Musculoskeletal Radiology
Usefulness of MRI for Outcome Evaluation after Mesenchymal Stem Cell Transplantation in Patients with Osteoarthritis in the Knee Joints

All Day Room: MK Community, Learning Center

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TEACHING POINTS
The purpose of this exhibit is:
1. To review technical aspect of mesenchymal stem cell transplanation for knee osteoarthritis.
2. To review the MR image findings of normal healing process, and abnormal healing process after the transplantation.
3. To review the image findings after other cartilage repair surgery such as microfracture.

TABLE OF CONTENTS/OUTLINE
Introduction- General review of surgical treatment of knee osteoarthritis.
Review of mesenchymal stem cell transplanation for knee osteoarthritis
Overformation of cartilage in medial femoral condyle and related complications
Minimal formation of cartilage
Normal reformation of cartilage in transplantation site
Overformation of bone, cartilaginous and meniscus in op site
Remodelling and changes in microfracture site
Bone Density Scan: The Secrets for a Correct Interpretation are Revealed

All Day Room: MK Community, Learning Center

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TEACHING POINTS
After the exhibit the reader would be able to,

- Review the World Health Organization criteria for the diagnosis of osteopenia and osteoporosis.
- Understand the information given by the bone density scan (DXA).
- Describe the correct bone density scan acquisition technique.
- Review the specific anatomic sites of acquisition and recognize when to acquire each one of them.
- Identify the pitfalls of bone density scan interpretation.

Teaching Points
Nowadays the bone density scan is the standard test to diagnose bone density anomalies, specifically osteoporosis. Bone density scan is usually performed in specific anatomic sites but it varies depending on the pathology. The correct acquisition of the scan is crucial to get the exact values of bone mineral density and avoid diagnostic mistakes.

TABLE OF CONTENTS/OUTLINE
Introduction Objectives Bone Mineral Density Definition Osteopenia Osteoporosis Bone Density Scan Technical Acquisition Aspects Fracture Risk Interpretation Pitfalls of bone density scan interpretation
Musculoskeletal Infection-Mimicking Lesions

All Day Room: MK Community, Learning Center

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TEACHING POINTS
The purpose of this exhibit is: 1. To review various radiographic findings of musculoskeletal infectious lesions. 2. To categorize osteomyelitis into three clinical stages (acute, subacute, chronic) and describe lesions that mimic the specific features of each stage. 3. To illustrate and describe lesions that mimic infectious arthritis. 4. To illustrate and describe lesions that mimic infectious spondylitis.

TABLE OF CONTENTS/OUTLINE
1. Introduction & purpose
2. Review of radiographic findings in musculoskeletal infectious lesions - Osteomyelitis - Infectious arthritis and spondylitis
3. Three clinical stages of osteomyelitis and their mimicking lesions - Acute osteomyelitis mimics aggressive bone destruction, bone marrow edema, reactive sclerosis; Osteosarcoma, osteoid osteoma, etc.
   Subacute osteomyelitis mimics abscess formation, periosteal reaction; Histiocytosis, osteosarcoma, etc.
   Chronic osteomyelitis mimics sequestra, sclerotic changes; Metastasis, histiocytosis, etc.
4. Infectious arthritis mimicking lesions - Destruction of articular margins; Neurotrophic arthropathy, ankylosing spondylitis, etc.
5. Infectious spondylitis mimicking lesions - Involvement of two consecutive vertebral bodies, destruction of end-plates; Metastasis, degenerative disc lesions, etc.
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TEACHING POINTS
The purpose of this exhibit is: 1) To review the normal structures of the knee that can mimic pathologic condition. 2) To illustrate the MR findings of normal structures of the knee that can mimic pathologic condition.

TABLE OF CONTENTS/OUTLINE
1. Posterior cruciate ligament- MR imaging finding of interposition of posterior cruciate ligament into the medial compartment of the knee
2. Posterior cruciate ligament recess- MR imaging finding
3. Patellar tendon- MR imaging finding of proximal patellar tendon
4. Lateral collateral ligament- MR imaging finding of proximal lateral collateral ligament- Fibular attachment patterns and MR finding
5. Posterior root of lateral meniscus- Insertion patterns and MR finding
Symptomatic Accessory Bones: Clinical Features and Radiological Differential Diagnoses

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Teaching Points
1) To define and classify various accessory bones in human body
2) To illustrate the imaging features of symptomatic ossicles and sesamoids and to describe their clinical features and radiological differential diagnoses

Table of Contents/Outline
1) Introduction: Accessory bones including ossicles and sesamoids are asymptomatic normal variants which are commonly observed in clinical reading practice. However, they occasionally accompany clinical symptoms because of morphological changes or their own pathologies, and can be misdiagnosed as other pathologic conditions such as trauma, osteonecrosis, inflammation, or crystal deposition diseases involving adjacent musculoskeletal structures.
2) Purposes
3) Definition/classification of various accessory bones
   - Ossicles
   - Sesamoids
4) Cases of symptomatic ossicles (Painful os peroneum syndrome, Os trigonum syndrome, Accessory navicular bone syndrome, Diastasis or impingement syndromes related to os acetabuli or os acromiale, Os odontoideum instability) (Case 1-4)
   - Clinical features
   - Imaging features and differential diagnoses
5) Cases of symptomatic sesamoids (Sesamoiditis, Fabella syndrome) (Case 5)
   - Clinical features
   - Imaging features and differential diagnoses
6) Conclusion
**Imaging Findings of Superficial Soft Tissue Masses in Epidermis and Dermis of the Extremities**

All Day Room: MK Community, Learning Center

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**TEACHING POINTS**
To illustrate radiologic features of the superficial soft tissue masses in epidermis and dermis of the extremities
To correlate the imaging features of these lesions with pathologic findings

**TABLE OF CONTENTS/OUTLINE**
Superficial soft tissue tumors in epidermis and dermis are categorized by their origin and malignancy potential.
1. **Epidermis**
   - Malignant Merkel cell carcinoma
   - Squamous cell carcinoma
   - Melanoma
2. **Dermis**
   1) Benign
      - Epidermal inclusion cyst
      - Eccrine spiradenoma
      - Pilomatricoma
      - Hidradenitis suppurativa
      - Cutaneous angioleiomyoma
      - Neurofibromatosis
      - Pilar sheath acanthoma
      - Ganglion tumor of soft tissue
   2) Malignant
      - Epitheloid sarcoma
      - Dermatofibrosarcoma protuberans
      - Superficial B-cell lymphoma

Summary: Through the review of this exhibit, radiologists recognize the characteristic imaging findings of each superficial soft tissue masses and it can be helpful for the exact diagnosis.
All Pathogens Have Their Own Shadows: Unique Image Findings of Infectious Spondylitis according to Their Causing Pathogens

All Day Room: MK Community, Learning Center

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TEACHING POINTS
Infectious spondylitis is rare with the incidence between 0.2 and 2 cases per 100,000 people per year. However, the incidence is on the rise thanks to the longer life expectancy in patients with chronic debilitating diseases. Although Staphylococcus aureus is known to be the most common single pathogen, various organisms have been identified during the past two years in our institution through multidisciplinary collaboration. The purpose of this exhibit is:
1. To review the image findings of infectious spondylitis with common pathogen.
2. To explain the various CT and MRI findings of infectious spondylitis according to unusual organism.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of infectious spondylitis
Review of imaging findings– Common pathogen
1. Staphylococcus aureus
2. Tuberculous spondylitis– Unusual organism
1. Fungus
   1) Candida
   2) Mucormycosis
2. Nontuberculous mycobacteria
3. Other unusual bacterial organism
   1) Actinomycosis
2) Brucellosis
When Tuberculosis Makes It to the Bones

All Day Room: MK Community, Learning Center

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TEACHING POINTS

Describe the different clinical pictures of the osteoarticular tuberculosis
Illustrate the different findings in patients with tuberculosis (TB) osteoarticular.
Correlate the findings visualized on CT and MRI.

TABLE OF CONTENTS/OUTLINE

Epidemiology of tuberculosis
Etiology
Tuberculous Spondylodiscitis
Clinical manifestations
Review of imaging findings: CT findings, MRI findings and CT-MRI correlation
Main differential diagnoses
Our clinical cases of daily practice
Tuberculous osteomyelitis
Clinical manifestations
Review of imaging findings: CT findings, MRI findings and CT-MRI correlation
Main differential diagnoses
Tuberculous arthritis
Clinical manifestations
Review of imaging findings: CT findings, MRI findings and CT-MRI correlation
Main differential diagnoses
Our clinical cases of daily practice
Conclusion
Use of Dual-energy CT and Metal Artifact Reduction Software in Evaluation of Postoperative Patients with Implants

All Day Room: MK Community, Learning Center

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TEACHING POINTS
1. Higher levels of photon energy should be used to reduce metal artifacts, but spatial resolution is reduced. To achieve optimal image quality, the best energy level is 110-120 keV. (Fig 1) 2. After one DECT scanning, a variety of CT images could be reconstructed including polychromatic image, monochromatic image, images with metal artifact reduction software (MARs), images with adaptive statistical iterative reconstruction (ASiR). (Fig 1&2) 3. The tube current used in DECT scan is higher than that used in most conventional single energy scanning protocols. DECT should be limited for appropriate patients. 4. Use of monochromatic images with/without MARs is different for different implants. Drawbacks of MARs should be cautioned. (Fig. 3&4) 5. Monochromatic imaging combined with/without MARs are not only useful to detect orthopedic complications, but also clearly demonstrate the fusion success of grafts and cages. (Fig. 5)

TABLE OF CONTENTS/OUTLINE
A. Scanning and postprocessing: 1) Principles and scanning protocol; 2) Postprocessing methods; 3) Patient selection B. Monochromatic imaging with/without MARs for large prosthesis: 1) Combined use of monochromatic imaging and MARs; 2) Common complications C. Monochromatic imaging without MARs for spinal implants: 1) Appropriate imaging technique; 2) Fusion success evaluation; 3) Common complications
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TEACHING POINTS
Review the etiopathogenesis of hallux valgus and how to assess and grade hallux valgus (HV) on radiographs, CT and MRI. Review current guidelines for surgical correction and methods of correction of HV. Discuss role of post-operative imaging to assess correction of hallux valgus, failure of correction and other post-surgical complications.

