.

Participants
Felix S. Chew, MD, Seattle, WA, (fchew@uw.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize and describe the features of shoulder joint replacements on radiologic images. 2) Recognize and describe the features of elbow joint replacements on radiologic images.

ABSTRACT
Shoulder joint replacements include anatomic total joint replacements, humeral head replacements, and reverse total joint replacements. Elbow joint replacements include replacements of the radial head alone, replacements of the radiocapitellar compartment, and replacements of the ulno-trochlear compartment. Knowledge of the expected appearances of each type of postsurgical construct and the range of complications will improve the radiologist’s ability to identify complications.

Active Handout:Felix Sze-Kway Chew

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Felix S. Chew, MD - 2012 Honored Educator

Participants
Laura W. Bancroft, MD, Orlando, FL, (laura.bancroft.md@flhosp.org) (Presenter) Royalties, Wolters Kluwer nv

LEARNING OBJECTIVES
1) Review imaging characteristics of arthroplasties in smaller joints, such as the ankle/foot, hands/feet and elbow. 2) Demonstrate complications of smaller joint arthroplasties with various imaging modalities.

ABSTRACT
This refresher course will encompass the imaging characteristics of arthroplasties in smaller joints, such as the ankle/foot, hands/feet and elbow. The normal appearances and complications of smaller joint arthroplasties will be demonstrated utilizing various imaging modalities.
**Participants**

A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose  
Bassem A. Georgy, MD, MSc, San Diego, CA (Presenter) Consultant, Johnson & Johnson; Consultant, DFINE, Inc; Stockholder, DFINE, Inc; Stockholder, Spine Solutions, Inc;  
Allan L. Brook, MD, Bronx, NY (Presenter) Advisor, Johnson & Johnson Advisor, Medtronic, Inc  
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose  
Todd S. Miller, MD, Bronx, NY, (Tmiller@montefiore.org) (Presenter) Nothing to Disclose

**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**

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 radioopaque implant, usually an acrylic bone cement, is carefully injected into the vertebra or sacral ala under imagining 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 embolus. 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**

Handout: Afshin Gangi  
Active Handout: Todd Stuart Miller  
Case-based Review of Musculoskeletal Radiology (An Interactive Session)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S406A

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

Participants
Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the application of basic anatomic, pathologic, and physiologic principles to tumors as well as specific disease processes that affect the knee, hip, ankle and foot. 2) Illustrate using case examples of several important disease processes that are characteristic of the chosen topics, using several imaging methods and emphasizing the value of each. 3) Present the major teaching points and differential diagnostic considerations for each of the chosen cases and, when appropriate, clarify the importance of early accurate diagnosis.

ABSTRACT
Accurate diagnosis of many disorders that affect the knee, hip, ankle and foot as well as musculoskeletal tumors can be accomplished with basic or advanced imaging methods, or both. A series of cases will be used to illustrate a few of these disorders, with attention to the most appropriate imaging protocol, the salient imaging findings, the anatomic and pathophysiologic factors that explain the findings, and the important differential...
**MSES52**

**Essentials of Trauma Imaging**

Thursday, Dec. 3 10:30AM - 12:00PM Location: S406B

**Participants**

Sub-Events

**MSES52A  Cervical Spine Trauma**

Participants

Peter J. MacMahon, MD, Dublin, Ireland, (pmacmahon@mater.ie) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the stabilizing anatomical structures of the cervical spine. 2) Appraise the indications for the various cervical spine imaging modalities. 3) Classify cervical spinal injuries based on the mechanism of injury and stability. 4) Differentiate the most common cervical spine injuries. 5) Detect subtle soft tissue and bony injuries of the cervical spine.

**MSES52B  A Simplified Approach to Imaging Acetabular Fractures**

Participants

Ustun Aydingoz, MD, Ankara, Turkey, (ustunaydingoz@yahoo.com) (Presenter) Speaker, AbbVie Inc; Spouse, Stockholder, Edita Medical Writing Editing Ltd; Spouse, Employee, Edita Medical Writing Editing Ltd;

**LEARNING OBJECTIVES**

1) Identify the imaginary lines on radiographs to determine the presence of an acetabular fracture. 2) List five most common acetabular fractures that comprise approximately 90% of all. 3) Apply an algorithm to detect the five most common acetabular fractures on radiographs and/or CT. 4) Explain the most relevant information for the clinician regarding imaging assessment of acetabular fractures.

**ABSTRACT**

Imaging plays an indispensable role in detecting and classifying acetabular fractures. This live activity will focus on: A) identifying acetabular fractures on radiographs and CT, B) using an algorithm to classify the five most common acetabular fractures (that comprise approximately 90% of all), and C) mentioning clinically relevant points on imaging reports to help decision-making for better management of the patient's condition.

**Handout**: Ustun Aydingoz


**MSES52C  Blunt Trauma of Lung, Pleura, Airways, and Chest Wall**

Participants

Guillermo P. Sangster, MD, Shreveport, LA, (gsangs@lsuhsc.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Substantiate the advantages of multidetector computed tomography (MDCT) over Chest x-ray for the initial screening of chest trauma. 2) Identify the MDCT imaging findings of the non-vascular traumatic thoracic injuries.

**ABSTRACT**

Chest radiography has been the traditional screening technique to evaluate traumatic thoracic injuries. The information obtained is usually sub optimal for the diagnosis of non-vascular thoracic injuries. The benefits of MDCT for its diagnosis are discussed in this live activity. Images from our level I trauma center database are shown, including: A) Thoracic wall injuries: diaphragmatic rupture, sternum and scapular fractures, sterno-clavicular dislocation and flail chest. B) Pleuro-pulmonary injuries: contusion, laceration, hemothorax, pneumothorax, and hemothorax. C) Intrathoracic traqueo-bronchial laceration.
**SSQ13**

**Musculoskeletal (Arthritis)**

Thursday, Dec. 3 10:30AM - 12:00PM Location: E451A

**MK CT MR**

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

---

**Participants**

Leon Lenchik, MD, Winston-Salem, NC (Moderator) Nothing to Disclose  
Brady K. Huang, MD, San Diego, CA (Moderator) Nothing to Disclose

---

**Sub-Events**

**SSQ13-01**  **Calcium Pyrophosphate Deposition Disease Detected with MRI Is Associated with Accelerated Cartilage Degeneration-Data from the Osteoarthritis Initiative**

**Participants**

Alexandra S. Gersing, MD, San Francisco, CA (Presenter) Nothing to Disclose  
Benedikt J. Schwaiger, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose  
Ursula R. Heilmeier, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose  
John A. Lynch, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose  
Charles E. McCulloch, San Francisco, CA (Abstract Co-Author) Instructor, F. Hoffmann-La Roche Ltd Expert Witness, Mallinckrodt plc Consultant, Mallinckrodt plc  
Lyne S. Steinbach, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose  
Thomas M. Link, MD, PhD, San Francisco, CA (Abstract Co-Author) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

**PURPOSE**

To evaluate sensitivity of different MRI sequences regarding detection of calcium pyrophosphate deposition disease (CPPD) lesions within cartilage and menisci and to longitudinally analyze if CPPD lesions are associated with accelerated cartilage degeneration.

**METHOD AND MATERIALS**

Subjects with radiographic evidence of CPPD (n=90, age 67.7±7.3y, 50 females) were randomly selected from the Osteoarthritis Initiative and frequency matched for age, sex, baseline KL and BMI to controls without CPPD (n=90). On AP knee radiographs, CPPD status was determined. Sensitivity of T1-weighted 3D FLASH, 3D DESS, 2D intermediate (IW) and proton density (PD)-weighted sequences obtained at 3T MRI was assessed in randomized order by two radiologists blinded to radiographic CPPD status, by grading visualization and morphology of cartilage and meniscal CPPD lesions, as well as focal cartilage degeneration at baseline and after 48 months. For analysis multivariate regression models were used to examine associations between CPPD lesions detected with MRI and with radiographs as well as longitudinal changes of cartilage morphology.

**RESULTS**

Lesion count in menisci and cartilage of the tibiofemoral joint detected by different MRI sequences correlated significantly with degree of CPPD determined on radiographs (r(FLASH)=0.73, r(DESS)=0.68, r(IW)=0.51, r(PD)=0.40, P<0.001). Overall, visualization of cartilage lesions was significantly higher rated in FLASH compared to DESS, IW and PD sequences (for each, P<0.05). Progression of focal cartilage degeneration was significantly higher in subjects with CPPD compared to controls (P=0.03). At the patella, lesion count was highest, progression of cartilage degeneration was most significant compared to other compartments (P=0.03) and a significant association between progression and lesion count was found (r=0.64, P=0.03).

**CONCLUSION**

Our findings demonstrate that T1W FLASH gradient echo sequences were superior to other sequences in detection of CPPD lesions in cartilage. Moreover CPPD was associated with faster progression of cartilage focal degeneration over 48 months compared to controls and occurred most often at the patella.

**CLINICAL RELEVANCE/APPLICATION**

MR T1-weighted gradient-echo FLASH sequence allows detection and quantification of CPPD lesions within cartilage and menisci, and may be used to predict progression of focal cartilage degeneration.

**SSQ13-02**  **Study of 640-slice Dynamic Volume CT Perfusion and Pathological Changes on Acute Gouty Arthritis of Knee-joint in Rabbit Model**

**Participants**

Yabin Hu, MD, Qingdao, China (Presenter) Nothing to Disclose  
Qing Yang, Qingdao, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To assess 640-slice dynamic volume CT perfusion imaging of acute gout arthritis in rabbit.

**METHOD AND MATERIALS**

preparation of acute gout arthritis model. 35 rabbits were randomly divided into two groups: experimental group (30 rabbits) and
control group (5 rabbits). The right knee-joints of experimental group was injected with sodium urate solution and polymyxin, and no treatment was for the control group. The experimental group was divided into six subgroups randomly with five rabbits in each one, and for every 4h, 16h, 32h, 48h, 60h, and 60h after injection, one experimental subgroup underwent CT perfusion scan. The control group was scanned for once at any time. Then time-density curves (T-DC) were depicted, and the values of blood flow (BF), blood volume (BV), clearance rate (CL), and microvessel density (MVD) were computed in the right knee-joints containing experimental and control groups. Rabbits were killed after perfusion, and their right knee-joints were taken for pathologic examination.

RESULTS

BF, BV, CL and MVD in the experimental group were significantly higher at those six intervals (one-way ANOVA and LSD t test, P<0.05). BF, BV, CL and MVD in experimental group were different at those six intervals (one-way ANOVA and LSD t test, P<0.05). 4h, 16h, and 32h after the injection, BF, BV, and MVD in the experimental group increased slowly, and the peak values were found at 32h. Between 32h ~ 48h, the peak values were relatively stable, and after 48h ~ 72h, they decreased slowly. Between 4h ~ 48h, CL showed a slow ascent, peaking at 48h, and between 48h ~ 60h, the peak was relatively stable with a slow decrease about 60 ~ 72h.

CONCLUSION

Dynamic volume CT can reflect the hemodynamic changes of acute gouty arthritis in rabbit models. The peak of inflammation and newborn microvessels emerge between 32h ~ 48h, and after that time, the inflammation is in remission with decrease of the number of microvessels. The high perfusion area is consistent with the distribution of newborn microvessels.

CLINICAL RELEVANCE/APPLICATION

Dynamic-Volume CT can reflect the hemodynamic changes of acute gouty arthritis in rabbit models and the high perfusion area is consistent with the distribution of newborn microvessels.

SSQ13-03 The Role of US and Magnetic Resonance Imaging In Early Detection of Psoriatic Arthritis; Comparison With Radiographic and Clinical Findings

Thursday, Dec. 3 10:50AM - 11:00AM Location: E451A

Participants
Mohammed F. Amin, MBBCch, El-Minia, Egypt (Presenter) Nothing to Disclose

PURPOSE

To detect early spondyloarthropathy in patients with psoriasis using both ultrasonography and magnetic resonance imaging comparing those with conventional radiography (x-ray), and clinical assessment.

METHOD AND MATERIALS

This prospective study was carried out on 50 patients with skin or nail psoriasis, their age ranged between 17 and 75 years, with a mean of 44.8 ± 17.5 years, the duration of psoriasis ranged between 0.5 and 40 years with a mean of 8.7 ± 8.7 years. There were 29 males (58%) and 21 females (42%). Plain x-ray to both hands, wrists, feet, lumbar spine, and sacroiliac joint in different radiologic positions, - Ultrasonographic examination to the small joints of both hands and feet as well as sites of enthesopathy in the lower limbs and MRI: Lumbar spine and sacroiliac joint done to detect early changes.

RESULTS

Abnormal US findings involving at least one finger and/or toe were seen in 9/50 patients, while only 3 patients had one or more X-ray abnormalities. Thirty seven patients (74%) had GUESS ≥ 1 at a higher percentage than tenderness revealed by clinical examination (46%), while plain radiography showed abnormalities in only 13 (26%) patients. There was a statistically significant association between arthritis and clinical enthesis. Fourteen patients had inflammatory back pain (28%), Magnetic resonance imaging demonstrated evidence of inflammation in the spine in 21 (42%) patients and sacroiliitis in 2 (4%) patients. ct early changes.

CONCLUSION

US is a non invasive tool, proved to be useful early detection of synovial abnormalities in the fingers and toes of patients with suspected PsA. MRI provide valuable help in early detection of psoriatic arthritic changes of the spine and sacroiliac joints. The use of US and MRI offers the opportunity for early diagnosis and early appropriate treatment. The peak of inflammation and newborn microvessels emerge between 32h ~ 48h, and after that time, the inflammation is in remission with decrease of the number of microvessels. The high perfusion area is consistent with the distribution of newborn microvessels.

CLINICAL RELEVANCE/APPLICATION

US is a non invasive tool, proved to be useful early detection of synovial abnormalities in the fingers and toes of patients with suspected PsA. MRI provide valuable help in early detection of psoriatic arthritic changes of the spine and sacroiliac joints.