TABLE OF CONTENTS/OUTLINE
Definition and causes of hallux valgus. Review quantitative and qualitative imaging findings to assess hallux valgus severity including hallux valgus angle (standard vs point method), intermetatarsal angle, interphalangeal angle, bony hypertrophy of median eminence, axial rotation and degree of lateral subluxation of the fibular sesamoid. Current surgical corrective procedures including arthrodesis (1st MTP or 1st TMT joints) vs periarticular osteotomy (chevron, base wedge or scarf osteotomies). Interobserver reliability of pre- and post-surgery radiographic measurements and their utility. Evaluate change in radiographic measurements before and after various surgical corrections at different intervals and among different treatment methods. Post-operative case examples with parameters used to assess correction of hallux valgus and failure of correction. Examples of post-surgical complications including hardware issues, non-union, infection and soft tissue injuries will be shown.
How to Fix the Ring? Imaging Role in Deciding the Best Surgical Technique for Pelvic Ring Fracture Fixation

All Day Room: MK Community, Learning Center

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Review mechanism, classification, and imaging findings of pelvic ring fractures. Describe how imaging guides surgical technique for pelvic ring fracture fixation. Review imaging findings of postoperative pelvic ring fracture fixation.

TABLE OF CONTENTS/OUTLINE
Background
Pelvic fractures often result from high-energy trauma. Long-term, patients frequently suffer from chronic pain and poor functional outcomes, which can be exacerbated by inadequate fracture reduction. Classification of pelvic ring fractures: Young and Burgess is the most common system for classifying pelvic ring fractures clinically and incorporates mechanism of injury to determine stability of the pelvic ring. While the Young and Burgess classification is based on radiographs, CT provides greater detail of fractures which can guide surgical technique. Surgical goals and techniques: Operative management generally reserved for unstable fractures. Goal is to provide stability to maintain reduction during healing to improve functional outcome. Surgical approach determined by stabilization of the anterior ring, posterior ring or both.

Conclusion
Understand mechanism and classification of pelvic ring fractures. Describe role of imaging in decision making of best surgical technique for pelvic fracture fixation and in postoperative 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/

Ali Guermazi, MD, PhD - 2012 Honored Educator
Morel-Lavallee Lesions: A Review of Cross-sectional Imaging Features and Differential Diagnostic Considerations

All Day Room: MK Community, Learning Center

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TEACHING POINTS
1. To gain a better understanding of the pathogenesis, clinical presentation and most common sites of involvement associated with Morel-Lavallee lesions. 2. To recognize the associated typical CT, MRI and sonographic imaging features and to become familiarized with the MRI classification system. 3. To understand the clinical management pathways as well as to appreciate potential complications including superinfection and dermal necrosis. 4. To appreciate the differential diagnostic imaging considerations, including necrotic soft tissue primary neoplasms and hemorrhagic bursitis.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of Morel-Lavallee lesions, most common distribution and clinical presentation Imaging features ultrasound CT MRI MRI classification system, types 1-6 Differential diagnostic imaging considerations Management options and strategies Complications Summary
Common Mistakes and Practical Tips in Dual X-ray Absorptiometry (DXA): A Case-based Review with Clues to Improve Performance

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS
• To review dual-energy X-ray absorptiometry (DXA) studies in the evaluation of osteoporosis.
• To analyze the most frequent pitfalls in DXA imaging providing a case-based review of common and uncommon mistakes, artifacts that influence BMD measurement and incidental detection of pathology. • To illustrate helpful tips emphasizing how to avoid artifacts in order to improve performance in DXA exams.

TABLE OF CONTENTS/OUTLINE
We present a review of dual-energy X-ray absorptiometry (DXA) basics, clinical use, image acquisition, analysis, interpretation, parameters to be determined, and pitfalls. We describe the different steps in DXA study: Patient positioning, image acquisition and interpretation. Case-based examples will be used to illustrate how a pitfall may influence on data obtained from DXA image. Frequent pitfalls and tips for their solution will be highlighted. The list of cases includes: an incorrect patient positioning, pitfalls artifactually influencing measurements: foreign bodies, bone diseases (fractures, osteoarthritis, tumors, Paget's disease), soft tissue lesions. Artifacts not influencing measurements and lesions incidentally detected will also be presented. Recommendations for reporting, including artifacts description and evaluation will also be provided.
Radiographic, MDCT and MRI Imaging Features of Avulsion Fractures of the Knee: A Review of the Pathophysiology and Prognostic Implications

All Day Room: MK Community, Learning Center

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TEACHING POINTS

The purpose of this exhibit is to: review the radiographic and MDCT imaging features of potential avulsion fractures occurring at the knee to explain the commonly associated vectors of traumatic force and discuss the most frequently associated secondary soft tissue injuries to present MRI imaging correlates of the avulsion fractures and illustrate the associated typical patterns of potential internal derangement to discuss the clinical management and implications for patient care in the event of fracture non-recognition.

TABLE OF CONTENTS/OUTLINE

introduction acl avulsion Meyers Mckeever classification pcl avulsion segond fracture reverse segond fracture arcuate complex avulsion iliotibial band avulsion posterior capsular avulsion quadriceps tendon avulsion patellar sleeve avulsion tibial tubercle avulsion Watson-Jones classification osteochondroses Sinding-Larsen-Johansson syndrome Osgood-Schlatter disease Summary
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TEACHING POINTS
To explain indications for specific radiographic views. To discuss how specific radiographic views are obtained. To recognize specific structures on special radiographic views.

TABLE OF CONTENTS/OUTLINE
For each of the special views below, we will: Explain indications for these specific views. Describe how these views are obtained. Demonstrate anatomic landmarks on these views.
Cervical Spine Swimmer's view  Fuchs view  Chest Serendipity view  Sternum view  Shoulder Transcapular view  Grashey view  Axillary view  Semi axial view  Transthoracic view  Wrist Carpal tunnel/ Hamate view  Radial deviation view  Ulnar deviation view  Clenched fist view  Knee Tunnel view  Patella/Skyline view  Ankle and Foot Stress view  Canale view  Sesamoid view

All Day Room: MK Community, Learning Center

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TEACHING POINTS
High spatial resolution magnetic resonance imaging (MRI) using three-dimensional (3D) sequences and radial reformation images are useful for evaluating acetabular labral injury and femoroacetabular impingement (FAI). As atrophy of the obturator and adductor muscles influences the functional prognosis of patients after total hip arthroplasty (THA), high spatial resolution MRI with fewer metal artifacts is also useful for evaluating atrophy of those muscles. We demonstrate the utility of radial reformation images using 3D multiple echo gradient echo (GRE) for evaluating labral injuries, FAI and other hip joint abnormalities, and show 3D cube proton density images (PDI) of muscle atrophy after THA.

TABLE OF CONTENTS/OUTLINE
The comparison of 2D radial scans (T2- and T2*-weighted images) and radial reformation of 3D multiple echo GRE scan Differences in reformation techniques of 3D multiple echo GRE imaging for evaluating acetabular labral injury and FAI 3D PDI and curved reformation for evaluating postoperative muscle atrophy Representative cases Labral injuries and tears FAI (cam, pincer, and combined cam and pincer types) Other hip joint abnormalities (osteoarthritis, avascular necrosis, herniation pit, etc.) Evaluation of muscle atrophy after THA by comparison with preoperative images
Peripheral Nerve Imaging of the Upper Extremity Using MR and Ultrasound

All Day Room: MK Community, Learning Center

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TEACHING POINTS
1. Familiarize the viewer with the anatomy of the peripheral nervous system in the upper extremity using MR and ultrasound.
2. Familiarize the viewer with causes of peripheral neuropathy in the upper extremity including clinical presentation and appearance on MR and ultrasound.
3. Familiarize the viewer with the use as well as the drawbacks of MR and ultrasound in the evaluation of the peripheral nervous system of the upper extremity.

TABLE OF CONTENTS/OUTLINE
1. Clinical impact of upper extremity peripheral neuropathy including prevalence, most common presentations, and a brief overview of electromyography and nerve conduction studies.
2. Atlas of the anatomy of the peripheral nerves of the upper extremity, specifically addressing the brachial plexus, median, ulnar, radial, and posterior interosseous nerves with MR and ultrasound correlates.
3. MR and ultrasound imaging techniques used to evaluate the peripheral nervous system highlighting the benefits and drawbacks of the respective modalities.
4. Cases of peripheral neuropathy in the upper extremity diagnosed using MR and ultrasound.
MR Imaging of Ankle Arthroplasty Implants

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
To apply basic optimization and advanced techniques for metal artifact reduction MRI of ankle arthroplasty implants including MAVRIC and SEMAC algorithms
To review the different FDA-approved ankle arthroplasty implant and their normal MRI appearances
To understand and diagnose the modes of failures of ankle arthroplasty implants using MRI
To utilize a systematically-arranged check list for structured reporting

TABLE OF CONTENTS/OUTLINE
Epidemiology and types of FDA-approved ankle arthroplasty implants
Optimization strategies for MR imaging of ankle arthroplasty implants
Multi-parametric metal artifact MRI protocols including dynamic and delayed contrast enhancement using conventional fast spin echo, MAVRIC and SEMAC pulse sequences
Types and frequency of modes of failure of ankle arthroplasty
Normal MRI appearances and MRI diagnosis of complications: Implant integration: Biological and cement fixation, fibrous membrane formation, bone resorption and osteolysis
Bone: progressive osteoporosis, implant subsidence, osseous stress reaction and focal overload, fracture, osteonecrosis
Synovium: non-specific synovitis, wear-induced synovitis, infection, arthrofibrosis
Impingement syndromes
Sagittal implant alignment
Musculotendinous abnormalities
Neurovascular compromise
1. Anterior shoulder dislocations with bipolar bone loss are common and should be carefully quantified. Bipolar bone loss can result in recurrent shoulder instability and engaging Hill Sachs lesions. Determination of whether a Hill Sachs lesion is on or off the "glenoid track" can predict whether future engagement may occur. The radiologist's role is to calculate the degree of bone loss and report if a Hill Sachs lesion is on or off the glenoid track. This determination helps the orthopedic surgeon predict if primary capsuloligamentous repair is likely to succeed in preventing future instability or if further surgery such as a remplissage or Latarjet procedure may be necessary.

TABLE OF CONTENTS/OUTLINE

1. Overview of anterior shoulder instability and the concept of bipolar bone loss. Historical context of experiments aimed at determining the size of the glenoid track. How to calculate the glenoid track and to determine if a Hill Sachs lesion is on or off the track by CT and MR. Review of data suggesting surgical management based on these measurements. Example Cases.
Sonography of the Radial Nerve: From the Top to the Bottom

Awards
Cum Laude

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TEACHING POINTS

The Radial Nerve is the biggest terminal branch of the posterior secondary trunk of the Brachial Plexus and the major nerve for extension and supination at the upper extremity. The Radial Nerve can be visualized using the "elevator technique" high resolution ultrasonography from the neck to the hand. Ultrasonography of the Radial Nerve must explore five targets levels: axillary, humeral shaft, elbow, forearm, wrist. Three anatomic levels are particularly subject to pathologic conditions: humeral shaft (muscular trauma in bodybuilder, fractures, lengthening osteotomies, osteosynthesis, thoracic surgery...), elbow (capitellum or radial head fractures, arthritis, masses, haematoma, vascular variations...) and wrist (trapeziectomy, radius fractures, Wartenberg syndrome, local infiltrations, venous punctures...) Denervation findings may be evaluated by comparison with contralateral normal side.

TABLE OF CONTENTS/OUTLINE

Ultrasound and MRI Evaluation of Lower Extremity Nerve Pathology

All Day Room: MK Community, Learning Center

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Adam D. Singer, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Teaching Point 1: Neuroma-in-continuity represents the end result of nerve injury with disorganized nerve regeneration, nerve fascicle hypertrophy, and fibrosis. Ultrasound and MR findings include ball-shaped mass with nerve continuity on both sides of the affected nerve segment. T2-hyperintensity of the affected nerve with variable enhancement on post-contrast MR images is also often seen. Teaching Point 2: End-bulb neuroma occurs when a nerve is completely divided and unopposed by adjacent neural tissue. MR findings include T2 hyperintense ball-shaped mass at the nerve end without distal continuity. Teaching Point 3: Plexiform neurofibroma along a major peripheral nerve is a hallmark musculoskeletal manifestation of Neurofibromatosis 1, identified as diffuse long-segment involvement of multiple T2-hyperintense lesions with variable, heterogeneous enhancement on MR. Rapid growth or invasion of adjacent fat structures should raise concern for transformation to malignant peripheral nerve sheath tumor (MPNST).

TABLE OF CONTENTS/OUTLINE

Dye Don’t Lie: Pearls and Pitfalls of Fluoroscopic Foot and Ankle Injections

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

Participants
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TEACHING POINTS

After reviewing this educational exhibit, the learner will be able to:
1. Discuss normal and variant anatomy
2. List which foot and ankle joints communicate
3. Review indications for diagnostic and therapeutic fluoroscopically guided foot and ankle injections
4. Compare efficacy of image-guided injections versus a blind approach
5. Detail joint-specific approaches for foot and ankle fluoroscopically guided injections, optimal patient positioning, pearls and pitfalls

TABLE OF CONTENTS/OUTLINE

Introduction/background-Indications for fluoroscopically guided foot and ankle injections-Radiologist’s role as a value adding consultant to the referring provider-Pre-procedural considerations/work-up including joint specific dose and formulations-Review of normal foot and ankle anatomy-Variant joint communications including congenital as well as post-traumatic/surgical-Joint based standard approach to foot and ankle injection including: Tibiotalar, tibiobular, posterior subtalar, calcaneocuboid, talonavicular, tarsometatarsal, and metatarsophalangeal joints-High yield “pearls” for challenging to access articulations including case based tutorials/examples-The importance of setting expectations with the patient regarding procedural efficacy/outcomes-Summary
The Normal Subchondral Bone and Common Elementary Changes: High Resolution MRI and µCT with Macroscopic Anatomical Correlations in Resected Human Femoral Heads

Awards
Cum Laude

Participants
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TEACHING POINTS

Imaging features of the normal subchondral bone plate and adjacent trabecular bone and marrow are demonstrated with emphasis on artifacts at MRI. Elementary changes involving the subchondral area will be illustrated by using high resolution MRI and microCT images obtained on resected femoral head specimens, with macroscopic and microscopic correlations.

TABLE OF CONTENTS/OUTLINE

We will be using images obtained from high resolution imaging (high resolution MRI and micro-CT) of resected femoral heads. Table of content 1- Anatomy of the normal osteochondral junction 2- Imaging features of the subchondral bone plate in normal conditions 3- Subchondral bone sclerosis 4- Subchondral bone cysts 5- Bone marrow edema 6- Subchondral fractures 7- Subchondral osteonecrosis
A PCL at the PCL: A Pretty Complete Look at the Posterior Cruciate Ligament

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS

The purpose of this exhibit is: To review the function and normal appearance of the PCL by magnetic resonance imaging. To examine the mechanisms that lead to acute PCL injury. To describe the magnetic resonance imaging features of complete and partial tears of the PCL. To learn the incidence of concomitant ligamentous, meniscal, myotendinous, and osseous injuries in the setting of acute PCL tear.

TABLE OF CONTENTS/OUTLINE

PCL Structure & Function Normal anatomy Mechanical functionMechanisms of Acute Injury Direct tibial blow Pure hyperextension Valgus hyperextension Varus hyperextension Pivot shift Complex Mechanisms (Dislocation/valgus or varus with rotation) Magnetic Resonance Imaging Features of PCL & PCL Tear Normal PCL appearance Complete tear Partial tearMimics of PCL Tear Mucoid degenerationConcomitant Knee Injuries Associated with Acute PCL Tear Ligaments Menisci Tendons Muscles Fractures Osseous Contusions
Articular Accumulation - Musculoskeletal Findings of Deposition Diseases

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS

Identify a systematic approach to articular diseases. Describe imaging findings of select articular deposition diseases.

TABLE OF CONTENTS/OUTLINE

Systematic approach to articular diseases. Radiographic features Joint space narrowing, erosion, bone production, soft tissue swelling or calcification, subluxation, mineralization, and calcification Magnetic Resonance Imaging features Signal characteristics Synovitis Erosions Distribution Carpal bones or phalangeal Metatarsals or tarsals Knee compartments Hip joint space loss Superolateral, medial and axial migration Glenohumeral Joints SI Joints Spine Describe and illustrate key features and distribution of articular deposition diseases. Gout Calcium Pyrophosphate Dihydrate Crystal Deposition Disease (Pseudogout) Hydroxyapatite Deposition Ochronosis/Alkaptonuria Hemochromatosis Hepatolenticular Degeneration (Wilson Disease)
Awards
Cum Laude

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TEACHING POINTS
Coccidioidal infections are endemic in the Southwestern United States with a steady rise in incidence in recent years. While most infections are asymptomatic, a minority cause varying degrees of respiratory disease, and a smaller minority cause extrapulmonary manifestations, commonly involving the musculoskeletal system. With increasing incidence and increased amount of travel to endemic areas, coccidioidal infections can be seen in patients throughout the United States and internationally. The aim of this exhibit is to characterize common appearances of musculoskeletal coccidioidal lesions to help the radiologist consider the diagnosis, and discuss distinguishing features from other infections and tumors.

TABLE OF CONTENTS/OUTLINE
Background of *Coccidioides immitis* and *posadasii* Risk factors for disseminated Coccidioides Common imaging characteristics of musculoskeletal Coccidioides, including radiographic, CT, MRI and nuclear medicine appearances Differential diagnosis and differentiating features Treatment options
Systematic Approach to Bone Tumors of the Pelvis and Hip: An Imaging Gallery

All Day Room: MK Community, Learning Center

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TEACHING POINTS
To illustrate the imaging spectrum of benign and malignant tumors of the pelvis and hip and its differential diagnosis. To determine key features on conventional radiographs, computed tomography (CT) and magnetic resonance (MR) to make a correct diagnosis.