SSQ13-04 Styloid Process Elongation on Cervical Spine CT is Associated with Ankylosing Spondylitis but not with DISH

Thursday, Dec. 3 11:00AM - 11:10AM Location: E451A

Participants
Gal Yaniv, MD, PhD, Ramat Gan, Israel (Presenter) Nothing to Disclose
Salim Bader, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose
Natallia Leve Levi, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose
Gahl Greenberg, Tel Aviv, Israel (Abstract Co-Author) Nothing to Disclose
Oshri Mozes, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose
Merav Lidar, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose
Iris Eshed, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate if styloid process (SP) elongation, thought to occur due to enthesopathy, is associated with two common enthesesis-
related diseases: ankylosing spondylitis (AS) and diffuse idiopathic skeletal hyperostosis (DISH).

**METHOD AND MATERIALS**

Cervical spine CT examinations of patients with DISH (n=41, Resnick criteria), AS (n=23, NY criteria) and a control group of patients with no radiological signs of DISH or AS (n=54) were retrospectively evaluated. The DISH group was further divided into patients with/without cervical DISH. The length of right and left SP was measured independently by two readers on coronal- and sagittal-oblique reformats. The average right and left styloid length and average length per person were compared between the groups.

**RESULTS**

Patients’ demographic characteristics were similar between the DISH and control groups (average age: 68.2±15.7/69.2±12.7 years, M/F ratio: 24:17/ 35:19, respectively, p=0.05). AS group’s age was significantly lower (average age: 53±15 years, p<0.0001) and, composed mainly of men. Inter-reader reliability of SP measurements was excellent in all groups (ICC=0.998, p<0.0001). The AS group but not the DISH group had significantly (p<0.02) longer SP compared to the controls (AS: 38.8±9.6 mm, DISH: 34.9±9 mm, Control: 31.2±10.1 mm). SP length was not different between the two DISH groups (cervical DISH/non-cervical DISH: 35.1±9/34.8±9, p>0.05).

**CONCLUSION**

Compared to the controls, significant SP elongation is associated with AS but not with DISH patients. Our findings may be caused by different enthesisopathy-related pathophysiology.

**CLINICAL RELEVANCE/APPLICATION**

Clinical and radiographic differentiation between AS and DISH may be challenging. The present observation provides an additional differentiating tool to the radiologist's diagnostic armamentarium.

**SSQ13-05 Sacroiliac Joint Alterations on CT Examinations of the Lumbar Spine in Patients Younger than 40 years Old: Prevalence and Radiologists’ Awareness**

**Thursday, Dec. 3 11:10AM - 11:20AM Location: E451A**

**Participants**

Eyal Klang, Ramat Gan, Israel (Presenter) Nothing to Disclose
Merav Lidar, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose
Iris Eshed, Ramat Gan, Israel (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the prevalence and awareness of reading radiologists for the presence of structural post-inflammatory and other sacroiliac-joint (SIJ) pathologies on lumbar-spine CTs of young patients with low back pain (LBP).

**METHOD AND MATERIALS**

499 lumbar-spine CT examinations (8/2012 - 1/2014) of patients 18-40 years old with LBP were retrospectively reviewed. Exams in which the entire SIJs were not visualized were excluded. The SIJs were scored in consensus by a musculoskeletal radiologist and a senior radiologist (study reading) for the presence of structural SIJ findings suggesting the presence of inflammatory sacroiliitis (modified NY criteria). Other SIJs pathologies and anatomic variants were also recorded. The original readings for these exams (all by senior radiologists) were compared to the study reading. 100 CT examinations were re-evaluated for reliability assessment (Intra-class Correlation Coefficient, ICC).

**RESULTS**

484 CTs were included (M:F 272:212, average age: 31.6 years). A total of 150 (31%) SIJ alterations were registered [Grade 1-4 sacroilitis=66(13.6%); Grade 1=29(5.9%), Grade 2=21(4.3%), Grade 3=14(2.9%), Grade 4=2(0.4%), (ICC: r=0.6, P<0.0001); osteitiscondensans-ilii=38(7.8%), diffuse idiopathic skeletal hyperostosis=24(5%), degenerative changes=22(4.5%) and accessory SIJ=22(4.5%)]. The SIJs were referenced 39 times (8.0%) in the original readings; sacroiliitis:1, sclerotic changes:2, degenerative changes:12 and normal SIJ:24. Total diagnostic accuracy for these reports only and for the entire readings were 49%/69% respectively and 13%/1.3% respectively for the pathological findings.

**CONCLUSION**

Sacroilitis and other SIJ alterations are highly prevalent in individuals younger than 40 years of age with LBP, albeit, majority of these alterations are not recognized nor reported by senior radiologists thus delaying efficacious treatment in spondyloarthritis (SpA) patients.

**CLINICAL RELEVANCE/APPLICATION**

Increased awareness for SIJ alterations on lumbar spine CTs may allow for earlier diagnosis and therapy in young SpA patients leading to improved quality of life and deterring irreversible changes.

**SSQ13-06 Pixel-by-Pixel Arterial Spin Labeling Blood Flow Pattern Variation Analysis for Depiction of Rheumatoid Synovitis**

**Thursday, Dec. 3 11:20AM - 11:30AM Location: E451A**

**Participants**

Taro Sakashita, Sapporo, Japan (Presenter) Nothing to Disclose
Tamotsu Kamehima, MD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Sugimori, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Atsushi Noguchi, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Mitsuhito Kono, Obihiro, Japan (Abstract Co-Author) Nothing to Disclose
Tatsuya Atsumi, MD, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Minghui Tang, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To pixel-by-pixel analyze the blood flow pattern variation of the rheumatoid synovitis using arterial spin labeling technique.
To evaluate noninvasively hyperemia of inflamed synovial tissue (pannus) of rheumatoid arthritis (RA), the arterial spin labeling (ASL) blood flow pattern variation (BFPV) map, which is the post labeling delay (PLD) time-independent variation in relative blood flow pattern, is introduced. The purpose of this prospective study was to test the feasibility of the BFPV map to distinguish pannus from other tissues.

**METHOD AND MATERIALS**

Eight patients (7 women and 1 man) with RA of the wrist or finger joints participated in the study. Dynamic contrast-enhanced LAVA sequences for detecting the extent of pannus formation as gold standard and 3D pulsed continuous ASL (pCASL) sequences (repetition time/echo time 4397-4852/10.704 ms, slice thickness 4 mm, number of slices 36, labeling duration 1450 ms, PLD 1025,2025 ms) for quantitative assessment of tissue perfusion were applied at 3 T (GE MEDICAL SYSTEMS, DISCOVERY MR750w). Pixel-by-pixel temporal changes of relative blood flow per PLD time were calculated from pCASL perfusion images with two different PLD times and were imaged as BFPV map. BFPV values of the radial or ulnar artery, pannus, and surrounding tissue were measured and compared by the Tukey test. Color-coded BFPV maps for quantifying pannus volume were imaged by setting threshold values on the BFPV map. The independent t-test was used to analyze pannus volume between two groups of patients classified depending on whether or not pannus formation was detected on the dynamic images.

**RESULTS**

There was a statistically significant difference in the BFPV values between artery and pannus, pannus and surrounding tissue, and artery and surrounding tissue (p<0.001) because of the advantage of precise tissue characterization related to the blood flow pattern of the labeled arterial spins. The patients showing apparent pannus formation showed a significantly larger volume of pannus on the color-coded BFPV map than the patients showing no or limited pannus formation (p=0.023).

**CONCLUSION**

This approach may be capable of depicting the extent of the synovial disease quantitatively and noninvasively without the need to determine the appropriate PLD time to allow the label to reach the tissue of interest.

**CLINICAL RELEVANCE/APPLICATION**

Pixel-by-Pixel Arterial Spin Labeling Blood Flow Pattern Variation introduced in this study may be capable of evaluating the extent of the synovial disease quantitatively and noninvasively.

**PURPOSE**

To prospectively compare an Indocyanine Green (ICG)-enhanced fluorescence optical imaging (FOI) system and contrast-enhanced 3T MRI with a composite reference consisting of MRI, FOI and clinical examination for the detection of synovitis in the hands of patients with rheumatoid arthritis and the differentiation to healthy volunteers.

**METHOD AND MATERIALS**

20 Patients (90% female, mean age = 59.1) with moderate to severe rheumatoid arthritis and 13 healthy volunteers (60% female, mean age = 26) were clinically examined and scanned with FOI (mivenion GmbH, Germany) and 3T MRI (Philips, Netherlands). The degree of inflammation in the metacarpophalangeal, proximal and distal interphalangeal joints of both hands on FOI and MRI was graded objectively by three independent radiologists on a 4-point-ordinate scale (0: no inflammation, 1: mild, 2: moderate, 3: severe) according to the OMERACT RAMRIS score. Results were compared using a composite reference consisting of MRI, FOI and clinical examination.

**RESULTS**

Evaluating 2862 joints of 20 patients and 13 volunteers using a composite reference, FOI had a sensitivity of 51.5% and a specificity of 90.7%, MRI had a sensitivity of 77.4% and a specificity of 88.8% and clinical examination had a sensitivity of 42.7% and a specificity of 90.2% for the detection of synovitis.

**CONCLUSION**

The evaluated ICG enhanced FOI system showed limitations in the detection of synovitis in patients with RA.

**CLINICAL RELEVANCE/APPLICATION**

Despite its advantages of its minimal invasiveness, lower costs and easy operability the FOI system appears to be of limited value for the clinical routine.
Michael Hannon, Oakland, PA (Abstract Co-Author) Nothing to Disclose  
Tomoko Fujii, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose  
Robert Boudreau, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose  
Kent C. Kwoh, MD, Pittsburgh, PA (Abstract Co-Author) Advisory Panel, Pfizer Inc Data Safety Monitoring Board, Novartis AG

PURPOSE

To assess whether presence of inflammation measured as joint effusion and Hoffa-synovitis differs between normalweight, and overweight/obese persons that develop incident OA two years prior the diagnosis of radiographic OA and to assess whether risk of OA differs for men and women.

METHOD AND MATERIALS

We studied 355 knees drawn from the Osteoarthritis Initiative study that developed incident ROA. They were matched 1:1 by gender, age, and baseline Kellgren-Lawrence grade to a control knee. MR images were acquired at 3 T systems. MRIs were read for Hoffa- and effusion-synovitis at the visit two years prior to incidence defined as P-2. Subjects were classified as normal weight (BMI < 25), overweight (BMI ≥25 and <30) or obese (BMI ≥ 30) at OAi enrollment. Bivariate logistic regression was used to assess the risk of synovitis and effusion at P-2 in subjects (N = 225 cases) that developed radiographic OA comparing overweight and obese subjects to normal weight subjects as the reference. Conditional logistic regression (N = 218 matched pairs) was used to assess the risk of ROA for the interaction of synovitis at P-2 and BMI category stratified by gender.

RESULTS

For men and women combined, among those who developed ROA there was no increased risk of synovitis in the combined overweight/obese BMI subgroup but being overweight was associated with an increased risk of effusion (OR 2.21, CI 1.11, 4.43). The distribution for the different categories for women was 31.7%, 35.3% and 33.0%. Using overweight women without synovitis as the reference, obesity without synovitis was associated with a greater risk of OA (OR 2.87, CI 1.21,6.83) in women, as was being overweight with synovitis (OR 3.26, CI 1.39, 7.65). For men, these associations were not found. Table 1 gives a detailed overview of these results.

CONCLUSION

For those who would develop OA, an increased risk of effusion was observed for the combined overweight/obese group at P-2 but not for synovitis. In regard to interaction of BMI with synovitis, the presence of synovitis increases risk of OA in overweight women while obese women had an increased risk for ROA without synovitis.

CLINICAL RELEVANCE/APPLICATION

Presence of inflammation seems to play a role especially in overweight women whereas obese women have an increased risk for OA even in the absence of imaging markers of inflammation confirming that both mechanical load and inflammation play a role in OA incidence at least for women.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ali Guermazi, MD, PhD - 2012 Honored Educator

SSQ13-09 Ultrashort TE Evaluation of Osteochondral Junction Alterations in Early Osteoarthritis

Thursday, Dec 3 11:50AM - 12:00PM Location: E451A

Participants

James MacKay, MBCHIR, MRCP, Norwich, United Kingdom (Presenter) Nothing to Disclose  
Samantha B. Low, MBChB, Norwich, United Kingdom (Abstract Co-Author) Nothing to Disclose  
Andoni P. Toms, FRCR, PhD, Norwich, United Kingdom (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the characteristics of the osteochondral junction (OCJ) in individuals with possible early osteoarthritis (OA) compared with normal controls using ultrashort echo time (UTE) MR imaging. The OCJ has been implicated in the pathogenesis of OA.

METHOD AND MATERIALS

Ten healthy controls (group 1) and ten patients aged between 40-50 years old with possible early OA - group 2) underwent 3T MR imaging of the knee using a 2D UTE sequence. UTE has shown the ability to depict the normal OCJ as a high signal intensity (SI) linear structure. Qualitative grading of the UTE high SI line at the medial (MT) and lateral tibial (LT) plateau OCJ was performed (present/focally or diffusely absent). Quantitative analysis involved creating regions of interest (ROI) at the MT OCJ, LT OCJ and in the femoral metaphysis (background ROI). The peak OCJ SI ratio was calculated by measuring the peak SI across the OCJ ROIs using averaged craniocaudal SI profiling, then dividing by the mean SI of the background ROI to standardize between studies. MT and LT peak OCJ SI ratios were compared between groups using Mann-Whitney tests. Measurements were performed by two independent observers, with reliability assessed using the intraclass correlation coefficient (ICC).

RESULTS

A high SI line at the OCJ was visualized at the MT and LT of all group 1 subjects. This was focally or diffusely absent in 5/10 group 2 participants at the MT and 4/10 group 2 participants at the LT. There was a significant difference (p < 0.001) in MT peak OCJ SI ratio between group 1 (mean ±SD = 0.85 ±0.10) and group 2 (0.77 ±0.12). There was no significant difference (p = 0.19) in LT peak OCJ SI ratio between group 1 (0.81 ±0.23) and group 2 (0.80 ±0.13). The technique demonstrated substantial interobserver reliability, with ICC = 0.65 (95% CI 0.53-0.74).