TABLE OF CONTENTS/OUTLINE
Tumors and pseudo-tumors of the pelvis and hip have specific differences with those arising in other parts of the body. Pelvic tumors locate deeper and are larger than those in the extremities and patients are usually older. The majority of tumors in the pelvis are malignant while those in the proximal femur are in the majority benign. Diagnosis of osseous lesions relies on conventional radiographs, CT and MR. CT is superior to MR in assessing matrix and periosteal mineralization and cortical destruction. MR is of choice to characterize and stage bone tumors. Our aim is to evaluate the efficacy of conventional radiographs, CT and MR in the diagnosis and management of bone tumors. 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: fibrous dysplasia, aneurysmal bone cyst, giant cell tumor, osteoid osteoma, chondrosarcoma, Ewing tumor, osteosarcoma, chordoma, lymphoma, multiple myeloma and metastases.
Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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TEACHING POINTS
1. Review of normal muscle anatomy and biomechanics is useful in predicting its imaging patterns and appearance. 2. Classification of muscle abnormalities based on these imaging patterns can aid in avoiding diagnostic pitfalls and delays.

TABLE OF CONTENTS/OUTLINE
Review muscle anatomy as it pertains to imaging appearance
Describe basic patterns of traumatic muscle injuries, highlighted with examples using a multimodality approach:
- Edema
- Muscle strain
- Anatomic/architectural distortion
- Contusion or hemorrhage Mass-like appearance
- Myositis ossificans (MO)
- Muscle herniation
- Atrophy
- Site specific injuries: Novel lesion of the infraspinatus muscle
- Degloving injury of the rectus femoris
- Pectoralis muscle tear
- Internal oblique muscle
- Hamstring muscle(s)
Participants
Sangam G. Kanekar, MD, Hummelstown, PA (Presenter) Nothing to Disclose

TEACHING POINTS
To review the imaging findings of various acute and chronic spinal manifestation and complications in the various hematological disorders.

TABLE OF CONTENTS/OUTLINE
Spinal complications in the course of hematologic disease are frequent and varied. Early diagnosis of these complications is very vital for better neurological outcome. For better understanding of the disease process we categorized our data into following categories: 1) RBC disorders: Fe++/Vit B12 def, polycythemia vera, thalassemia, sickle cell disease, 2) Proliferative disorders: leukemia, lymphoma, myelomatosis, 3) Hemorrhagic disorders: hemophilia, VIII def, DIC, TTP, thrombocytopenia, Hemolytic uremic syndrome, 4) Coagulation disorders: antiphospholipid antibody syndrome, hereditary thrombophilia, homocystinemia, 5) Hematological malignancy.
Skeletal Manifestations of Tumors of Hematopoietic and Lymphoid Tissues

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
- To review normal hematopoietic differentiation as a background for discussion of hematopoietic and lymphoid tumors
- To discuss normal bone marrow composition and its appearance on imaging studies
- To discuss the clinical, epidemiological, and imaging features of myeloid neoplasms, lymphoid neoplasms and histiocytic neoplasms as they relate to the musculoskeletal system

TABLE OF CONTENTS/OUTLINE
- Introduction
- Normal hematopoietic differentiation
- Normal marrow composition and imaging appearances
- Diseases Overview and classification Myeloid neoplasms Lymphoid neoplasms Histiocytic and dendritic cell neoplasms
The differential diagnosis is broad for lytic lesions involving the posterior elements of the spine. These include benign and malignant primary bone tumors, and metastatic lesions. The goal of this educational exhibit is to help the radiologist become more familiar with the clinical presentation, radiographic appearance, and pathological findings of the different lesions.

**TABLE OF CONTENTS/OUTLINE**

There are a number of lytic lesions that can involve the posterior elements of the spine, which can be differentiated by a combination of clinical, radiographic, and pathologic findings. Often the differential can be narrowed by using a combination of demographics, clinical presentation, and radiographic appearance. Case examples will be presented in a question-and-answer format to provide the viewer with an active and engaging format for learning about various lesions. Examples include aneurysmal bone cyst, giant cell tumor, osteoid osteoma and osteoblastoma, osteochondroma, hemangioma, chordoma, chondrosarcoma, osteosarcoma, eosinophilic granuloma, multiple myeloma, and various metastatic lesions.
Body MRI of the Pelvis: What the Musculoskeletal Radiologist Needs to Know

All Day Room: MK Community, Learning Center

Participants
Richard L. Barger JR, MD, Painesville, OH (Presenter) Nothing to Disclose
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Ravi Guttikonda, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. After viewing this exhibit, the learner should have a better understanding of the types of intrapelvic pathology that may be present on MRI scans of the pelvis or hip, performed primarily for the purpose of assessing musculoskeletal pathology, that may be incidental and/or may be the source of the clinical complaint of the patient.  
2. The learner should be better aware of the pitfalls inherent in MRI examinations protocled to assess musculoskeletal structures.  
3. The learner should be able to use an organ systems based algorithmic approach to formulate a differential diagnosis and recommendations for intrapelvic pathologies that one may encounter that fall outside the rubric of musculoskeletal pathology.

TABLE OF CONTENTS/OUTLINE
I. Introduction
II. MRI Sequences
   A. Typical MR sequences used in musculoskeletal MRI
   B. Typical MR sequences used in pelvic MRI
   C. Pitfalls in musculoskeletal MRI based on limitations of typical utilized sequences
III. Organ systems
   A. Gastrointestinal imaging in the pelvis
      1. Appendix
      2. Colon
      3. Anorectal
   B. General urinary tract
      1. Bladder
      2. Ureters
   C. Male genitourinary tract
      1. Prostate
      2. Penoscrotal
   D. Female Genitourinary
      1. Ovaries and Adenxa
      2. Uterus
      3. Cervix and Vagina
      4. Vulva
   E. Vascular
      1. Arterial
      2. Venous
IV. Conclusion
V. References
DIXON Sequence: Technical Adjustments and Clinical Applications Focused on the Musculoskeletal System

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

Participants
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TEACHING POINTS
To explain the technical basis, and the optimization of DIXON sequence for musculoskeletal applicationsTo compare its performance with other fat suppression techniques. To review with clinical cases its potential applications in the musculoskeletal system.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Physical basis of 2D, 3D and multipoint Dixon
3. Sequence design for musculoskeletal system- GE and TSE sequences- T1-weighted sequences- T2-weighted sequences
4. Derived images and quantitative information- Chemical-shift imaging- Water-only images- Fat-only images- Quantification of fat fraction
5. Comparison to other fat suppression techniques- STIR/SPIR/SPAIR
6. Clinical applications- Bone Marrow: Detection of true substitution of normal marrow, Tumor detection, Define intramedullary tumor extent Biopsy targeting of bone tumors Therapy monitoring of bone tumors Osteoporotic vs malignant vertebral facture Stress fracture Osteomielitis Soft tissue: Tumor characterization Trauma- Joints and tendons: Degenerative pathology Inflammatory disorders Whole body applications: Staging of multiple myeloma Metastasis detection and therapy monitoring Fat quantification
8. Conclusion
Awards
Certificate of Merit

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TEACHING POINTS
To define the concept of meniscal implant and allograft transplantation, their clinical indications and contraindications and the surgical technical aspects. To highlight the presurgical information needed for surgery focused on conventional and advanced MRI techniques. To describe their postsurgical appearance with MRI

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Meniscal implant-Definition-Types: meniscal allograft: fresh, fresh-frozen, cryopreserved and lyophilized-Surgical techniques-Clinical indications
3. Meniscal allograft transplantation-Definition-Types: permanent and resorbable scaffolds, the most common are collagen and polyurethane types-Surgical techniques-Clinical indications
4. Presurgical imaging assessment- X-ray-MRI: morphological sequences, T2 mapping, mDixon, DWI and Magnetization Transfer
5. Postsurgical assessment- MRI protocol-Differentiate normal from pathological appearances
6. Complications- Due to surgical intervention: neurovascular lesions and infection-Due to allograft transplantation: immune response and disease transmission- Others: unaccurate patient selection, unaccurate size of the implant, malpositioning of the bone anchors, persistent joint pain, progression of degenerative joint disease, reruptures, graft shrinkage, and extrusion
7. Conclusions
Musculoskeletal Metastases Secondary to Melanoma: A Pictorial Multimodality Imaging Review With Pathological Correlation

All Day Room: MK Community, Learning Center

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Josima A. Luchsinger Heitmann, Madrid, Spain (Presenter) Nothing to Disclose
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Constanza Martinez, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The learning objectives of this exhibit are: Illustrate the spectrum of imaging features in musculoskeletal melanoma metastases in plain x-rays, computerized tomography, magnetic resonance imaging and PET/CT. Compare radiological findings with underlying histological samples when available.

TABLE OF CONTENTS/OUTLINE
Physiopathology of melanoma, including demographics. Review of common imaging findings in musculoskeletal disease secondary to melanoma: Plain x-ray, CT, PET/CT and MRI, and when available their pathological correlation as the findings are often unspecific. As skeletal muscle melanoma metastases and solitary melanoma metastases are unusual, we provide the reader with unique cases and their histological slides that affect the axial skeleton (vertebral pedicle) and appendicular skeleton (knee, calcaneus, toe) as well as other peculiar manifestations, such as diffuse musculoskeletal disease. Conclusions: Patients diagnosed with metastatic disease secondary to melanoma must be evaluated using a multiple imaging modalities for diagnosis and treatment planning. This teaching exhibit gives an overview of the wide spectrum of radiological patterns and underlying histopathologic changes.
The MSK Radiologist and Orthopedic Surgeon Tag Team: A Survey of MSK Imaging Training Amongst Orthopedic Surgeons

All Day Room: MK Community, Learning Center

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TEACHING POINTS
1. The MSK radiologist and orthopedic surgeon are an integral team to providing the best possible orthopedic care for patients.  
2. Imaging training amongst orthopedic surgeons is highly variable. Knowledge of the various facets of orthopedic surgeon imaging training is helpful for the MSK radiologist.  
3. Results of this survey can help both radiology and orthopedic residency programs better identify standards of practice.