CONCLUSION

...
Qualitative and significant quantitative differences in the UTE appearance of the MT OCJ were seen in individuals with possible OA compared with normal controls.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative UTE analysis has potential as a biomarker of early OA by detecting early pathological changes at the OCJ.
**SSQ14**

**Muscculoskeletal (Soft Tissue Tumor)**

Thursday, Dec. 3 10:30AM - 12:00PM Location: E451B

**PURPOSE**

Increasing workload for radiologists demands innovative solutions to preserve high quality of reports. Dual energy CT (DECT) provides contrast media mapping without a precontrast scan and allows high-contrast visualization of enhancing lesions. Goal of this study is to evaluate the potential of iodine maps (IM) from DECT to improve detection of melanoma metastases.

**METHOD AND MATERIALS**

75 DECT scans (thorax (T) and abdomen (A)) from 75 melanoma patients were retrospectively analyzed. For each patient 3 conventional image reconstructions (T: lung kernel (B70f very sharp) 1mm axial and soft tissue kernel (D20f smooth) 3 mm axial, A: soft tissue kernel (D20f smooth) 3 mm axial) were performed. With commercially available software, the spectral information from DECT data was used to generate IM in axial 3 mm slices (for lung parenchyma additional 1 mm slices). These maps are comparable to color coded CT images, but the displayed voxel values base exclusively on materials which the algorithm identifies as contrast media. To facilitate radiological assessment, an overlay of IM and conventional CT (cCT) was provided. A radiologist analyzed initially cCT and afterwards the IM. Number, localization and characterization of lesions detected additionally by assessing the IM were reported.

**RESULTS**

In 29 patients in total 44 lesions (17 metastases) were additionally detected on IM. All lesions could retrospectively be identified on cCT and were located in the liver (34%), inter- or intramuscular (23%), subcutaneous (9%), lung (7%), mesenterial (5%), intestinal (5%), mediastinal (5%), skeleton (4%), pancreas (2%), vagina (2%), supraclavicular (2%) and peritoneal (2%). Lung findings include 2 pulmonary emboli.

**CONCLUSION**

In view of increased workload powerful tools supporting a fast and accurate assessment of radiological images are essential. This study demonstrates that IM from DECT improve detection of metastases as well as relevant secondary findings like pulmonary emboli in staging examinations of melanoma patients. To the best of our knowledge, the potential of iodine maps for lesion detection in staging examinations has not been shown before.

**CLINICAL RELEVANCE/APPLICATION**

Increased workload bears the risk of impaired quality of CT reports. IM from DECT improve detection of metastases and relevant secondary findings without increasing radiation dose.

**SSQ14-02**

**Diagnostic Performance of Diffusion-weighted and Dynamic Contrast Enhanced (DCE) MR Images for Evaluating Soft-tissue Tumors**

Thursday, Dec. 3 10:40AM - 10:50AM Location: E451B

**PURPOSE**

To evaluate the diagnostic efficacy of diffusion-weighted (DW) and dynamic contrast enhanced (DCE) MR images for evaluating soft-tissue tumors.

**METHOD AND MATERIALS**

Between September 2012 and March 2015, 102 patients (57 female, 45 male, age range, 11-86 years; mean age, 47.7 years) who
had soft-tissue tumors performed MR examinations including DWI and DCE images. We investigated the size and signal intensities of the mass on conventional MR images. On DWI, we obtained the values of ADC (apparent diffusion coefficient) and evaluated the presence or absence of diffusion restriction visually. We obtained the values of Ktrans, kep, ve, and IAUC, and time-concentration curve (TCC) of 7 types on DCE images. These results were compared between benign and malignant lesions statistically.

RESULTS

Malignant lesions were 28 cases and benign 74. DWIs were not obtained adequately in 8 cases. For differentiating between benign and malignant lesions, the sex of patient, and the size and signal intensities of the mass were not significant. However, the age of patient and the margin of the mass were significant. On DWI, the values of minimum and mean ADC and the presence or absence of diffusion restriction visually were significant. On DCE MR images, the values of Ktrans, kep, IAUC and the types of TCC were significant.

CONCLUSION

For the differentiating benign and malignant soft-tissue lesions, added DWIs and DCE MR images were very effective and thus these quantitative evaluations might be necessary.

CLINICAL RELEVANCE/APPLICATION

There are many indistinct cases in the differentiation of benign from malignant lesions with only conventional MR images. In the future, the quantitative analyses by using functional MR images might be helpful for distinguishing between benign and malignant soft tissue lesions.

SSQ14-03 Does CT Imaging Have the Ability to Identify the Dedifferentiated Component (DDLPS) in a Retroperitoneal Well Differentiated Liposarcoma (WDLPS)?

Thursday, Dec. 3 10:50AM - 11:00AM Location: E451B

Participants
Jieqi Wang, BA, Houston, TX (Abstract Co-Author) Nothing to Disclose
Priya R. Bhosale, MD, Houston, TX (Presenter) Nothing to Disclose
Datla G. Varma, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Corey T. Jensen, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Tara L. Sagebiel, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Madhavi Patnana, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Chitra Viswanathan, MD, Houston, TX (Abstract Co-Author) Consultant, Hollister Incorporated
Neeta Somiah, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the CT imaging features which may predict the presence of a DDLPS component within a retroperitoneal WDLPS.

METHOD AND MATERIALS

49 treatment naive patients with WDLPS (12) or DDLPS (37) who underwent computed tomography (CT) were included in the study following approval of the institutional review board. Three Radiologists evaluated the studies independently in a blinded fashion on a diagnostic workstation for < or >25% fat, presence of a ground glass nodule (a nodule having an attenuation lower than adjacent psoas muscle and hazy internal architecture), enhancing nodule (higher attenuation than psoas muscle), necrotic nodule (enhancing nodule with central areas of low attenuation), capsule surrounding the mass, septations, calcification (popcorn, spiculated or curvilinear), and final diagnosis of WDLPS or DDLPS. Statistical analysis: Multivariate logistic regression model with generalized estimating equations (GEE) method was used to correlate imaging features with pathology. P-values of 0.05 or less were considered statistically significant. Kappa Statistics were performed to assess agreement of the 5 features by all the three radiologists.

RESULTS

The accuracy, sensitivity, specificity, positive predictive value and negative predictive values to diagnose the DDLPS in the WDLPS were 75.5%, 91.7%, 70.2%, 50.0% and 96.3%, 79.6%, 91.7%, 75.7%, 55.0% and 96.5% and 73.3%, 91.7%, 67.6%, 55.0% and 96.5% and 73.3%, 91.7%, 67.6%, 47.8% and 96.5% for reader 1, 2 and 3. All three readers showed almost perfect agreement in overall diagnosis based on Kappa statistics [95% confidence interval = 0.83 (0.63 to 0.99)]. The presence of an enhancing nodule was highly suggestive of DDLPS ( P < 0.02).

CONCLUSION

The presence of an enhancing nodule is highly specific for the diagnosis of DDLPS component in a retroperitoneal WDLPS.

CLINICAL RELEVANCE/APPLICATION

Imaging may help guide appropriate biopsy of the dedifferentiated component within a well differentiate liposarcoma which can further help streamline patient management.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Priya R. Bhosale, MD - 2012 Honored Educator

SSQ14-04 Value of US Imaging in the Diagnosis of Epidermal Cysts

Thursday, Dec. 3 11:00AM - 11:10AM Location: E451B

Participants
Vasiliki Perlepe, MD, Brussels, Belgium (Presenter) Nothing to Disclose
Nicolas Michoux, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
SSQ14-06

To evaluate the ultrasonographic appearance of subcutaneous soft-tissue tumors and pseudo-tumors with a focus on epidermal cysts.

METHOD AND MATERIALS
112 small subcutaneous nodules (mean maximum size: 9.7mm) with US imaging and pathologic correlation were included in this retrospective study. The histopathology revealed 7 ganglion cysts, 24 epidermal cysts, 10 pilomatricomas, 47 benign tumors (including 25 lipomas), 9 malignant tumors and 15 various lesions. One MSK radiologist with 20 years of experience analysed several US imaging features of the lesions: morphology, margins, size, echogenicity, Doppler signal, peripheral halo, focal intra-dermal penetration, relative skin thinning opposite to the mass, posterior acoustic enhancement, lateral shadows. ROC analysis was performed to evaluate the performance of individual parameters and that of a multi-parametric model using logistic regression in the specific identification of epidermal cysts.

RESULTS
Best imaging parameters were posterior acoustic enhancement (AUC = 0.87, Se = 100%, Sp = 65%), lateral shadows (AUC = 0.83, Se = 75%, Sp = 91%), Doppler signal=0 (AUC = 0.75, Se = 86%, Sp = 63%), well-defined margins (AUC = 0.74, Se = 96%, Sp = 27%), relative skin thinning (AUC = 0.71, Se = 100%, Sp = 35%) and focal intra-dermal penetration (AUC = 0.65, Se = 42%, Sp = 89%), showing a performance ranging from moderate to good. A multi-parametric model based on 4 parameters (posterior acoustic enhancement, well-circumscribed margins, lateral shadows and Doppler) allowed diagnosis of epidermal cysts with a very good performance (AUC = 0.96, Se = 91%, Sp = 94%).

CONCLUSION
A computer-aided decision based on a multi-parametric model of US imaging features of subcutaneous lesions allows diagnosis of epidermal cysts. Further tests on a larger cohort of patients are needed to confirm the performance of the present model.

CLINICAL RELEVANCE/APPLICATION
Ultrasound is a reliable imaging technique for the diagnosis of epidermal cysts.

SSQ14-05

Indeterminate Soft Tissue Tumors: How Good is Noncontrast Imaging with Quantitative DWI at Distinguishing Benign from Malignant Disease Compared with Contrast-enhanced Imaging?

Thursday, Dec. 3 11:10AM - 11:20AM Location: E451B

Participants
Filippo Del Grande, MD, MBA, Baltimore, MD (Presenter) Nothing to Disclose
Shivani Ahlawat, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the added value of contrast enhanced sequences (static [CE] and dynamic [DCE]) to noncontrast imaging (T1, fluid-sensitive and quantitative diffusion weighted imaging [DWI] with apparent diffusion coefficient [ADC] mapping) for distinguishing benign and malignant soft tissue tumors (STTs).

METHOD AND MATERIALS
Forty-three patients with indeterminate STTs referred for biopsy underwent 3T MRI with conventional noncontrast (T1-weighted, fluid-sensitive), DWI (b-values 50, 400, 800 with ADC mapping), and post-contrast imaging (DCE at 7 second time resolution, delayed static CE). Two readers independently reviewed imaging in 4 sessions (conventional noncontrast alone, conventional + DWI/ADC maps, conventional + DWI/ADC maps + CE images, conventional + DWI/ADC maps + CE + DCE all together). Readers recorded the likelihood of malignancy by a 5 point scale (definitely benign, probably benign, possibly malignant, probably malignant, definitely malignant) at each session; interobserver variability (weighted kappa (k)) and accuracy (ROC analysis) were calculated.

RESULTS
Of 43 indeterminate STTs, 31 were benign and 12 were malignant. The accuracy for distinguishing benign and malignant disease (ROC analysis in Figure 1) was highest with the addition of DCE (area under curve (AUC) 0.87 for both readers), although noncontrast imaging (conventional and quantitative DWI) performed similarly to imaging with the addition of static CE sequences (AUC 0.82-0.78 and 0.82-0.81 for 2 readers respectively). Inter-observer agreement was highest with contrast (k 0.83(CE) and 0.82(DCE)), but was lower for non-contrast conventional without (k 0.55) or with DWI (k 0.66).

CONCLUSION
The addition of DCE sequences increases the diagnostic performance of MRI to distinguish benign and malignant STTs. Although non-contrast sequences alone (conventional and DWI) offer diagnostic performance similar to conventional sequences with static CE, their inter-reader reliability is lower.

CLINICAL RELEVANCE/APPLICATION
Non-contrast imaging with DWI offers reasonable diagnostic performance for characterizing STTs for malignancy, if intravenous contrast is administered, DCE is likely more valuable than static CE imaging.

SSQ14-06

Exploring the Value of Fiber Tractography Used for Describing Relations of Soft Tissue Tumors and the Peritumoral Muscle

Thursday, Dec. 3 11:20AM - 11:30AM Location: E451B
Purpose

To study value of the diffusion tensor imaging, fiber tracer Tractography (FT) on soft tissue tumors and relationship of the tumor around muscle on 3.0 T MRI.

Method and Materials

1. General Information: Collected 30 patients with soft tissue mass during the period of from June 2014 to March 2014 in our hospital. 16 cases of men in, 14 cases of women. All will be divided into three groups: 12 cases in intermuscular malignant tumor group; 12 cases in intermuscular benign tumor group; And 6 cases in intramuscular tumor group. 2. Observe indicator: According to the FT reconstruction image form and FS-T2WI signal changed muscle into four types. Type I: peritumoral muscles appear only displacement change, muscle fiber continuous, muscle FS-T2WI signal has no exception. Type II: peritumoral muscle appear edema or inflammatory change, FS-T2WI sequences signal increased, muscle fiber bundle is still continuous. Type III: Tumor invasive peritumoral muscle fibers, but a certain number of fiber bundles can still imaging, FS-T2WI sequence signal unevenly increased. Type IV: Tumor will destroyed peritumoral muscle, muscle fiber bundle interruption. 3. Statistical methods: Muscle outside benign group and malignant group, within muscle tumor group FT reconstruction type composition differences result using the Fisher’s exact probability method test.

Results

83.33% of intermuscular benign tumor group tumor showed the type I; 41.67% of intermuscular malignant tumor group showed type III, 25% of intermuscular malignant tumor group showed type IV; 100% intramuscular tumor group showed type IV, difference had statistical significance (P = 0.00).

Conclusion

FT reconstructions can reflect tumor growth way, intuitive shows the degree of muscle fiber infringement, outside benign and malignant peritumoral muscle with different kinds of FT reconstruction, within the intramuscular tumor peritumoral muscle FT reconstruction showed type IV.

Clinical Relevance/Application

FT reconstructions can reflect tumor growth way, intuitive shows the degree of muscle fiber infringement, outside benign and malignant peritumoral muscle with different kinds of FT reconstruction, within the intramuscular tumor peritumoral muscle FT reconstruction showed type IV.