TABLE OF CONTENTS/OUTLINE
1. Purpose and Background Goal of project is to survey orthopedic surgeons and determine level of MSK training they receive during residency. Survey is done to assess orthopedic surgeon level of imaging training, which will help future collaboration between surgeons and MSK radiologists to help orthopedic patient care.  
2. Survey Analysis List of survey questions Graphs / charts of survey responses Analysis of survey responses  
3. Conclusions Most orthopedic surgeons felt an MSK radiologist read their cases was beneficial to their education and their practice. A majority of orthopedic surgeons were not provided formal training in radiation safety or physics. Most orthopedic surgeons desired more formal training in ultrasound. Knowledge of these survey results can help training programs in radiology and orthopedic surgery better establish standards of practice.
**MK134-ED-X**

**Multimodality Imaging of Bone Lesions of the Spine: Pearls and Pitfalls**

All Day Room: MK Community, Learning Center

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**TEACHING POINTS**

To illustrate key findings in conventional radiography, computed tomography (CT) and magnetic resonance (MR) imaging in degenerative, infectious, traumatic, tumor and idiopathic diseases (Paget’s disease) and its differential diagnosis. To remark the specific contribution and indication of each technique and show diagnostic difficulties and potential pitfalls.

**TABLE OF CONTENTS/OUTLINE**

The increasingly greater life expectancy of the population has raised the number of adults with a previous history of cancer, osteoporosis, prolonged use of corticosteroids or immunosuppression due to chemotherapy or to a chronic illness that suffer back pain. In these patients CT or MR are indicated mainly to rule out metastases or spinal infection. In many cases back pain is due to concomitant age-related pathology such as degenerative disk disease. Our aim is to show the specific imaging features of bone lesions of the spine and to evaluate the efficacy of conventional radiographs, CT and MR in its diagnosis and management. We show key findings at each modality with emphasis on potential pitfalls, diagnostic difficulties and differential diagnosis. Specific topics addressed include: Modic changes, infectious spondylodiskitis, inflammatory changes, Paget’s disease, metastases, myeloma, lymphoma and primary bone tumors.
Clinical Assessment and Imaging of Distal Radioulnar Joint Instability

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Mihra S. Taljanovic, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:
1. To demonstrate clinical exam of the distal radioulnar joint (DRUJ)
2. To show normal anatomy of the distal DRUJ on radiographs, computed tomography (CT), ultrasound (US), arthrography, magnetic resonance (MR) imaging
3. To demonstrate multimodality imaging findings of DRUJ instability secondary to traumatic and various pathologic conditions including but not limited to degenerative joint disease, inflammatory, metabolic and infectious arthritides, and tumor and tumor-like conditions
4. To discuss current treatment options for DRUJ instability in appropriate clinical settings.

TABLE OF CONTENTS/OUTLINE

1. Distal radioulnar joint anatomy
   - Radiographs
   - CT
   - US
   - Arthrography
   - MRI
2. DRUJ instability
   - Traumatic
     a.Characteristic imaging findings related to fracture, fracture/dislocation, and involvement of capsuloligamentous structures and/or triangular fibrocartilage complex (TFCC).
     b. Sample cases
       - Degenerative
       - Inflammatory/Metabolic/infectious
       - Neoplastic
3. Review treatment options
   - Sample cases
4. Summary

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/

Mihra S. Taljanovic, MD - 2016 Honored Educator
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TEACHING POINTS
1. Review of normal muscle anatomy and biomechanics is useful in predicting its imaging patterns and appearance. 2. Classification of muscle abnormalities based on these imaging patterns can aid in avoiding diagnostic pitfalls and delays.

TABLE OF CONTENTS/OUTLINE
Review muscle anatomy and biomechanics as it pertains to its imaging appearance. Describe basic patterns of non-traumatic muscle injuries, highlighted with examples using a multimodality approach: Edema Muscular dystrophy Inflammatory myopathy Denervation Vasculitides Myositis (e.g. radiation, drug-induced, collagen-vascular disease, HIV/AIDS) Necrotizing fasciitis Mass-like Intramuscular HADD Accessory muscle Atrophy
Brachial plexus anatomy can be easily identified on MRI by remembering the five plexus segments and the anatomic landmarks delineating them. Sagittal images are best to assess the relationship between a plexus lesion and the neurovascular bundle. Coronal images with a large field of view allow for comparison of signal intensity, size, and enhancement of the affected side with the contralateral plexus. MRI of traumatic brachial plexus injury can differentiate between preganglionic or postganglionic lesions, with several indirect signs indicating postganglionic injury. In thoracic outlet syndrome, neurovascular compression is best demonstrated on MRI with the arm in abduction-exorotation; disappearance of the fat surrounding the brachial plexus and close contact with the adjacent bony structures are signs of neurologic compression. Intrinsic neurogenic tumors are more seen in young patients, while extrinsic malignancies are the most common cause of non-inflammatory plexopathy in adults. Radiation fibrosis can be hard to differentiate from metastatic disease.

TABLE OF CONTENTS/OUTLINE

1. Anatomy of the brachial plexus
2. MRI Imaging anatomy Normal nerve signal intensity Protocol
3. Pathology Trauma Thoracic Outlet Syndrome Tumor Inflammation Radiation-induced Plexopathy
4. Advanced MRI
5. Conclusion
**Imaging of Below the Knee Amputation: Expected Post-operative Appearance and Potential Complications**

All Day Room: MK Community, Learning Center

**Awards**

Cum Laude

**Participants**

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John S. Reid, MD, Hershey, PA (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

To review the indications and common techniques for below the knee amputation, including expected post-operative imaging appearance. To understand the potential complications of below the knee amputation and accompanying radiologic findings.

**TABLE OF CONTENTS/OUTLINE**

Background  
Evolution of techniques for below the knee amputation  
Indications: Vascular, Infection, Trauma, Tumor, Congenital  
Contraindications  
Common Techniques for Below the Knee Amputation: Standard Burgess, Ertl and Modified Ertl  
a. Theory  
b. Brief surgical description  
c. Advantages and disadvantages  
   Expected Post-operative imaging appearance  
Potential Complications: Aggressive Bone Edge, Heterotopic Ossification, Neuroma, Adventitial bursitis, Infection
**Ultrasound and MR of the 1st Metatarsophalangeal Joint: Anatomical Correlation, Findings in Volunteers, and Pathological Findings**

**Awards**
Certificate of Merit

**Participants**
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- Maryam Shahabpour, MD, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
1. The ligaments, tendons, and muscles of the first MTP joint are well depicted on 3T MRI and high resolution ultrasound images.
2. Understanding the complex anatomy is essential for interpretation of first MTP joint pathology.
3. The anatomy of the plantar plate is considerably different from that at the lesser toes.

**TABLE OF CONTENTS/OUTLINE**

Seven fresh cadaveric feet were imaged with 3T MRI, using proton density weighted sequences, and high resolution ultrasound, using an 18 MHz probe. Four embalmed feet were dissected. The specimens were sliced with a band saw, while deep frozen (2 in coronal, 1 in sagittal, and 1 in transverse plane). Two specimens were dissected. Ultrasound and MRI images were obtained in 5 volunteers. Case examples of first MTP joint pathology were compiled to help illustrate key anatomic structures.

**Results**
The following structures could be well assessed with ultrasound and MRI:
- abductor hallucis muscle and tendon
- adductor hallucis (oblique and transverse head)
- flexor hallucis brevis (2 heads)
- extensor hallucis brevis and longus and sling
- intersesamoid ligament
- sesamoidophalangeal ligament
- sesamoidometatarsal ligament
- collateral ligaments
- joint recesses.
Musculoskeletal Applications of Bone Marrow Derived Mesenchymal Stem Cells

All Day Room: MK Community, Learning Center

Participants
Elisabeth R. Garwood, MD, New York, NY (Presenter) Nothing to Disclose
Christopher J. Burke, MBChB, New York, NY (Abstract Co-Author) Nothing to Disclose
Ronald S. Adler, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To understand the biology, existing literature, regulatory considerations and interventional musculoskeletal applications of stem cells with an emphasis on bone marrow derived mesenchymal stem cells. 2. Describe percutaneous ultrasound guided technique for the administration of bone stem cells in the outpatient setting and our clinical experience.

TABLE OF CONTENTS/OUTLINE
A Radiologist's Guide to Evaluate Wrist Alignment: The Good, Bad and Ugly

All Day Room: MK Community, Learning Center

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TEACHING POINTS

Evaluate adult wrist alignment on radiographs, specifically the distal radioulnar joint, carpal bones, and carpometacarpal joints. Discuss developmental and congenital variants that alter normal wrist alignment and their potential osteoarticular complications. Review classification of carpal instability. Illustrate traumatic and non-traumatic disorders that cause wrist malalignment.

TABLE OF CONTENTS/OUTLINE

Normal wrist alignment: Distal radius, ulna and radioulnar joint: ulnar variance, radial inclination, radioulnar angle; volar tilt. Carpal bones: carpal translation, Glula carpal arcs, carpal height ratio, scapholunate distance, pisotriquetral alignment; carpal axes, carpal angles (radiolunate, scapholunate, capitohumate, lunotriquetral) Carpometacarpal (CMC) joints: "M" configurationVariants that alter wrist alignment and complications: negative ulnar variance/Keinboch's disease; positive ulnar variance/unocarpal abutment; type 2 lunate/lunohamate abutment; carpal coalition.Classification of carpal instability: Type I-IVExamples of traumatic and non-traumatic disorders causing malalignment including: DRUJ injury, scapholunate dissociation and DISI, lunotriquetral dissociation and VISI, pisiform/lunate/perilunate dislocation, CMC fracture/dislocation, rheumatoid arthritis with carpal translation, Madelung deformity
Contrast Enhanced Ultrasound (CEUS) for Therapy Response Evaluation in Soft Tissue Sarcomas

All Day Room: MK Community, Learning Center

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS
1. Technique of contrast enhanced ultrasound (CEUS)
2. Typical CEUS enhancement patterns of soft tissue sarcomas (STS)
3. Quantitative evaluation of STS using CEUS
4. Response assessment to neoadjuvant chemotherapy (NAC) for soft tissue sarcoma (STS)
5. Pictorial cases where CEUS aids therapy monitoring and surveillance of STS

TABLE OF CONTENTS/OUTLINE

CONTENT ORGANIZATION
I. STS Background
II. CEUS scanning protocol
III. Limitations of conventional imaging response assessment criteria (such as RECIST) during NAC in STS
IV. Typical CEUS enhancement pattern of STS, with examples
V. Quantitative evaluation of STS using CEUS, including time-intensity curves (TIC)
VI. Utility CEUS in STS response assessment. Specifically,
   • STS often increase in size but demonstrate more necrosis during NAC, quantifiable by CEUS
   • CEUS does not affect kidneys, crucial in STS patients often receiving nephrotoxic NAC
VII. CEUS imaging examples with CT/MRI comparison

SUMMARY
1. Combined CEUS morphologic and perfusion information allows accurate assessment of STS
2. CEUS qualitatively correlates with standard of care CT /MR
3. CEUS also offers quantifiable metrics, including assessment of tumor necrosis, which change as STS undergo NAC
4. Quantitative CEUS data can be incorporated into clinical decision making
Analytical Triage in Bioarchaeological Samples through Osteological and Radiological Methods

All Day Room: MK Community, Learning Center

Participants
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Frank J. Ruhli, MD, PhD, Zurich, Switzerland (Abstract Co-Author) Institutional research contract, Siemens AG

TEACHING POINTS

Thorough osteological analysis of skeletal human remains in bioarchaeological contexts is necessary to assess burden of disease adequately.

If osteological analysis yields indeterminate results about burden of disease, a radiologist's analysis of a plain film is a vital means of increasing the precision of efforts to determine burden of disease in the past.

Analysis of disease in the past can shed light on epidemiological shifts in the burden of disease that continue to shape human health.

TABLE OF CONTENTS/OUTLINE

Overview of bioarchaeological analysis: methods and limitations.
Description of study population: an 18th-19th century collection of the skeletal remains of 224 individuals with historically verifiable age-at-death data.
Description of study methods: complete osteological analysis of each skeleton, and radiological analysis of tibiae, femora, pelvis, humeri, and cranium for each skeleton with sufficient bone available.
Results: correlation analyses and analysis of variance tests investigated the relationships between age, sex, and pathological conditions observed by osteological and radiological analysis.
Discussion: Radiological analysis is a vital tool for the thorough analysis of pathological conditions present in human remains, and it is especially useful when osteological findings are inconclusive.

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Ronald L. Eisenberg, MD, JD - 2012 Honored Educator
Ronald L. Eisenberg, MD, JD - 2014 Honored Educator
Awards
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TEACHING POINTS
This exhibit will review pelvis anatomy, improve detection of traumatic pelvic injuries, instruct on how to utilize mechanism of injury to predict the type of pelvic fracture, and educate regarding treatment of pelvic fractures. Improved detection of traumatic pelvic injuries can prevent delays in treatment that could result in long-term disability.

TABLE OF CONTENTS/OUTLINE
- Review of the anatomy and biomechanics of the osseous, myotendinous and ligamentous structures associated with the pelvis.
- Describe and illustrate the major patterns of injury include lateral compression, anteroposterior compression, vertical shear injury, or complex injury due to a combination of forces. A multimodality review will include radiographs, multiplanar reformatted CT, CT angiography and MRI.
- Discuss an approach to reporting pelvic trauma findings and emphasize pitfalls when reviewing these cases.
- Describe treatment options and their imaging appearance.
Macro Discordant: Key Pearls and Pitfalls of Musculoskeletal Tumor Interpretation Identified on Secondary Review of Cases Referred into a Tertiary Care Center

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
The purpose of this exhibit is: 1. To review categories of bone and soft tissue pathology prone to misinterpretation 2. To discuss imaging characteristics of the different entities which can help the radiologist make a more precise interpretation 3. To highlight what are the appropriate “next steps” for the radiologist to convey to the referring provider based on the imaging findings

TABLE OF CONTENTS/OUTLINE
1. Overview
2. Non-aggressive/Benign Lesions - Preventing Malignant Overcall
   - Intraosseous lipoma/ganglion cyst, bone island, degenerative disease, treatment changes (radiation osteonecrosis)
3. Spectrum lesions - Raising the Possibility of Malignant Transformation
   - Enchondroma
   - Osteochondroma
   - Lipoma vs. Atypical lipomatous tumor/Low Grade Liposarcoma
4. Joint-based Processes
   - Chronic inflammatory synovitis/synovial (osteochondromatosis, PVNS, malignant (osteosarcoma, lymphoma)
5. Trauma - subacute and chronic - mimics of malignant pathology
   - Stress fracture
   - Muscle strain
   - Hematoma
   - Myositis ossificans
6. Infection - osteomyelitis, septic arthritis
7. Soft tissue masses - characteristic features
   - Vascular malformation
   - Bursitis
   - Peripheral Nerve Sheath Tumor
   - Desmoid
Complications of Arthroscopic Surgery for Femoro-acetabular Impingement (FAI)

All Day Room: MK Community, Learning Center

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Participants
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TEACHING POINTS
1. Radiographs and MRI are used in combination to detect causes of pain and disability after hip arthroscopy. These include heterotopic ossification, cartilage damage, rapidly progressive osteoarthritis, stress fracture, adhesions, micro-instability or frank dislocation, recurrent labral tear, migration of hardware or psoas weakness.  
2. Understanding surgical techniques aids in detection of postoperative abnormalities.

TABLE OF CONTENTS/OUTLINE
I. Background: what is FAI? What are osteochondroplasty and rim trim? How is arthroscopy performed?  
II. What complications are reported? What is their prevalence? What is patient satisfaction?  
II. Surgical findings and imaging analysis of complications of surgery  
A. Normal postoperative findings  
B. Heterotopic ossification  
C. Chondrolysis and rapidly progressive OAD  
D. Instability  
E. Abnormalities of the psoas muscle and tendon
Revisiting Imaging Findings of Traumatic and Non-traumatic Brachial Plexopathies using 3T MRI Neurography

Participants
Isha D. Atre, MBBS, Mumbai, India (Presenter) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is: To understand the anatomy of the brachial plexus, the lesion site and localize the lesion as pre or post ganglionic. To evaluate the role of 3T MRI Neurography in identification and characterization of various brachial plexus pathologies. To gain awareness of imaging findings in traumatic and non-traumatic brachial plexus pathologies.

TABLE OF CONTENTS/OUTLINE

1. Imaging and Functional Anatomy of Brachial plexus- Roots, trunks, divisions and cords.
2. Imaging Technique:
   - Patient positioning
   - Equipment & scanning parameters
   - Image reconstruction
3. 3T Neurography Imaging findings in:
   [A] Preganglionic injury:
      1. Root avulsion.
      2. Pseudomeningocele
   [B] Postganglionic injury:
      1. Trunk / cord contusion / thickening neuropraxia with perineural scarring
      2. Partial neurotmesis with neuroma formation
      3. Complete laceration/neurotmesis.
      4. External compression due to hematoma/fracture.
   Nontraumatic cases:
      1. Primary neoplasm
      2. Secondary involvement by metastases.
      3. Radiation plexitis
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Participants
Carrie K. Gomez, DO, Rochester, NY (Presenter) Nothing to Disclose
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TEACHING POINTS

The sternoclavicular joint can be affected by different pathologies including trauma, osteoarthritis, infection, tumors and other entities such as osteitis condensans. Sternoclavicular dislocation represents 3% of the upper extremities dislocations with anterior dislocation being the most common. However, posterior dislocation can cause life-threatening injury given its proximity to major vessels. Septic arthritis of the sternoclavicular joint is rare. Early MR findings are effusion, widening of the joint space and mild cortical irregularity. Osteoarthritis is the most common cause of pain and most commonly affects the medial inferior clavicle. Syndrome of synovitis, acne, pustulosis, hyperostosis and osteitis (SAPHO) can lead to ankyloses of the sternoclavicular joint.

TABLE OF CONTENTS/OUTLINE

A Practical Guide to Evaluation of Total Knee Prosthesis: What to Look for in XR, CT and MRI

All Day Room: MK Community, Learning Center

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TEACHING POINTS
1- Review the role of imaging techniques (plain radiograph, CT and MR) in the evaluation of prosthesis. 2- Demonstrate the main angles and measurements used in the evaluation of prosthesis positioning, understand the usefulness and limitations of XR. 4- Illustrate normal and abnormal postoperative findings and complications in these modalities.

TABLE OF CONTENTS/OUTLINE
The number of total knee arthroplasties has increased every year. Despite the advances in surgical technique and in the components of the prosthesis, some patients develop complications. Knowledge the types of prosthesis and identify their most common appearances in XR, CT, MR, can help detect complications at earlier stages and improve outcomes. The objective of this paper is to guide for quick and practical evaluation total knee prosthesis and its major complications, to facilitate the daily practice of the radiologist.
How to Diagnose an Isolated Presacral Mass?

TEACHING POINTS

The purpose of this exhibit is: 1. To review the most common presacral masses. 2. To propose an algorithm to diagnose a presacral mass using imaging characteristics.