SSQ14-08 Detection of Soft Tissue Sarcoma Recurrence: Use of Additive Qualitative and Quantitative Diffusion-weighted MR Imaging to Standard MR Imaging at 3.0 T
To retrospectively determine the added value of diffusion-weighted imaging (DWI) to standard magnetic resonance imaging (MRI) to detect recurrent soft tissue sarcoma after surgical resection at 3.0 T.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and informed consent was waived. From June 2009 through April 2014, 30 patients without residual tumor referred for postoperative surveillance of soft tissue sarcoma underwent 3T MRI including DWI. Two independent musculoskeletal radiologists first scored standard MRI. Then, they assessed a combination of standard MRI and qualitative and quantitative DWI. Interobserver agreement for apparent diffusion coefficient (ADC) measurement in recurrent soft tissue sarcoma was assessed using intraclass correlation coefficient (ICC). The receiver operating characteristic (ROC) curve with areas under the curve (AUC) was obtained for diagnostic performance.

RESULTS

There were 13 histologically proved recurrent soft tissue sarcomas in nine patients. In qualitative analysis of DWI, all recurrent soft tissue sarcoma revealed hyperintensity relative to skeletal muscle. In quantitative analysis of recurrent soft tissue sarcoma, median ADCs of two readers were 1025 (774-1092) μm²/sec and 996 (801-1126) μm²/sec, respectively, showing excellent interobserver agreement (ICC = 0.900). Sensitivity, specificity and accuracy of each reader were 69%, 81%, and 77%; 92%, 57%, and 71% on standard MRI alone, whereas 100%, 95%, and 97%; 92%, 95%, and 94% on standard MRI combined DWI, respectively. AUCs of a combination of standard MRI and DWI were higher than those of standard MRI alone: 0.824 vs 0.969 (P = .029), and 0.866 vs 0.958 (P = .127) for each reader, respectively.

CONCLUSION

The addition of DWI to standard MRI improves the detection of recurrent soft tissue sarcoma at 3.0 T.

CLINICAL RELEVANCE/APPLICATION

DWI should be added to standard MRI protocols to help detect the recurrent soft tissue sarcoma.
A T1-weighted 3D volumetric sequence is a fast alternative to spin echo imaging for 3-plane anatomic post-contrast imaging, and can be coupled with subtraction imaging for greater lesion conspicuity in the detection of recurrent tumors.
MK368-SD-THA1
Characterization of Deposits in Patients With Calcific Tendinopathy of the Supraspinatus. Role of Phytate and Osteopontin

Station #1

Participants
Mark R. Robbin, MD, Cleveland Hts, OH (Moderator) Nothing to Disclose

Sub-Events

PURPOSE
Calcific tendinopathy of the tendons of the rotator cuff is common in adults. These calcifications tend to be reabsorbed after a period of acute pain. This study evaluated the morphologic characteristics of calcific deposits and the participation of phytate and osteopontin (OPN) in their development.

METHOD AND MATERIALS
Calcific deposits were removed from 21 patients with calcific tendinopathy by ultrasound-guided needle puncture under local anesthesia. The removed deposits were evaluated by scanning electron microscopy, X-ray diffraction and Fourier transform infrared spectroscopy. The amounts of calcium and phosphorus in the deposits were semi-quantitatively determined by energy dispersive X-ray analysis. Phytate was determined in 2 h urine samples, and OPN was extracted from a pool of deposits.

RESULTS
The calcific deposits consisted of amorphous and poorly crystalline carbonated hydroxyapatite containing molecular water and organic matter. OPN was associated with the hydroxyapatite deposits. Phytate concentrations were significantly lower in the urine of patients with calcific tendinopathy than in healthy controls. The deficit in crystallization inhibitors such as phytate, and the presence of regulators such as OPN, may play important roles in the development of calcific tendinopathy.

CONCLUSION
A deficit in crystallization inhibitors, such as phytate, and the presence of potent regulators such as osteopontin, may be important in the development of calcific tendinopathy.

CLINICAL RELEVANCE/APPLICATION
This study was designed to evaluate the morphological characteristics of deposits that develop during calcific tendinopathy (CT) and to determine whether crystallization inhibitors such as phytate and protein regulators such as osteopontin participate in the pathogenesis of CT. Administration of phytate as a natural salt in amounts similar to those in the Mediterranean diet (1-2 g phytate/day) did not have any negative effect. Since the development of pathological calcification is a multifactorial process, alterations in only one factor, such as crystallization inhibitors, are generally insufficient to produce calcifications.

MK343-SD-THA2
Accuracy of Identification of Anterior Cruciate Ligament Attachments on MRI for Virtual Arthroscopy

Station #2

Participants
Yeli Pi, Edmonton, AB (Presenter) Nothing to Disclose
Catherine Hui, MD, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Myles Mabee, BEng, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
 Vimansha G. Swami, MD, BSc, Toronto, ON (Abstract Co-Author) Nothing to Disclose
June Cheng-Baron, PhD, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Jacob L. Jaremko, MD, PhD, Edmonton, AB (Abstract Co-Author) Nothing to Disclose

PURPOSE
Anatomic anterior cruciate ligament reconstruction (ACL) is currently considered the gold standard treatment for ACL injuries, aiming to restore the biomechanics of the knee joint in order to improve patient outcomes and prevent clinical sequelae. However, the optimal placement of femoral and tibial tunnels at the center of native insertion sites can be difficult to determine intraoperatively. We developed a “virtual arthroscopy” tool that utilizes preoperative MRI to generate 3D models that help guide tunnel positioning. We tested the validity of ACL attachment sites located with the model, and determined the accuracy of arthroscopic ACLR guided by our program.

METHOD AND MATERIALS
Sixteen adult cadaver knees with intact ACLs were pre-scanned using routine MRI sequences, which were loaded into our MATLAB-based program. A blinded observer identified the ACL footprints on coronal, sagittal, axial views, along with bony contours of the...
femur and tibia. Eight knees were opened by an orthopedic surgeon, who marked the center of each attachment site with a screw. In the remaining 8 knees, arthroscopic tunnels were drilled at locations determined from our MRI model. Post-procedural MRI was done on all 16 knees and the attachment sites (now defined by margins of screws or tunnels) were again identified. The 3D distances between pre and postoperative centers of ACL footprints were calculated.

RESULTS
In specimens that underwent an open arthrotomy, the 3D center of the surgically identified femoral and tibial ACL attachments differed by 2.5±0.9mm (mean±SD) and 3.4±1.2mm from attachments identified on preoperative MRI. When MRI landmarks were used to guide arthroscopic ACLR, postoperative femoral and tibial tunnel centers differed by 4.3±2.4mm and 3.1±0.7mm from the preoperative landmarks. When a single outlier was removed, the femoral tunnel center mean dropped to 3.5±1.3mm.

CONCLUSION
MRI "virtual arthroscopy" models reliably locate native ACL attachment sites within approximately 5 mm of surgically identified attachments. ACLR tunnels can be placed at these locations under MRI guidance with similar precision. With further refinement, these models may prove to be a practical and effective tool to assist surgeons performing ACLR.

CLINICAL RELEVANCE/APPLICATION
An MRI-based virtual arthroscopy tool can reliably identify ACL attachments, encouraging future integration into preoperative planning and intraoperative assistance in arthroscopic ACL reconstruction.

MK370-SD-THA3 Optimization of the Time of Spin Lock for the T1rho Relaxation Time in Lumbar Intervertebral Discs

Participants
Rui Imamura, Sapporo, Japan (Presenter) Nothing to Disclose
Hiroyuki Takashima, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Hiroki Shishido, RT, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Yoshihiro Akatsuka, RT, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Masamitsu Hatakenaka, MD, PhD, Sapporo, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation

PURPOSE
The aim of this prospective study was to evaluate the effects of numbers and patterns of the time of spin lock (TSL) on the T1rho relaxation time in the intervertebral discs.

METHOD AND MATERIALS
The lumbar intervertebral discs of 30 volunteers (22 males, 8 females; age range, 23-57 years) were evaluated by 3.0T MRI (Ingenia, Philips Healthcare). The degree of disc degeneration was assessed in the midsagittal section on T2-weighted images according to the Pfirrmann classification (grades I-V). The T1rho relaxation time calculated using all data (TSL = 1, 5, 10, 20, 40, 60, 80, and 100 ms) was defined as the standard value. We compared the standard value with calculated T1rho relaxation times using undersampling data (nine sampling patterns). The differences between these T1rho relaxation times were then evaluated using Pearson's product-moment correlation coefficients.

RESULTS
According to the T2-weighted image-based Pfirrmann grade classification, grade I consisted of 45 discs, grade II consisted of 66 discs, grade III consisted of 126 discs, and grade IV consisted of 63 discs. A strong correlation was found between the standard value and the calculated T1rho relaxation time using TSLs of 1, 5, 10, 20, and 80 ms (r = 0.96, p < 0.01). However, the three-TSL (1, 20, and 60 ms) pattern showed a poor correlation with the standard value (r = 0.47).

CONCLUSION
To accurately assess the T1rho relaxation time, it is necessary to include a short TSL (< 20 ms) and at least five or more TSLs.

CLINICAL RELEVANCE/APPLICATION
With optimized TSL sampling, it is possible to more accurately assess the T1rho relaxation time in degenerated intervertebral discs.

MK37I-SD-THA4 Rotator Cuff Tear Shape Characterization: A Comparison of 2D Imaging and 3D MR Reconstructions

Participants
Soterios Gyftopoulos, MD, New York, NY (Presenter) Nothing to Disclose
Luis S. Beltran, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Kevin P. Gibbs, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Philip M. Berman, BA, New York, NY (Abstract Co-Author) Nothing to Disclose
James S. Babb, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Robert Meislin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To see if 3D MR imaging could improve our understanding of rotator cuff tendon tear shapes. We believed that 3D MR imaging would be more accurate than current 2D MR imaging for classifying tear shapes.

METHOD AND MATERIALS
We performed a retrospective review of MR examinations of patients with arthroscopically proven full thickness rotator cuff tears. Two orthopaedic surgeons reviewed the information for each case, including scope images, and characterized the shape of the cuff tear into: crescent, longitudinal, U/L shaped longitudinal, and massive type. Two musculoskeletal radiologists reviewed the
corresponding MRIs independently and blind to the arthroscopic findings, and characterized the shape based on the tear's retraction and size using 2D MRI. 3D reconstructions of each rotator cuff tear were then reviewed by each radiologist, blindly and independently, to characterize the shape. The 3D reconstructions were created through manual segmentation using post-processing software. The average time for creation of each reconstruction was 2-3 minutes. Statistical analysis included 95% confidence intervals and intra-class correlation coefficients.

RESULTS
34 patients were reviewed. The accuracy for differentiating between crescent shaped, longitudinal, and massive tears using 2D MRI for reader #1 was 70.6% and 67.6% for reader #2. The accuracy for tear shape characterization into crescent and longitudinal U or L shaped using 3D MRI for reader #1 was 97.1% and 82.4% for reader #2. When further characterizing the longitudinal tears as massive or not, both readers had an accuracy of 76.9% (10/13). The overall accuracy of the 3D MRI reconstructions, including both readers, was 82.4% (56/68), significantly different (p=0.021) from 2D MRI accuracy (64.7%).

CONCLUSION
Our study has demonstrated that 3D MR reconstructions of the rotator cuff improve the accuracy of characterizing rotator cuff tear shapes compared to current 2D MRI based techniques.

CLINICAL RELEVANCE/APPLICATION
The findings in our study suggest that 3D imaging of the rotator cuff may serve as an important tool in the future for better characterizing and understanding rotator cuff tears, and providing important information for surgical planning.

MK372-SD-THA5  Primary OsteoArthritis of the Hip in Young People: Benefits of Ultrasound Guided Injection of PRP vs Hyaluronic Acid

Station #5

Participants
Andrea Mancini, MD, L'Aquila, Italy (Presenter) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Arrigoni, Coppito, Italy (Abstract Co-Author) Nothing to Disclose
Silvia Mariani, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To propose an effective treatment in young people with premature primary osteoarthritis of the hip.

METHOD AND MATERIALS
From January 2013 to January 2015, we enrolled 45 patients (25 M, 20 F), with symptomatic monolateral OA of the hip; 25 treated with PRP (group 1) and 20 treated with HA (group 2). Inclusion criteria were: age between 30-45 (avg 38.6); grade 1 or 2 of an adapted scale of Kallgren and Lawrence; grade 1-3, according the gradations of severity in an MRI scale; Visual Analogic Scale 7-10 (group 1 = avg 8.3, group 2 = avg 8.1); Harris Hip Score 60-70 (group 1 = avg 62, group 2 = avg 66). We excluded patients with secondary OA (for example post-traumatic or immunologic disorders related). In both groups we started our treatment with an intrarticular steroids injection; after 2 weeks we performed three injection of PRP or of HA at the distance of 2 weeks from each other. We performed an MRI 6 months after the last PRP or HA treatment.

RESULTS
Benefits were evauted after 6 months in terms of: Group 1: pain relief with VAS = improved of 75.9% (VAS 1-3 avg 2.0); HHS = improved of 41.61% (HHS 75-95 avg 87.8); MR findings = we obtained an improvement in : synovitis (25 out of 25), subcondral signal of femoral head (18 of 25) , T2WI of the articular cartilage (14 out of 25). Group 2: pain relief with VAS = improved of 70.37% (VAS 1-3 avg 2.4); HHS = improved of 21.21 % (HHS 75-95 avg 80); MR findings = we obtained an improvement in : synovitis (20 out of 20), subcondral signal of femoral head (10 out of 25) , T2WI of the articular cartilage (2 out of 20).

CONCLUSION
Our study showed that the US-guided intra-articular injection of PRP is a good solution for primary OA of the hip, especially for young people in comparison with HA treatment.

CLINICAL RELEVANCE/APPLICATION
Our study is very important in order to offer a minimally invasive and effective treatment in young patients with painful osteoarthritis of the hip.

MK373-SD-THA6  Comparison of Conventional MR Findings and ADC Values in Differential Diagnosis of Benign and Malignant Soft Tissue Tumors

Station #6

Participants
Young Cheol Yoon, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yoonah Song, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yousun Chong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the diagnostic performance of conventional MR findings and ADC values for differentiating benign and malignant soft tissue tumors.