TABLE OF CONTENTS/OUTLINE

Anatomy of presacral space, Epidemiology, Others presacral masses, Isolated presacral masses - Cystic masses - Non cystic masses, Algorithm.
The purpose of this exhibit is:
1. Review the pathophysiology of peripheral nerve sheath tumors.
2. Discuss common clinical presentations and associated clinical syndromes.
3. Highlight distinguishing characteristics of peripheral nerve sheath tumor types.
4. Explain how MRI can complement sonographic findings in indeterminate lesions.
5. Relate imaging characteristics directly with pathology.

TABLE OF CONTENTS/OUTLINE

Overview and pertinent literature review
Pathophysiology of peripheral nerve sheath tumors
Review and relate imaging with pathology findings
- Ultrasound
- MRI
- General radiographs
- Gross pathology
- Histology
Illustrative cases
Management and outcomes
Summary
Integration of Cross-sectional Imaging in Diagnosis, Treatment Decision-making, and Therapy of Pudendal Entrapment versus Pudendal Neuralgia

All Day Room: MK Community, Learning Center

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TEACHING POINTS
The purpose of this review is to:1. Discuss the role of MRI in the diagnosis and management of pudendal neuralgia.2. Review pelvic floor anatomy on MRI and CT and recognize pathology involving the pudendal neurovascular bundle.3. Review imaging landmarks for treatments, namely CT guided injection or ablation of the pudendal nerve, and surgery for pudendal entrapment.

TABLE OF CONTENTS/OUTLINE
Definition of pudendal neuralgia-Clinical diagnostic algorithm-Physical examinationPudendal nerve anatomy-Sites of entrapmentUtility of MRI-MRI protocol-Atlas of normal findings and conditions frequently seen in patients with pudendal neuralgia-Using imaging findings for clinical guidance for surgical versus non-surgical treatment Treatment of pudendal neuralgia-Imaging guided interventions-Surgical decompressionFuture directions-MR neurography
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TEACHING POINTS
1. To review the functional anatomy of the forefoot and the changes associated with pathology. 2. To highlight the sonographic features of the common pathologies, with clinical and surgical correlation. 3. Suggest a dynamic sonographic approach and grading system

TABLE OF CONTENTS/OUTLINE
1. FUNCTIONAL ANATOMY 2. PATHOPHYSIOLOGY 3. CLINICAL FEATURES 4. SONOGRAPHIC FEATURES 5. PROPOSED GRADING SYSTEM 6. SURGICAL AND HISTOLOGICAL FEATURES 7. SAMPLE CASES WITH IMAGING PEARLS AND PITFALLS
TEACHING POINTS

• Understand the relevant anatomy of the acetabulum  
• Understand common types of trauma and injury patterns to the femoroacetabular joint  
• Understand the key findings that help the surgeon make a management decision

TABLE OF CONTENTS/OUTLINE

Acetabular fractures are usually seen in high energy trauma scenarios in-conjunction with pelvic fractures in younger patient’s and low energy falls in the elderly. Occult or missed fractures can be a cause of significant morbidity and potential mortality if not repaired in a timely manner and can lead to premature joint degeneration, osteoarthritis, reduced mobility or immobility. Clinically significant fractures extending to the articular surface can require either conservative management, open reduction and internal fixation with or without hip arthroplasty or percutaneous screw fixation. Accurate assessment of marginal impaction involvement, presence of incarcerated fragments, age and bone quality are essential factors in deciding optimal management. In addition, the importance of root of ramus fractures will be discussed with respect to pelvic ring stability. In this educational abstract we will discuss these factors using illustrated case examples, indicating the important features to emphasise to Orthopaedic colleagues.
*Food for Thought: Rice Bodies in Musculoskeletal Imaging*

All Day Room: MK Community, Learning Center

**Awards**

**Certificate of Merit**

**Participants**

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**TEACHING POINTS**

- The purpose of this exhibit is: To review imaging characteristics of rice bodies in diseases of the joints, bursae, and tendon sheaths
- To discuss the significance of rice bodies in musculoskeletal MRI

**TABLE OF CONTENTS/OUTLINE**

- Pathophysiology of rice bodies
- Review of imaging findings with sample cases and mimics
The Most Common Mistakes in Hip Magnetic Resonance Arthrography

All Day Room: MK Community, Learning Center

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TEACHING POINTS
It is well known that the main mistakes in hip MR arthrography are labral tears caused by variants of labrum and misinterpretation of chondral lesions. We reviewed 47 hip MR arthrograms performed between 2012 and 2015 in our institution, using arthroscopy as reference standard. The aim of this study is to show our more significant mistakes in order to help readers avoid images misinterpretation.

TABLE OF CONTENTS/OUTLINE
The list of cases we are presenting includes:
- Sublabral sulcus or labral tear? Sublabral sulcus may mimic a tear, however, it has linear shape, regular margins and has not associated perilabral cysts.
- Degenerative changes of labrum or labral tear? The labrum may show globular or linear internal hyperintensity, especially with age; these signal changes may also extend to labral margins mimicking a tear.
- Supraacetabular fossa or chondropathy? Supraacetabular fossa may be confused with focal chondropathy; it is commonly smooth and without subchondral bone edema.
- Ligamentum teres tear or normal ligamentum teres? The normal ligamentum teres may vary in thickness and T2 signal intensity in absence of pathological abnormalities; preoperative diagnosis of ligamentum tears is difficult also because there are not specific clinical test.
TEACHING POINTS

1) Radiographs are the initial imaging modality in the evaluation of cervical spine in patients with rheumatic diseases. 2) MRI of the cervical spine in Rheumatoid Arthritis (RA) and Spondyloarthritis (SpA) patients may identify signs of active inflammation, when radiographs are still normal. 3) Late stage complications of RA and SpA may cause spinal cord compression, which is better evaluated with MRI. 4) Crystal deposition arthritis of the cervical spine may be better characterized by CT.

TABLE OF CONTENTS/OUTLINE

Introduction. Rheumatoid arthritis: A) Early stage: MRI (synovitis, bone edema, erosions) and radiographic (erosions) findings. B) Advanced stages: atlantoaxial (AA) instability (anterior, vertical), subaxial instability and ankylosis, discussing the role of radiographs, CT and MRI. Spondyloarthritis: 1) Ankylosing spondylitis: A) Early stage: MRI (bone edema at vertebral corners, facet joint arthritis, enthesitis) and radiographic (erosion -Romanus lesion- and sclerosis of vertebral corners, vertebral squaring) features. B) Advanced stages: radiographic (syndesmophytes, disc ossification, facet joints ankylosis) and MRI (fatty corners, syndesmophytes, disc/facet joints ankylosis) findings. C) Complications: fracture of fused spine. 2) Psoriatic arthritis: distinctive imaging features (parasyndesmophytes, AA instability). CPPD arthropathy. Gout.
TEACHING POINTS
This study aims to discuss and illustrate the anatomy of the nail and the variety of subungual lesions in ultrasound (US). The purpose of this exhibit is:- To recognize characteristic imaging findings and anatomy of the normal nail apparatus.- To list and illustrate ultrasound techniques that may help reaching the correct characterization of the nails and its lesions.- To describe and keep in mind the major differential diagnosis of ungueal lesions.

TABLE OF CONTENTS/OUTLINE
More Than Just Bone Marrow Edema: Differential Diagnosis of Increased Signal Intensity in Bone Marrow Seen on Water-Sensitive MR Sequences

All Day Room: MK Community, Learning Center

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TEACHING POINTS
This study aims to demonstrate the changes of bone marrow (BM) signal, illustrating the main causes and highlighting important image aspects for its correct detection and characterization on magnetic resonance imaging (MRI). The purpose of this exhibit is:

To recognize characteristic imaging findings of the normal bone marrow signal intensity.
To illustrate the main image patterns of bone marrow edema.
To list and illustrate magnetic resonance sequences that may help reaching the correct diagnosis of increased signal intensity in bone marrow.
To describe and keep in mind the major differential diagnosis of increased signal intensity in bone marrow seen on water-sensitive MR sequences.

TABLE OF CONTENTS/OUTLINE
I. DEFINITIONS: BONE MARROW EDEMA x INCREASED SIGNAL
II. CAUSES OF BONE MARROW INCREASED SIGNAL: 1) REACTIVE MARROW EDEMA 2) BONE BRUISE 3) TRAUMATIC BONE FRACTURES 4) INSUFFICIENCY BONE FRACTURES 5) OSTEONECROSIS 6) INFECTION: SEPTIC JOINT, OSTEOMYELITIS, BRODIE ABSCESS 7) INFLAMMATORY: ARTHRITIS 8) NEOPLASMS 9) FIBROUS CORTICAL DEFECT 10) BONE ISLAND (ENOSTOSIS) 11) BONE CYSTS 12) VASCULAR ECTASIA 13) IDIOPATHIC TRANSIENT OSTEOPOROSIS 14) TRANSIENT BONE MARROW EDEMA 15) RED MARROW: ANEMIA / STEM CELL STIMULATION
*PITFALL: FAILURE OF FAT SUPPRESSION
III. DISCUSSION
IV. CONCLUSION
Awards
Certificate of Merit

Participants
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TEACHING POINTS
By completion of this educational exhibit, the learner will be able to: Describe the variety of clinical presentations of peripheral nerve tumors and tumor-like conditions. Understand the imaging approach and potential clinical applications of various imaging modalities in the evaluation of peripheral nerve tumors and tumor-like conditions. Recognize typical imaging findings of peripheral nerve tumors and tumor-like conditions.