METHOD AND MATERIALS
123 patients (90 male and 33 female; 73 of myxoid and 50 non-myxoid) were included in the study. The MR imaging was performed using a 1.5 Tesla unit with standard protocols. ADC maps were created using a diffusivity measurement technique.
123 patients (70 malignant and 53 benign STTs; 72 of myxoid and 51 non-myxoid) who underwent pre-operative MR including ADC maps were enrolled. Two MSK radiologists analyzed conventional MR findings by a consensus: maximum diameter, deep compartment involvement, central necrosis, signal heterogeneity in T1W image. These two readers measured mean and minimum ADC values of STTs independently. Statistical analyses were done; to evaluate the difference of frequency of each parameter; to determine the cut-off values of ADC values and maximum diameter for calculating sensitivity/specificity/accuracy/AUC; to calculate the OR; to compare the size of AUC of each parameter. The same analyses were performed in subgroup of non-myxoid STTs.

RESULTS

There were significant differences of frequency of conventional MR findings and mean and minimum ADC values except deep compartment involvement between benign and malignant STTs. The order of AUC and OR was maximum diameter (AUC/OR, 0.73/9.29; cut-off value of 31.5 mm), min ADC (AUC/OR, 0.70/5.68; cut-off value of 805.4 mm²/sec), mean ADC (AUC/OR, 0.68/4.33; cut-off value of 1348.15 mm²/sec), T1 heterogeneity (AUC/OR, 0.65/3.58), and central necrosis (AUC/OR, 0.59/5.36). The AUC of maximum diameter was significantly larger than that of central necrosis (p=0.0140). Regarding the subgroup analysis of non-myxoid STTs, mean ADC, min ADC, and T1 heterogeneity showed significant differences between benign and malignant STTs. The order of AUC and OR was mean ADC (AUC/OR, 0.83/21.25; cut-off value of 1132.45 mm²/sec), min ADC (AUC/OR, 0.78/10.51; cut-off value of 630.75 mm²/sec) and T1 heterogeneity (AUC/OR, 0.63/4.38). The AUC of mean ADC was larger than that of T1 heterogeneity (p=0.0470). There were no significant differences of AUC between mean ADC and min ADC.

CONCLUSION

Conventional imaging findings including maximum diameter, signal heterogeneity on T1W image, presence of central necrosis, and ADC values were useful to differentiate benign and malignant STTs. ADC values and signal heterogeneity on T1W image were much powerful tools to differentiate benign and malignant non-myxoid STTs.

CLINICAL RELEVANCE/APPLICATION

ADC values of DW images are much helpful parameters in differentiation of non-myxoid benign and malignant soft tissue tumors.
TEACHING POINTS
- To recognize characteristic imaging findings of the normal degenerative changes of the spine.
- To describe a systemized approach for evaluating spinal column degenerative disease (SCDD).
- To identify appropriate uses of imaging methods for evaluating SCDD.
- To list the essential imaging features of the main degenerative spinal changes.
- To keep in mind the major differential diagnosis of SCDD.

TABLE OF CONTENTS/OUTLINE
PURPOSE
To prospectively evaluate the ability of dual-energy computed tomography, compared with magnetic resonance imaging, to identify vertebral compression fractures in acute trauma patients.

METHOD AND MATERIALS
This institutional review board-approved study included 23 consecutive patients with 32 vertebral fractures who underwent both dual-energy computed tomography and magnetic resonance imaging of the spine between February 2014 and September 2014. A total of 209 vertebrae were evaluated for the presence of abnormal bone marrow attenuation on dual-energy computed tomography and signal on magnetic resonance imaging by five experienced radiologists. The specificity, sensitivity, predictive values, and intra- and inter-observer agreements were calculated.

RESULTS
MRI revealed a total of 47 vertebrae (22.4% of all vertebrae) and dual-energy computed tomography revealed 44 vertebrae (21% of all vertebrae) with edema. Using MRI as the reference standard, dual-energy computed tomography had a sensitivity, specificity, positive predictive value, negative predictive value and accuracy for the detection of vertebral edema 89.3%, 98.7%, 95.4%, 96.9%, and 96.6 %, respectively. With respect to establishing the presence of edema, the inter-observer agreement was almost perfect (k = 0.82), and the intra-observer agreement was substantial (k = 0.80).

CONCLUSION
Compared with magnetic resonance imaging, dual-energy computed tomography can provide an accurate demonstration of acute vertebral fractures and can be used as an alternative imaging modality for the assessment of vertebra fractures in patients with contraindications for magnetic resonance imaging.

CLINICAL RELEVANCE/APPLICATION
DSCT scanning can be used routinely in the clinic as an alternative imaging modality for the assessment of vertebral fractures in patients with contraindications for MRI.

PURPOSE
This study aims to evaluate whether an ultra low dose CT scan (ULD-CT) is sufficient to detect, diagnose, and guide treatment for various fracture types as compared to conventional CT imaging (C-CT).

METHOD AND MATERIALS
An ULD-CT protocol was developed as a quality improvement/patient safety measure at our academic medical center. This protocol was applied to 50 consecutive patients. A representative sample of cases were extracted and compared to cases matched for injury, age and sex in a cohort of patients who had undergone C-CT scanning previously. Estimated effective dose was calculated.
for all ULD-CT and C-CT scans chosen comprising 32 total studies of the extremities. Images from each study were selected, de-identified, and grouped into one set that was reviewed by nine fellowship trained orthopaedic traumatologists and 1 chief orthopaedic resident, from 5 academic level I trauma centers. The set of images consisted of a series of key cuts of 8 different fracture types in 5 anatomic locations (5 foot, 3 knee, 3 ankle, 3 elbow, and 2 hip fracture). Each evaluator individually reviewed the image set two times at a minimum of 4 weeks apart, to allow for adequate washout. Outcome measures included correct diagnosis, management plan, weight bearing status (WBS) and adequacy of image quality.

RESULTS

Mean estimated effective dose (ED) for ULD-CT vs. C-CT was 0.03 mSv vs. 0.43 mSv (p<0.05). The Sn, Sp, PPV, and NPV of ULD-CT to detect all fractures was 0.86, 0.80, 0.98, and 0.36, but increased to 0.98, 0.80, 0.98, and 0.80 with occult fractures excluded. Interobserver and intraobserver reliability for diagnosis utilizing ULD-CT (κ=0.75, κ=0.67) yielded substantial agreement among observers, similar to C-CT (κ=0.85, κ=0.82). Interobserver agreement for treatment, treatment modality, WBS, and study quality utilizing ULD-CT was moderate to near perfect (κ=0.67, κ=0.67, κ=0.56, κ=0.81) versus C-CT (κ=0.84, κ=0.84, κ=0.78, κ=0.86).

CONCLUSION

A mean estimated ED of .03 mSv was achieved with ULD-CT, a 14x reduction as compared to C-CT. Reliability statistics between ULD-CT and C-CT were comparable across images indicating that ULD-CT could be readily interpreted by orthopaedic traumatologists.

CLINICAL RELEVANCE/APPLICATION

This ULD-CT protocol appears to provide for high fidelity images in appropriately selected patients. Dose reduction strategies as demonstrated here may help to address public concerns over radiation exposure.

MK376-SD-THB3 Minimizing Radiation Exposure, Healthcare Costs, and Wait Times without Missing Fractures: The Ottawa Ankle Rules in the Pediatric Population

Station #3

Participants
Amy L. Ellenbogen, MD, Washington, DC (Presenter) Nothing to Disclose
Pranav K. Vyas, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose

PURPOSE

We hope to contribute to the existing literature on the accuracy of the Ottawa Ankle Rules (OAR) in the pediatric population in order to minimize unnecessary radiation exposure as well as decrease healthcare costs and Emergency Room wait times. Our study differs from previous literature in that it is retrospective in nature and has a larger sample size than previous studies but lacks the disadvantages inherent in a meta-analysis.

METHOD AND MATERIALS

We conducted a retrospective chart review consisting of children with the ability to walk through eighteen years of age. We first used a radiology search engine to find all ankle X-rays obtained at our institution’s Emergency Room and that of an associated institution between 1/1/2011 and 4/30/2014. We recorded whether a fracture was identified on the X-ray read and if so, what type of fracture. If the read was indeterminate, the subject was excluded. We then used our hospital’s electronic medical record to access the Emergency Room provider’s note to determine whether the patient met criteria for X-ray based on the Ottawa Ankle Rules and if so, which criteria were met. The subject was excluded if the provider did not document sufficient exam data to determine whether criteria were met. Patients with underlying diseases that could predispose them to fracture were excluded.

RESULTS

A total of 1050 subjects met inclusion criteria. The mean age was 11.6 years with ages ranging from fourteen months to eighteen years. One hundred and thirteen fractures were identified (11%), seventy-eight of which were significant. Sensitivity was 63%, specificity 82%, positive predictive value 25%, and negative predictive value 94%.

CONCLUSION

Our results show a lower sensitivity and higher specificity than previous studies on the Ottawa Ankle Rules (OAR) in the pediatric population. Our study differs in that we have a larger sample size than previous studies. We conducted a retrospective study, whereas most of the previously published literature is prospective, however we were careful to exclude all subjects where documentation was insufficient to determine whether the patient met the OAR.

CLINICAL RELEVANCE/APPLICATION

Our study aims to reduce unnecessary radiation exposure in children, decrease healthcare costs, and possibly decrease wait times in pediatric Emergency Rooms.

MK377-SD-THB4 Total Elbow Arthroplasty: A Radiographic Outcome Study

Station #4

Participants
Xue S. Bai, MD, Seattle, WA (Presenter) Nothing to Disclose
Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (Abstract Co-Author) Consultant, Medical Metrics, Inc
Alice S. Ha, MD, Seattle, WA (Abstract Co-Author) Grant, General Electric Company

PURPOSE

Total elbow arthroplasty (TEA) is becoming a more popular alternative to arthrodesis for patients with end-stage elbow arthrosis in an attempt to decrease pain and restore function of the elbow joint. Prior outcome studies have primarily focused on surgical findings. Our purpose is to determine the radiographic outcome of TEA and to correlate it with clinical outcome.

METHOD AND MATERIALS
In a 10-year retrospective review of patients with TEA (semiconstrained type), all available elbow radiographs and clinical data were reviewed. Data analysis included descriptive statistics, Fischer's exact test, and Kaplan-Meier survival curves for radiographic and clinical survival.

RESULTS

59 total elbow arthroplasties in 55 patients were reviewed. 74% were in women, and the mean patient age was 62.4 years. Mean radiographic follow-up was 1.9 years with an average of 3.3 radiographs per patient. 40 patients (67%) developed one or more radiographic complications, including periprosthetic lucency (44%), periarticular lucency (43%), osteosynthesis failure (24%), subluxation/dislocation (18%), and brushing wear down/particle disease (10%). 17 patients (31%) developed significant pain and 18 patients (33%) underwent at least one reoperation. In patients with radiographic complications, 49% of them had significant pain compared with 13% without radiographic complication, which was statistically significant (p = 0.008). Of the patients with radiographic complications, 37% had to undergo at least 1 revision surgery compared to 25% without radiographic complication, not statistically significant (p=0.2555).

CONCLUSION

Radiographic complications are common after total elbow arthroplasty. There is a strong positive correlation between postoperative radiographic findings and clinical outcome.

CLINICAL RELEVANCE/APPLICATION

Total elbow arthroplasty is becoming a popular option for patients with end stage arthrosis. Therefore, knowledge of common postoperative radiographic findings and the clinical significance of those findings are important for the radiologist.

MK378-SD-THB5

Loaded versus Unloaded Magnetic Resonance Imaging (MRI) of the Knee: Effect on Meniscus Extrusion in Healthy Volunteers and Patients with Osteoarthritis

Participants

Rina Patel, MD, San Francisco, CA (Presenter) Nothing to Disclose
Daria Motamedi, MD, Washington DC, DC (Abstract Co-Author) Nothing to Disclose
Matthew Elgyroth, MD, San Bruno, CA (Abstract Co-Author) Nothing to Disclose
Richard B. Souza, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Sharmila Majumdar, PhD, San Francisco, CA (Abstract Co-Author) Research Grant, General Electric Company
Thomas M. Link, MD, PhD, San Francisco, CA (Abstract Co-Author) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

PURPOSE

The purpose of this study was to assess the impact of axial knee joint loading on meniscal extrusion in normal individuals and those with varying degrees of osteoarthritic (OA).

METHOD AND MATERIALS

157 healthy volunteers and patients with OA underwent 3 Tesla MRI of the knee under unloaded and loaded conditions. Loaded MRI was performed with an axial loading device at 50% body weight. Meniscal extrusion was defined as the distance from the peripheral margin of the medial tibial plateau to the peripheral margin of the meniscus, measured on the coronal sequence at the mid-point of the femoral condyle. Kellgren-Lawrence (KL) grading system was used to grade OA. The mean and standard deviation of the difference were calculated. Statistical analysis with a paired T-test was performed for each KL group. Statistical significance was defined for all calculations as p<0.05.

RESULTS

The cohort included 97 women and 60 men with an average age of 53 years +/- 10 years (range 35 to 73 years). Kellgren-Lawrence grade distribution was as follows: 60 with grade 0, 50 with grade 1, 26 with grade 2, 18 with grade 3, and 3 with grade 4. Differences in medial meniscal extrusion between loading and unloading were significant in the entire cohort (p<0.05). Medial meniscal extrusion significantly increased with the KL grade and differences became more significant during loading (p<0.05). Differences in medial meniscal extrusion between loading and unloading were highest in the KL2 and 4 groups. Interestingly, no significant differences in extrusion were found for the lateral meniscus (p>0.05).

CONCLUSION

Prior studies have suggested that meniscal extrusion or altered meniscal function may precede osteoarthritic progression. Our study demonstrated that medial meniscal extrusion significantly increased during loading and with KL grade; differences between KL grades were most significant during loading. Interestingly, at the lateral meniscus no such relationship was found.

CLINICAL RELEVANCE/APPLICATION

Our study shows that loaded MRI may more accurately determine the extent of medial meniscal extrusion in particular in those with mild OA.

MK379-SD-THB6

Does CT Imaging have the Ability to Identify the Dedifferentiated Component (DDLPS) in a Retroperitoneal Well Differentiated Liposarcoma (WDLPS)?

Participants

Priya R. Bhosale, MD, Houston, TX (Presenter) Nothing to Disclose
Jieqi Wang, BA, Houston, TX (Abstract Co-Author) Nothing to Disclose
Datla G. Varma, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Corey T. Jensen, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Tara L. Sagediel, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Madhavi Patnana, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

...
PURPOSE
To evaluate the CT imaging features which may predict the presence of a DDLPS component within a retroperitoneal WDLPS.

METHOD AND MATERIALS
49 treatment naive patients with WDLPS (12) or DDLPS (37) who underwent computed tomography (CT) were included in the study following approval of the institutional review board. Three Radiologists evaluated the studies independently in a blinded fashion on a diagnostic workstation for < or >25% fat, presence of a ground glass nodule (a nodule having as attenuation lower than adjacent psoas muscle and hazy internal architecture), enhancing nodule (higher attenuation than psoas muscle), necrotic nodule (enhancing nodule with central areas of low attenuation), capsule surrounding the mass, septations, calcification (popcorn, spiculated or curvilinear), and final diagnosis of WDLPS or DDLPS. Statistical analysis: Multivariate logistic regression model with generalized estimating equations (GEE) method was used to correlate imaging features with pathology. P-values of 0.05 or less were considered statistically significant. Kappa Statistics were performed to assess agreement of the 5 features by all the three radiologists.

RESULTS
The accuracy, sensitivity, specificity, positive predictive value and negative predictive values to diagnose the DDLPS in the WDLPS were 75.5%, 91.7%, 70.2%, 50.0% and 96.3%, 79.6%, 91.7%, 55.0% and 96.5% and 73.3%, 91.7%, 67.6%, 47.8% and 96.5% for reader 1, 2 and 3. All three readers showed almost perfect agreement in overall diagnosis based on Kappa statistics [95% confidence interval r= 0.83 (0.63 to 0.99)]. The presence of an enhancing nodule was highly suggestive of DDLPS (P< 0.02).

CONCLUSION
The presence of an enhancing nodule is highly specific for the diagnosis of DDLPS component in a retroperitoneal WDLPS.

CLINICAL RELEVANCE/APPLICATION
Imaging may help guide appropriate biopsy of the dedifferentiated component within a well differentiated liposarcoma which can further help streamline patient management

TEACHING POINTS
1. Emphasize the importance of careful examination of the ribs as an integral component of both the chest radiographic and CT examination and present an algorithm for interpretation. 2. Provide key examples of congenital and pathologic diseases of the ribs, whether unique to the ribs themselves or as a component of a more diffuse disease or syndrome.

TABLE OF CONTENTS/OUTLINE
Provide an algorithm for examination of the ribs in addition to illustrating the following categories of rib abnormalities: 1. Congenital diseases including cervical ribs, Sprengel's deformity, congenital rib fusion, duplicate ribs and pectus excavatum. 2. Primary malignancies (enchondroma, osteochondroma, fibrous dysplasia) as well as metastatic disease and post-radiation changes in the rib. 3. Metabolic diseases which may affect the ribs including hypertrophic pulmonary osteoarthropathy, sickle cell disease and brown tumor associated with primary hyperparathyroidism. 4. Syndromes such as Proteus syndrome, Englemann's disease, myositis ossificans, SAPHO and POEMS syndromes.

Awards
Certificate of Merit

Participants
Phey M. Yeap, MBChB, FRCR, Dundee, United Kingdom (Presenter) Nothing to Disclose
Matthew J. Budak, MD, FRCR, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Jonathan Weir-McCall, MBChB, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
David Scott, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Barry Oliver, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The sternoclavicular joint forms the only synovial articulation between the upper limb and the axial skeleton. Disease related to the sternoclavicular joint commonly manifests as non-specific joint pain and swelling. Substantive diagnosis usually necessitates appropriate imaging work up, and possibly biopsy for histopathology assessment. The aims of this exhibit are: 1. To illustrate the normal anatomy and common variants of the sternoclavicular joint. 2. To describe various disorders of the sternoclavicular joint. 3. To
demonstrate characteristic and key imaging findings of these disorders on radiographs, CT and MR.

**TABLE OF CONTENTS/OUTLINE**

- Normal anatomy and normal variants
  1. sternum and clavicle
  2. sternoclavicular joint
- Disorders
  1. Trauma (fracture and dislocation)
  2. Infection (septic arthritis)
  3. Inflammatory arthropathy (Rheumatoid, seronegative)
  4. Crystal arthropathy (gout)
  5. Chronic recurrent multifocal osteomyelitis (CRMO), SAPHO syndrome
  6. Condensans osteitis
  7. Tumors (benign and malignant)
  8. Metabolic (Paget)
  9. Degeneration

**TEACHING POINTS**

- Advanced MRI techniques, could provide some information, in detecting bone marrow disorders, which is not possible to obtain with conventional images. DWI whole-body imaging can be used to detect and to follow-up treatment response in some bone marrow disease (ex: Myeloma Multiple, Lymphoma, Bone metastasis), which affect management and prognosis of these patients.
- The purpose is to illustrate imaging findings, of bone marrow disorders using advanced MRI techniques (in and out phase sequence, DWI, perfusion and whole-body imaging).
- To correlate with Computer Tomography, PET-TC and histopathologic findings.

**TABLE OF CONTENTS/OUTLINE**

- To explain and illustrate the normal marrow distribution and normal variants;
- To illustrate with advanced MRI techniques (in and out phase, DWI, perfusion, Whole body imaging with DWI) the different pathologies that affect bone marrow: 1. Neoplasia (Hematological bone marrow malignancies, Bone metastases and Multiple myeloma);
  2. Benign process (Anemias, osteonecrosis, osseous infarct, non-infective inflammatory disease, trauma and infective inflammatory disease);
- To correlate advanced MRI with MR conventional images, CT, PET-CT and histopathologic findings;
- To illustrate the differential diagnosis of these pathologies;
- The usefulness of these method in follow-up treatment management (ex: Lymphoma, Multiple Myeloma).
Hot Topic Session: Musculoskeletal Applications of Dual Energy CT

Thursday, Dec. 3 3:00PM - 4:00PM Location: E353C

Participants
Kenneth S. Lee, MD, Madison, WI (Moderator) Research Consultant, SuperSonic Imagine; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
Mary G. Hochman, MD, West Roxbury, MA (Moderator) Stockholder, General Electric Company; Stock options, Nomir Medical Technologies, Inc; Author, UpToDate, Inc

Sub-Events

SPSH51A  MSK Applications of Dual Energy CT: Gout

LEARNING OBJECTIVES
1) Describe the basic theory and technique of dual energy CT for detection and localization of uric acid. 2) Highlight the current role for DECT in the current clinical algorithm for the diagnosis of gout. 3) Identify the value of DECT 3D tophus quantification in the management of gout.

ABSTRACT

URL

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jeffrey J. Peterson, MD - 2012 Honored Educator

SPSH51B  MSK Applications of Dual Energy CT: Metal Artifact Reduction, Bone Marrow Edema and Tendon/Ligament Analysis

LEARNING OBJECTIVES
1) Briefly review the basic physics principles of DECT/Spectral imaging. 2) Explain the clinical utility of DECT in MSK Applications, with a focus on metal artifact reduction, bone marrow edema and tendon/ligament analysis.
**RC704**

**Musculoskeletal Tumors**

Thursday, Dec. 3 4:30PM - 6:00PM Location: S406B

**Participants**
Mark D. Murphey, MD, Reston, VA, (MMurphey@acr.org) (Director) Nothing to Disclose

**Sub-Events**

**RC704A Staging of Musculoskeletal Tumors**

Participants
David M. Panicek, MD, New York, NY, (panicekd@mskcc.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Describe the rationale and systems for staging musculoskeletal tumors. 2) List the components of local staging of musculoskeletal tumors at MRI. 3) Identify various MRI pitfalls in staging musculoskeletal tumors.

**ABSTRACT**

**RC704B Dilemmas and Pitfalls in MSK Tumor Imaging**

Participants
Mark D. Murphey, MD, Reston, VA, (MMurphey@acr.org) (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 hematomas 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.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mark D. Murphey, MD - 2015 Honored Educator

**RC704C Post-Treatment Imaging of MSK Tumors**

Participants
Mark J. Kransdorf, MD, Phoenix, AZ (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Construct a framework for evaluation of patients following treatment. 2) Recognize the spectrum of post treatment imaging findings. 3) Identify features to distinguish post treatment change from recurrent tumor.

**ABSTRACT**

Active Handout:Mark J. Kransdorf


**RC704D Radiologic Treatment of MSK Tumors**

Participants
Peter L. Munk, MD, Vancouver, BC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Familiarize the attendee with the most commonly used imaging guided per cutaneous thermal ablation techniques used in treatment of both benign tumours and metastatic disease involving the MSK system. 2) Review indications for radiologic treatment of bone tumors. 3) Examine the potential complications that can be encountered.
Participants

**LEARNING OBJECTIVES**

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

**Sub-Events**

**RC708A Orthopedic Hardware: All You Wanted to Know**

Participants

Manickam Kumaravel, MD, FRCR, Houston, TX, (Manickam.Kumaravel@uth.tmc.edu) (Presenter)  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the various types of orthopedic hardware in musculoskeletal imaging practice. 2) Understand the functionality of orthopedic hardware. 3) Identify the adequate positioning of hardware. 4) Diagnose malpositioning and complications of hardware placement and guide treatment.

**ABSTRACT**

Radiologists are routinely faced with images containing orthopedic hardware. Appropriate recognition of various types of hardware is crucial for the continuation of patient care. The lecture will explain the functionality of orthopedic hardware. Illustrations of the appearance of orthopedic hardware will be made with cartoons, radiographs and Computed Tomography (CT). The attendee will be educated about identification of type of hardware; adequacy of hardware and emphasis will also be placed on diagnosis, complications and malposition of common orthopedic hardware. Guidance will also be provided with regard to appropriate report formulation.

**RC708B Ankle and Foot**

Participants

Ken F. Linnau, MD, MS, Seattle, WA, (klinnau@uw.edu) (Presenter) Speaker, Siemens AG; Royalties, Cambridge University Press;

**LEARNING OBJECTIVES**

1) To identify clinical scenarios which may require advanced foot and ankle imaging in the emergency department in addition to radiography. 2) To select appropriate imaging modality and exam parameters for advanced foot and ankle imaging on CT, MR and sonography. 3) To identify radiographic, CT, MR and ultrasound findings of complex or subtle foot and ankle injuries in order to aide in efficient clinical decision making and treatment planning.

**ABSTRACT**

The foot and ankle are very commonly injured in extremity trauma. Radiographs are the most common initial imaging study for evaluation of foot and ankle injuries. Unfortunately, radiography can be of limited utility for complete assessment of the bones and soft tissues of the foot and ankle. As a result advanced imaging, including CT, MRI or sonography may be helpful to fully characterize injuries and aid in treatment decision making. The purpose of this interactive presentation is to highlight injuries and clinical settings which may require expedited advanced imaging of the foot and ankle in addition to radiography while the patient is still in the emergency room.

**RC708C Pelvis**

Participants

Bharti Khurana, MD, Boston, MA (Presenter)  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the key factors that contribute to pelvic stability. 2) Recognize the patterns of osseous and soft-tissue injuries in pelvic fractures.

**ABSTRACT**

Treating trauma patients with displaced pelvic fractures requires a multidisciplinary approach at a designated trauma center to reduce morbidity and mortality. Immediate recognition of pelvic ring disruption and determination of pelvic stability are critical components in the evaluation of such patients. Stability is achieved by the ability of the osseoligamentous structures of the pelvis to withstand physiologic stresses without abnormal deformation. The supporting pelvic ligaments, including the posterior and anterior sacroiliac, iliolumbar, sacrospinous, and sacrotuberous ligaments, play a crucial role in pelvic stabilization. Radiologists should be familiar with the ligamentous anatomy and biomechanics relevant to understanding pelvic ring disruptions, as well as the Young and Burgess classification system, a systematic approach for interpreting pelvic ring disruptions and assessing stability on the basis of fundamental force vectors that create predictable patterns. This system provides an algorithmic approach to interpreting images and categorizes injuries as anterioposterior (AP) compression, lateral compression, vertical shear, or combined. Opening and closing of the pelvis from rotational forces result in AP compression and lateral compression injuries, respectively,
whereas vertical shear injuries result from cephalad displacement of the hemipelvis. AP and lateral compression fractures are divided into types 1, 2, and 3, with increasing degrees of severity. Knowledge of these injury patterns leads to prompt identification and diagnosis of other subtle injuries and associated complications at pelvic radiography and cross-sectional imaging, allowing the orthopedic surgeon to apply corrective forces for prompt pelvic stabilization.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: [https://www.rsna.org/Honored-Educator-Award/](https://www.rsna.org/Honored-Educator-Award/)

Bharti Khurana, MD - 2014 Honored Educator
Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E263

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

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose
Bassem A. Georgy, MD, MSc, San Diego, CA (Presenter) Consultant, Johnson & Johnson; Consultant, DFINE, Inc; Stockholder, DFINE, Inc; Stockholder, Spine Solutions, Inc;
Allan L. Brook, MD, Bronx, NY (Presenter) Advisor, Johnson & Johnson Advisor, Medtronic, Inc
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY, (tmiller@montefiore.org) (Presenter) Nothing to Disclose
Stanley Golovac, MD, Merritt Island, FL (Presenter) Consultant, St. Jude Medical, Inc; Investigator, Vertos Medical Inc; Investigator, St. Jude Medical, Inc

LEARNING OBJECTIVES

1) Describe and demonstrate methods for patient selection, evaluation and technique for Image-guided injection procedures used in spine pain management. 2) These procedures will include epidural steroid injections, nerve root blocks, facet blocks, sacroiliac joint injections, lumbar synovial cyst therapy, radiofrequency ablations. 3) Review procedural complications and how to avoid them. 4) Discuss pertinent anatomy, instruments and pharmacology. 5) These objectives will be accomplished using didactic lectures complemented by procedure videos, supervised hands on lab work with training models and round table case discussions.

ABSTRACT

Neck and back pain complaints are very common in the general population. Radiologists can contribute to the diagnosis and management in patients who are not responding to conservative management. Spine injection procedures can frequently be performed on an outpatient basis with a brief recovery phase. These procedures are performed with imaging guidance, such as a multi-directional fluoroscope or under CT guidance, in order to correctly localize the specific anatomic sites in or about the spine for diagnostic and or therapeutic needle localization. An understanding of patient selection, indications and contraindications, are paramount to the safety and success of these procedures. The diagnostic and therapeutic potential of these procedures is also facilitated by a thorough evaluation of the spine, with respect to both anatomy and potential pathology, with cross sectional imaging techniques as well as other radiologic tests. Communication of these results between the Radiologist and the spine proceduralist will contribute to optimal patient outcomes.

Handout:Afshin Gangi

Active Handout:Todd Stuart Miller
**Pitfalls in Shoulder MRI Interpretation**

**Friday, Dec. 4 8:30AM - 8:55AM Location: E451A**

**Participants**

Douglas W. Goodwin, MD, Lebanon, NH, (douglas.goodwin@hitchcock.org) *(Moderator)* Nothing to Disclose  
Jenny T. Bencardino, MD, New York, NY *(Moderator)* Nothing to Disclose

**ABSTRACT**

**Handout:** Jenny T. Bencardino  

**LEARNING OBJECTIVES**

1) Recognize a series of pitfalls encountered in shoulder MRI, including variations in normal anatomy and subtle frequently overlooked injuries and abnormalities. 2) Understand how imaging parameters can be manipulated to account for the inherent challenges of shoulder MR imaging. 3) Improve performance by adjusting patterns of image review.

**Active Handout:** Douglas W. Goodwin  

---

**3D-CT vs. 3D-MR of the Shoulder in Patients with Glenohumeral Instability**

**Friday, Dec. 4 8:55AM - 9:05AM Location: E451A**

**Participants**

Laurence D. Stillwater, MD, Winnipeg, MB *(Presenter)* Nothing to Disclose  
James K. Koenig, MD, Winnipeg, MB *(Abstract Co-Author)* Nothing to Disclose  
Bruce W. Maycher, MD, Winnipeg, MB *(Abstract Co-Author)* Nothing to Disclose  
James M. Davidson, MD, Winnipeg, MB *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**

To determine if 3D-MR osseous reformats of the shoulder are equivalent to 3D-CT osseous reformats in patients with glenohumeral instability.

**METHOD AND MATERIALS**

Patients with glenohumeral instability, who were to be imaged with both CT and MRI, were prospectively selected. CT and 3TMR were performed within 24 hours of one another on 10 shoulders. Each MR study included an axial 3D isotropic VIBE sequence (acquisition time 4 minutes 15 seconds). The image data from the isotropic VIBE sequence was post processed using subtraction and 3D software. CT data was post processed using 3D software. The following measurements were obtained for both 3DCT and 3DMR post processed images: height and width of the humeral head and glenoid, Hill-Sachs size and percent humeral head loss (if present), Bankart size and percent glenoid bone loss (if present). Paired T-tests and two one-sided tests for equivalence were used to assess the differences between imaging modalities and equivalence.

**RESULTS**

The measurement differences from the 3DCT and 3DMR post processed images were not statistically significant: humeral height p=0.06, 95% CI [-0.03, 0.99], humeral width p=0.13, 95% CI [-0.14, 0.90], Hill-Sachs size p=0.42, 95% CI [-0.17, 0.37], percent humeral head loss p=0.93, 95% CI [-0.49, 0.53], glenoid width p=0.15, 95% CI [-0.01, 0.64], Bankart size p=0.43, 95% CI [-0.22, 0.42] and percent glenoid bone loss p=0.22, 95% CI [-0.52, 1.68]. The measurement difference for glenoid height was borderline, p=0.04, 95% CI [0.01, 0.43], however using any adjustment for multiple comparisons this failed to be significant. Using an equivalence margin of 1 mm for measurements and 1.5% for percent bone loss, the 3DMR and 3DCT post processed images were equivalent.

**CONCLUSION**

3DMR osseous models of the shoulder using a 3D isotropic VIBE sequence were equivalent to 3DCT osseous models and the differences between modalities were not statistically significant. This sequence can be added to MR examinations with only a minimal increase in imaging time and can be used to quantify humeral head and glenoid bone loss. This may eliminate the need for pre-surgical CT examinations pending continued recruitment to obtain a larger sample size.

**CLINICAL RELEVANCE/APPLICATION**

3DMR osseous reformats are equivalent to and demonstrate no significant statistical difference from 3DCT osseous reformats, which
Many rotator cuff muscle classifications are in use, making it difficult to compare results and agree on treatment. Muscle atrophy and fatty degeneration are negative prognostic factors for clinical and structural outcome after repair. The 5 point Goutallier classification (Clin Orthop Relat Res 1994) was subsequently simplified by Fuchs (J Shoulder Elbow Surg 1999) into a 3 point system. Thomazeau (Acta Orthop Scand 1996) introduced a system based on the cross-sectional area (CSA) of the supraspinatus (SS) muscle on sagittal oblique (SAG) images with respect to the area of the SS fossa, reported as an occupation ratio (OR). Currently, there are no studies accounting for tendon retraction and its affect on grading.

**METHOD AND MATERIALS**

This IRB approved, HIPAA compliant retrospective study was performed using radiology reports from a single institution. Search terms of 'retraction' or 'retracted' were applied to non-arthrogram MRI reports from Jan 2014-Jan 2015. Full-thickness SS tendon tears were included. Partial-thickness tears and post-operative cases were excluded. MRI exams were reviewed by an MSK radiologist. Degree of tendon retraction was recorded. Thomazeau CSA and OR was recorded at the standard reference location on SAG images. OR was re-measured correcting for tendon retraction, medial to the reference location, obtaining a new (corrected) CSA. Fuchs grading was applied to both coronal (COR) and SAG planes. Paired Wilcoxon signed-ranks test was used to compare measurements. 25% of the cases were remeasured and independently measured by a second reader and reliability statistics were calculated.

**RESULTS**

79 patients were in the study group (71/150 excluded). Mean SS CSA at the standard vs corrected location was 4.0±1.6 cm² (mean±SD) vs 5.6±1.7 cm² (p<0.001). OR was 0.44±0.13 vs 0.62±0.12 (p<0.001). Standard Thomazeau and corrected stages revealed a concordance of 17.7% (14/79). Concordance for SAG and COR Fuchs staging was 94% (74/79). Inter- and intraobserver reliability statistics were excellent for OR, corrected OR, Thomazeau Stage, and SAG/COR Fuchs (ICC=0.832-0.997).

**CONCLUSION**

Accounting for tendon retraction is important in assessing SS atrophy and can significantly alter the grading using standard systems. Caution should be used when reporting these findings, as SS atrophy may be overestimated.

**CLINICAL RELEVANCE/APPLICATION**

Tendon retraction can result in overestimation of SS muscle atrophy, which may ultimately alter the decision to perform a cuff repair.

**RC804-03 Effect of Rotator Cuff Tendon Retraction on Grading of Supraspinatus Muscle Atrophy and Fatty Degeneration**

Friday, Dec. 4 9:05AM - 9:15AM Location: E451A

**Participants**

Vanessa M. Finato, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (Presenter) Nothing to Disclose

**PURPOSE**

To investigate the prevalence, imaging findings, treatment and outcome of distal clavicular osteolysis (DCO) in adults as well as the association with bench pressing intensity.

**METHOD AND MATERIALS**

Patients with atraumatic DCO were selected in a retrospective review of 4217 consecutive magnetic resonance imaging (MRI) shoulder reports of individuals between 20 and 40 years of age. The prevalence of DCO, the DCO grade (mild, moderate, severe), pain scale, bench pressing frequency (times per week and years of bench pressing), bench pressing weight (maximum single repetition and per body weight), conservative and surgical treatment outcome and the long-term sequelae on follow-up MRI were analyzed.

**RESULTS**

8% (342/4217) of patients between 20 and 40 years of age had atraumatic DCO and 9% of these were females. 82% of DCO patients were bench pressing on a regular basis compared to 41% in the control group (p<0.001, chi-square). In male bench pressers who suffered from DCO (n=240), the mean bench pressing weight (maximum single repetition) was 283 lbs (±SD 57) compared to 209 lbs (±SD 60) in male bench pressers not affected by DCO (n=127; p=0.001, Mann-Whitney). Intense bench pressing with a bench pressing weight (maximum single repetition) of more than 1.5 times the body weight was a risk factor for DCO (OR=18; 95%CI=11-31, p<0.001). High frequency (>1x/week) and duration (>5 years) of bench pressing further increased the risk. 77% of DCO patients responded to conservative therapy, and 23% underwent surgery with resolution of symptoms. On follow-up imaging, acromioclavicular (AC) joint osteoarthritis was significantly more common in DCO patients treated conservatively than in DCO patients treated surgically (74% vs. 47% p<0.001, chi-square).
CONCLUSION
Prevalence of DCO in adults undergoing shoulder MRI is 8%, and females are affected in 9% of cases. Bench pressing more than 1.5 times the body weight is a substantial risk factor. AC joint osteoarthritis is a long-term sequela of conservative, but not surgical treatment of DCO.

CLINICAL RELEVANCE/APPLICATION
DCO is associated with AC joint osteoarthritis on follow-up imaging. Maximum bench pressing weight should be kept below 1.5 times the body weight to prevent DCO.

RC804-05 Non-contrast MRI Diagnosis of Adhesive Capsulitis
Friday, Dec. 4 9:25AM - 9:35AM Location: E451A

Participants
Andrew S. Chi, MD, MS, Philadelphia, PA (Presenter) Nothing to Disclose
John Kim, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Suzanne S. Long, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The MR arthrographic findings of adhesive capsulitis or frozen shoulder are well described. However, adhesive capsulitis most commonly occurs in patients age 45 to 60 years old, a population for whom direct MR arthrography is rarely ordered. We sought to investigate specific noncontrast MRI findings and constellations of MRI findings in patients with clinical adhesive capsulitis.

METHOD AND MATERIALS
A prospective assessment of a retrospective study group was performed. 31 non-contrast, non-arthrographic, shoulder MRI exams were divided into subject and control groups (mean age 55.8 years; 10 men, 20 women). Two blinded MSK radiologists evaluated the MRI exams for coracohumeral ligament thickness >2 mm, fatty infiltration of the rotator interval, and thickening/edema of the inferior joint capsule/axillary recess. Clinical diagnosis of adhesive capsulitis was provided by orthopedic surgery physical exams. One patient with clinical suspicion of adhesive capsulitis was excluded due to concomitant traumatic labral tear, leaving 15 subjects in each group.

RESULTS
A triad of MRI findings is associated with adhesive capsulitis. Adhesive capsulitis can be diagnosed on noncontrast shoulder MRI with high sensitivity/low specificity, intermediate sensitivity and specificity, or high specificity/low sensitivity based on the number of MRI criteria observed. Using a single criterion of coracohumeral ligament thickening, sensitivity is 76.7% and specificity is 53.3% for detection of adhesive capsulitis. Using two criteria of coracohumeral ligament thickening and fatty infiltration of the interval, sensitivity is 66.7% and specificity is 55.2%. Using all three criteria of coracohumeral ligament thickening, interval infiltration, and axillary recess thickening/edema, sensitivity is 23.3% and specificity is 86.7%.

CONCLUSION
Adhesive capsulitis can be accurately diagnosed on routine noncontrast shoulder MRI in conjunction with appropriate clinical criteria. The finding of a thickened coracohumeral ligament shows strong sensitivity for adhesive capsulitis while the constellation of coracohumeral ligament thickening, subcoracoid fatty infiltration of the rotator interval, and axillary recess thickening/edema yields great specificity for adhesive capsulitis.

CLINICAL RELEVANCE/APPLICATION
Routine noncontrast MRI findings in adjunct with clinical findings suspicious for adhesive capsulitis can provide accurate diagnosis without need for direct MR arthrography.

RC804-06 Extraarticular Shoulder MRI
Friday, Dec. 4 9:35AM - 10:00AM Location: E451A

Participants
David A. Rubin, MD, Saint Louis, MO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Modify MR imaging protocols of the shoulder to address suspected abnormalities in the chest wall that may refer symptoms to the shoulder joint. 2) Detect injuries in the shoulder muscles and tendons outside of the rotator cuff, and identify salient features on MR images that guide clinical management. 3) Assess the rib cage using for radiographically-occult injuries.

RC804-07 Postoperative Shoulder MRI
Friday, Dec. 4 10:10AM - 10:30AM Location: E451A

Participants
Lawrence M. White, MD, FRCPC, Toronto, ON (Presenter) Advisory Board, Siemens AG

LEARNING OBJECTIVES
1) Understand the general principles of common shoulder surgical procedures and their expected postoperative appearance at MR imaging.2) Review the value of MR imaging techniques in evaluation of the postoperative shoulder3) Identify MR imaging features of complications or recurrent pathology of the postoperative shoulder.

ABSTRACT
This presentation will cover the expected spectrum of findings in the postoperative shoulder following common modern surgical.
CONCLUSION
Glenoid can be subdivided into three size groups: small (diameter<26mm), medium (diameter ranging from 26mm to 28mm), and big glenoid (diameter>28mm). There was no correlation between patient’s height and bone stock.

METHOD AND MATERIALS
Sixty-four slice MDCT of 50 normal shoulders were used for this study (Siemens Healthcare, Erlangen Germany). The biometry of the glenoid was assessed on PACS multiplanar and 3D reconstructions: we measured the surface of the largest circle covering the glenoid and being tangent to the inferior rim, the diameter of the circle, the height of the glenoid and the depth of the bone stock at nine representative target points. Glenoid were divided into 3 groups based on the diameter of the circle and correlation with glenoid size and bone stock and 2) to optimize the selection of prosthetic size.

PURPOSE
Reverse shoulder arthroplasty has become popular in the treatment of excentrated omarthrosis. However even with up-to-date prosthetic designs and surgical techniques, complications are still frequent. Variations of the glenoid in the general population regarding patient’s height, glenoid width and glenoid bone stock, have never been precisely assessed. This could help orthopaedic surgeons to choose the right reverse shoulder implant for one patient. The purpose of the study is 1) to provide a structural analysis of glenoid size and bone stock and 2) to optimize the selection of prosthetic size.

METHOD AND MATERIALS
One hundred consecutive post operative conventional shoulder MR and MR arthrography exams performed on the same patients were reviewed retrospectively by two musculoskeletal radiologists. Nineteen of these patients also had CT arthrography performed. Exams were assessed for labral tears and supraspinatus tendon tears. All patients went on to arthroscopy.

RESULTS
Of these one hundred patients, thirty-two had SLAP (superior labral anterior to posterior) tears, sixteen had posterior labral tears, nineteen had anterior labral tears and forty-two had full thickness supraspinatus tendon tears on conventional MR exam. On MR arthrogram exam forty six patients had SLAP tears, twenty-two had posterior labral tears, twenty-four had anterior labral tears and fifty-one had full thickness supraspinatus tendon tears. MR arthrogram detected fourteen SLAP tears, six anterior labral tears, five anterior labral tears and nine supraspinatus tendon tears not detected on conventional MR exam. Nineteen patients had additional imaging performed with CT arthrography due to metallic artifacts precluding MR assessment of shoulder pathology. There were two SLAP tears, three posterior labral tears, four anterior labral tears and one supraspinatus tendon tear seen on CT arthrography not seen on MR exam.

CONCLUSION
MR arthrography is more accurate than conventional MR in assessment of post-operative shoulder pathology. CT arthrography can detect additional pathology when there is metallic artifact in post operative patients. It is beneficial to inject a combination of gadolinium and CT contrast at arthrography so CT imaging can be performed post arthrography if metallic artifact precludes imaging shoulder pathology by MR.

CLINICAL RELEVANCE/APPLICATION
MR arthrography is more accurate than conventional MR in assessment of post operative shoulder pathology. It is beneficial to inject a combination of gadolinium and CT contrast at arthrography so CT imaging can be performed post arthrography if metallic artifact precludes imaging shoulder pathology by MR.
The knowledge of glenoid diameter may be useful to prevent mismatch of prosthetic shoulder implant by choosing between small, medium or big implants.

**RC804-10 Imaging of the Unstable Elbow**

Friday, Dec. 4 10:50AM - 11:15AM Location: E451A

Participants
Mark W. Anderson, MD, Charlottesville, VA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) List the primary stabilizing ligaments of the elbow. 2) Describe the role of the ulnar collateral ligament in the development of the valgus overload syndrome. 3) Discuss the bone and soft tissue injuries commonly found after posterior dislocation of the elbow.

**ABSTRACT**

Stability of the elbow depends heaviy upon the medial and lateral collateral ligament complexes. This session will focus on the normal anatomy of these ligaments as well as the most common types of ligament pathology that result in elbow instability and the radiographic and MR imaging findings that are seen in these conditions.

**Active Handout:** Mark W. Anderson


**Handout:** Mark W. Anderson


**RC804-11 The Legend of the Luschka's Tubercle and its Association with Snapping Scapulae: Osseous Morphology of Snapping Scapulae on 2D and 3D CT Images**

Friday, Dec. 4 11:15AM - 11:25AM Location: E451A

Participants
Tobias J. Dietrich, MD, Zurich, Switzerland (Presenter) Nothing to Disclose
Christoph A. Agten, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Philipp Furnstahl, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Lazaros Vlachopoulos, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Abstract Co-Author) Advisory Board, Siemens AG; Consultant, Medtronic, Inc

**PURPOSE**

To determine the osseous morphology of snapping scapulae on CT images in comparison with a control group.

**METHOD AND MATERIALS**

Two and three-dimensional CT images of scapulae of 34 patients with a snapping scapula were compared to a control group of 34 age and gender matched patients without a snapping scapula. Two blinded observers analyzed the following parameters: The presence of the so-called Luschka's tubercle was rated as yes or no. Measurements of the thickness and length of the superior angle of the scapula, the distance from the superior angle to the inferior angle, the depth of the subscapular fossa, the minimal distance between the scapula and rib cage, and the angle between the superior angle of the scapula and the subscapular fossa were obtained. The superior angle of the scapula was rated as concave or convex. Abnormalities of the rib cage and periscapular soft tissues were noted. The Fisher's exact test and Student's t-test served for data analysis.

**RESULTS**

In snapping scapula patients observer 1 did not find any Luschka's tubercle while observer 2 detected one Luschka's tubercle compared to two Luschka's tubercle in the control group for both observers (p-values>0.48). The superior angle of the scapula was significantly thicker in the snapping scapula group compared to the control group for both observers (observer 1: 4.8±1.3 mm versus 4.1±1.1 mm, observer 2: 5.1±1.6 versus 4.1±1.3 mm, p-values<0.02). The subscapular fossa was significantly deeper in snapping scapula patients compared to control group patients for both observers (observer 1: 21.9±5.0 mm versus 18.8±4.5 mm, observer 2: 28.6±5.9 mm versus 25.1±5.6 mm, p-values<0.035). The comparison of the remaining parameters did not differ significantly between the groups. No abnormalities of the rib cage and periscapular soft tissues were found in snapping scapula patients.

**CONCLUSION**

The superior angle of the scapula was significantly thicker and the subscapular fossa was significantly deeper in patients with a snapping scapula compared to control group patients. The Luschka's tubercle was rarely seen and not associated with a snapping scapula.

**CLINICAL RELEVANCE/APPLICATION**

CT images may detect subtle osseous variants in patients with a snapping scapula. Neither published original articles nor the present data suggest an association between the Luschka's tubercle and a snapping scapula.

**RC804-12 Ultrasound Elastography Assessment of Changes in Ulnar Nerve Stiffness with Elbow Flexion**

Friday, Dec. 4 11:25AM - 11:35AM Location: E451A

Participants
Tony T. Wong, MD, New York, NY (Presenter) Nothing to Disclose
Ronny Li, New York, NY (Abstract Co-Author) Nothing to Disclose
PURPOSE

The intraneural pressure of the ulnar nerve (UN) within the cubital tunnel increases during elbow flexion. The purpose of this study is to determine whether ultrasound elastography can detect corresponding changes in nerve stiffness at the cubital tunnel and at defined distances away from it.

METHOD AND MATERIALS

Institutional review board and informed consent were obtained. Prospective examination of the UN in twenty elbows for ten consecutive volunteers was performed with ultrasound elastography. Each UN was examined in four positions while the elbow was in full extension: at the cubital tunnel, 4 cm proximal, 4 cm distal, and 8 cm distal. The elbow was then placed in full flexion (145 degrees) for three minutes and the entire examination was repeated. All ultrasounds were performed by a single radiologist on a SonixTouch system (Analogic Corp., Peabody, MA, USA) with a 10 MHz linear array transducer. An acoustic coupler (C) (EZU-TECPL1, Hitachi-Aloka Medical) with a standardized elasticity was attached to the probe. Ultrasound radio-frequency (RF) signals were obtained at each time point with a compression-decompression cycle lasting 4-6 seconds. Inter-frame axial displacements of the UN were estimated offline using a 1D normalized cross-correlation-based motion estimation method (Luo and Konofagou 2010) on the RF signals. Based on these displacements, inter-frame strains were computed using a least-squares strain estimator (Kallel and Ophir 1997) and added together to obtain cumulative strains. UN stiffness at each interrogated position was semi-quantified as a mean cumulative strain ratio (C/UN).

RESULTS

P-values were calculated using a matched pairs t-test. The change in mean C/UN ratios +/- standard deviation from extension to flexion were as follows: At cubital tunnel: 1.31 +/- 0.98 to 2.41 +/- 0.88 (p-value < 0.00015) 4 cm proximal: 0.50 +/- 0.37 to 0.41 +/- 0.27 (p-value 0.24) 4 cm distal: 1.23 +/- 0.90 to 0.85 +/- 0.91 (p-value 0.14) 8 cm distal: 2.61 +/- 1.41 to 2.01 +/- 1.45 (p-value 0.10)

CONCLUSION

Increased UN stiffness within the cubital tunnel can be detected by ultrasound elastography shortly after elbow flexion. No significant changes are detected 4 cm proximal, 4 cm distal, and 8 cm distal.

CLINICAL RELEVANCE/APPLICATION

Ultrasound elastography can detect changes in ulnar nerve stiffness during elbow flexion without significant lag time. It has potential for diagnostic use in early nerve compression.

RC804-13 Distal Triceps Tendon and Cubital Tunnel

Friday, Dec. 4 11:35AM - 12:00PM Location: E451A

Participants
Jenny T. Bencardino, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the normal MR anatomy of the distal triceps tendon and cubital tunnel at the elbow. 2) To describe the clinical syndromes that affect the distal triceps tendon and cubital tunnel including insertional triceps tendon tears, snapping triceps syndrome and cubital tunnel syndrome. 3) To review the MR findings associated with distal triceps tendon disease and cubital tunnel syndrome.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jenny T. Bencardino, MD - 2014 Honored Educator
Participants

Sub-Events

RC813A  Imaging of Pediatric Musculoskeletal Infections

Participants
Robert Orth, MD, PhD, Houston, TX (Presenter) Research support, General Electric Company;

LEARNING OBJECTIVES
1) Describe the optimal imaging strategy for evaluating suspected pediatric musculoskeletal infections including specifics of the MRI protocol. 2) List common missed diagnoses and imaging pitfalls. 3) Describe methods for differentiating musculoskeletal infections from alternative diagnoses.

RC813B  Imaging of Osteochondritis Dissecans

Participants
Jonathan D. Samet, MD, Chicago, IL, (jsamet@luriechildrens.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To identify imaging features of osteochondritis dissecans (OCD) using multiple modalities. 2) To recognize the spectrum of findings between low and high grade lesions. 3) To identify the varying postoperative appearances after surgical intervention.

ABSTRACT
For 'Imaging of Osteochondritis Dissecans'. 1. To identify imaging features of osteochondritis dissecans (OCD) using multiple modalities. 2. To recognize the spectrum of findings between low and high grade lesions. 3. To identify the varying postoperative appearances after surgical intervention.

RC813C  Imaging of Musculoskeletal Soft Tissue Masses

Participants
Michele M. Walters, MD, Boston, MA (Presenter) Nothing to Disclose
**RC850**

**Image-guided Biopsy of the Spine (Hands-on)**

Friday, Dec. 4 8:30AM - 10:00AM Location: E260

**Participants**
John L. Go, MD, Los Angeles, CA (Moderator) 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**

**RC850A Pre- and Post Biopsy Assessment**

**Participants**
Richard Silbergleit, MD, Royal Oak, MI (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.

**RC850B Equipment Used for Image-guided Biopsies of the Spine**

**Participants**
Michele H. Johnson, MD, New Haven, CT (Presenter) Nothing to Disclose

**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.

**RC850C Thoracic and Lumbar Biopsies**

**Participants**
John L. Go, MD, Los Angeles, CA (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**

**RC850D Cervical Spine Biopsies**

**Participants**
A. Orlando Ortiz, MD, MBA, Mineola, NY (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.

**RC850E Disc Biopsy and Aspiration**
Participants
Amish H. Doshi, MD, New York, NY, (amish.doshi@mountrnsai.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
Participants

LEARNING OBJECTIVES

1) An important aspect of Nuclear Medicine and Molecular Imaging is that the same core compound of the administered radiopharmaceutical can be labeled with both gamma emitters (for diagnostic) and beta (or alpha) emitters (for therapy), allowing for the targeted treatment of lesions. This is an expression of theranostics, the combination of therapy and diagnostics that is based on the specific tumor biology of each patient’s disease. This proposed session will provide several examples of such paired diagnostic studies and treatments using Nuclear Medicine methods.

Sub-Events

SPNM61A  Radioactive Iodine and Thyroid Cancer - Current Use and Controversies

Participants

Douglas Van Nostrand, MD, Washington, DC, (douglas.van.nostrand@medstar.net) (Presenter) Speakers Bureau, sanofi-aventis Group

LEARNING OBJECTIVES

1) Define remnant ablation, adjuvant treatment, and treatment of locoregional/distant metastases. 2) Discuss the indications and controversies of 131I for each. 3) Discuss the range of prescribed activity of 131I for each.

SPNM61B  Bone Scintigraphy and the Use of Radionuclides in the Management of Patients with Metastatic Castrate-Resistant Prostate Cancer

Participants

Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To review bone scintigraphy with single photon and PET radiotracers in the imaging evaluation of patients with prostate cancer. 2) To summarize the results of the ALSYMPCA clinical trial for 223Ra dichloride therapy in patients with castrate resistant metastatic prostate cancer.

SPNM61C  Updates on the Use of PET/CT (and PET/MRI) and Radioimmunotherapy in NHL

Participants

Erik S. Mittra, MD, PhD, Stanford, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPNM61D  Peptide Receptor Radionuclide Imaging and Therapy: Where Are We in Europe and What Shall the US Do to Catch Up?

Participants

Frederik L. Giesel, MD, MBA, Heidelberg, Germany (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the concept of theragnostic. 2) Identify promising candidates for PRRT. 3) Challenges and limitations of PRRT. 4) Future perspective using alpha-emitters.

ABSTRACT

Well-differentiated neuroendocrine tumors (NETs) demonstrate modest responses to conventional chemotherapy due to their slow proliferation rate. However, the expression of somatostatin receptors by NET enables targeting with high affinity peptides. When these octreotide analogue peptides are labelled with beta emitters such as 90Y or 177Lu promising anti-tumor effects have been observed. The presentation will introduce the concept of theragnostic (68Ga-DOTATOC and 90Y/177Lu-DOTATOC) for improved patient stratification. Today, PRRT is well established for a long time in NET-patients. However challenges and limitations will be discussed in regard to other systemic therapies such as everolimus or sunitinib. Finally, outlook will be given in regard to the novel of targeted alpha therapy in NET-patients and its implication to other tumor entities.

URL
Selective Internal Radiation Therapy for Hepatic Malignant Lesions

Ghassan El-Haddad, MD, Tampa, FL, (ghassan.elhaddad@moffitt.org) (Presenter) Speaker Bureau, Bayer AG

LEARNING OBJECTIVES

View learning objectives under main course title.