TABLE OF CONTENTS/OUTLINE
Review of the clinical presentation and imaging approach of peripheral nerve tumors and tumor-like conditions. Illustration of the imaging appearance of peripheral nerve tumors including: schwannoma, neurofibroma, and malignant peripheral nerve sheath tumor; and tumor-like conditions, tumor mimics, and non-neurogenic lesions including: intraneural ganglion, traumatic neuroma, radiation-induced neuritis, lipomatosis of nerve, Morton's neuroma, and neurolymphomatosis.

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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
Imaging plays an important role in early diagnosis and characterization of the second ray syndrome and related causal factors. The purpose of this exhibit is:

1. To recognize characteristic anatomy and imaging findings of the normal second ray.
2. To discuss and illustrate this syndrome through anatomical review of the mechanisms of injury - intrinsic factors (foot anatomy) and extrinsic (traumatic and iatrogenic factors, hallux valgus).
3. To list and illustrate imaging findings of the evolution of this syndrome from pre-instability, simple instability, subluxation or reducible dislocation to fixed dislocation.
4. To describe and keep in mind the major differential diagnosis of second ray syndrome.

**TABLE OF CONTENTS/OVERSE**

I. INTRODUCTION: DEFINITIONS
II. ANATOMY:
   - Bones
   - Plantar Plate
   - Collateral Ligaments
   - Transverse Intermetatarsal Ligament
   - Intrinsic and Extrinsic Muscles
III. ETIOPATHOLOGY:
   - Intrinsic Factors
   - Extrinsic Factors
IV. SRS Characterization:
   - Prodromal Phase
   - Simple Instability Phase
   - Subluxation / Reducible Dislocation Phase
   - Fixed Dislocation Phase
V. DIFFERENTIAL DIAGNOSIS:
   - Degenerative Joint Disease
   - Inflammatory Arthropathies
   - Intermetatarsal or Plantar Bursitis
   - Fractures
V. CONCLUSIONS
Participants
Roque Oca, MD, Bilbao, Spain (Presenter) Nothing to Disclose
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TEACHING POINTS
To review the current role that radiology plays in the diagnosis and management of osteoporosis.

To illustrate the different types of osteoporosis, distinguishing between regional and diffuse.

To present the potential complications of osteoporosis and its main differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Osteoporosis is the most common metabolic bone disorder. Multiple causes may lead to osteoporosis, and it can be classified into primary or secondary. Fragility fractures are the main complication, and they determine severe morbimortality and high economic impact. An early diagnosis is crucial for a correct therapeutic plan, and also to distinguish it from other similar conditions. Different imaging modalities help in its diagnosis: from conventional radiographies and DXA to more sophisticated methods such as micro-CT or high resolution MRI. Although osteoporosis is a common condition in daily clinical practice, radiologists are not always familiar with the use of diagnostic criteria and its classification; there is also scarce experience with the newest diagnostic techniques. In this exhibit, we review the pathophysiology of osteoporosis, summarize its classification and diagnostic criteria, present the new imaging modalities available, and emphasize the special importance of fragility fractures and the differential diagnosis.
MR Imaging of Subscapularis Injuries: The 'Forgotten' Tendon

All Day Room: MK Community, Learning Center

Participants

Luis E. Diaz, MD, Needham, MA (Presenter) Nothing to Disclose
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TEACHING POINTS

Review of the anatomy and imaging appearance of the normal subscapularis tendon/muscle and relevant adjacent structures. Description of biomechanical function and mechanisms of injury of the subscapularis tendon. Imaging subscapularis tendon injuries and current classification schemes. Imaging review of associated pathology. Implication of imaging findings on therapeutic management.

TABLE OF CONTENTS/OUTLINE


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Ali Guermazi, MD, PhD - 2012 Honored Educator
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TEACHING POINTS
Sternal abnormalities are commonly seen in clinical practice. This study aims to demonstrate and illustrate such conditions, as the knowledge of its characteristics and imaging findings is essential for correct diagnosis and management of patients. The purpose of this exhibit is:- To recognize characteristic imaging findings of the normal sternum anatomy- To illustrate the main image patterns of congenital anomalies of the sternum- To describe and illustrate using different imaging methods and keep in mind the major pathological conditions that affect the sternum

TABLE OF CONTENTS/OUTLINE
I. INTRODUCTION
II. DISCUSSION
III. ANATOMY
- Manubrium
- Body of the sternum
- Xiphoid process
- Sternoclavicular / Manubriosternal / Xiphisternal joints
- Muscle attachments

IV. SPECTRUM OF THE STERNAL LESIONS:
A. CONGENITAL ABNORMALITIES / ANATOMICAL VARIANTS
- PECTUS EXCAVATUM (treatment)
- TILTED STERNUM
- PECTUS CARINATUM
- STERNALIS MUSCLE

B. DEGENERATIVE CHANGES
- OSTEOARTHRITIS OF THE STERNAL
- CLAVICULAR / COSTOSTERNAL / MANUBRIOSTERNAL JOINTS

C. TRAUMA
- STERNAL FRACTURE
- TUMORS / METASTASIS: LYTIC / BLASTIC
- OSTEOSARCMA - PLASMOCYTOMAE
- INFLAMMATORY CHANGES
- CRYSTAL INDUCED ARTHROPATHY
- SERONEGATIVE ARTHRITIS (PSORIATIC)
- SAPHO SYNDROME
- TIETZE SYNDROME

D. INFECTION
- POST STERNOTOMY

E. OTHERS
- STERNOTOMY DEHISCENCE
- MYONECROSIS
- PAGET DISEASE
Awards
Certificate of Merit

Participants
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TEACHING POINTS
Review of anatomy and function of the meniscus and the cartilage-covered surfaces of femur and tibia. Examine clinical implication of radiologic and orthopedic classifications of chondral lesions and meniscal tears. Meniscal-osteochondral unit: provide an image-based approach for the understanding of the interdependence between cartilage lesions and meniscal tears.

TABLE OF CONTENTS/OUTLINE
I. MRI protocol Clinical sequences used for evaluation of cartilage and meniscus
II. MRI of Cartilage Normal morphology → Layered structure: emphasis on bone cartilage junction Function: weight bearing versus trochlear Review of lesion's classification
III. MRI of Meniscus Normal meniscal morphology → Fiber groups: anatomy and function Review of the concepts of degeneration, tear and instability Review the importance of the meniscal mechanical axis and challenges in early, non-invasive identification
IV. Interdependence between cartilage and meniscal pathology Tear with instability: cartilage alteration serves as a surrogate for altered mechanical axis of the meniscus Free edge tearing: widening of uncovered areas Meniscal translation: shifting of uncovered areas
Awards
Certificate of Merit

Participants
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TEACHING POINTS
The purpose of this exhibit is to: Review current indications and utility of intraoperative ultrasound of peripheral nerves. Discuss technical and diagnostic considerations when performing intraoperative ultrasound of peripheral nerves. Review intraoperative ultrasound imaging findings and techniques in a spectrum of peripheral nerve pathology via a case-based approach. Discuss potential directions in this new emerging field.

TABLE OF CONTENTS/OUTLINE
Introduction
Indications for peripheral nerve surgery
Utility of intraoperative ultrasound in peripheral nerve surgery
What does the surgeon want to know?
How can intraoperative imaging change management or prognostication?
Techniques in intraoperative ultrasound of peripheral nerves
Equipment
Ultrasound tools and measurements
Methylene blue injection
Intraoperative ultrasound appearance of peripheral nerve pathology: an institutional case based review (> 30 cases)
Trauma
Tumor
Other
Summary
Future Directions
MRI Features of Intermediate Fibrous Soft-Tissue Tumors in Adults

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
To review MRI findings of intermediate fibrous soft-tissue tumors in adults. To demonstrate specific features of intermediate fibrous soft-tissue tumors. To elaborate on means of differentiation with benign and malignant lesions.

TABLE OF CONTENTS/OUTLINE
Overview of Intermediate Fibrous Soft-Tissue Tumors in Adults Imaging features of fibrous tissue Review of imaging findings Sample cases and mimics Future directions and summary
**TEACHING POINTS**

To describe the principles of morphologic and compositional MR imaging techniques for imaging of cartilage repair and their application to longitudinal studies To illustrate relevance of MR imaging with correlation to intra-operative images

**TABLE OF CONTENTS/OUTLINE**

1. Introduction – history of cartilage repair surgery and currently available surgical techniques
   - Marrow stimulation, osteochondral autograft, osteochondral allograft, particulate cartilage allograft, autologous chondrocyte implantation
   - MRI sequences that can be applied for imaging of cartilage repair tissue in the knee
   - Comparison of 2D and 3D Fast Spin Echo and Gradient Recalled Echo sequences

2. Imaging features of cartilage repair tissue
   - Morphologic assessment with conventional MRI imaging techniques for specific cartilage repair techniques as described above
   - Semiquantitative scoring systems for the knee cartilage repair – MR Observation of Cartilage Repair Tissue (MOCART) and Cartilage Repair OA Knee Score (CROAKS)
   - Overview of compositional MRI techniques

3. Conclusion, ongoing research efforts and future directions

**Honored Educators**

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Alice S. Ha, MD, Seattle, WA (Abstract Co-Author) Grant, General Electric Company

TEACHING POINTS
After reviewing this exhibit, readers will learn the different subtypes and imaging findings of ankle impingement. Specifically, the reader will understand the mechanism of injury and pathogenesis of ankle impingement for each subtype, special imaging considerations to best visualize these syndromes, and the various imaging appearances using radiography, MRI, and ultrasound. Lastly, normal and abnormal imaging appearances after surgical treatment will be reviewed. It is important for the radiologist to understand the various imaging findings of ankle impingement so that these complex syndromes can be detected and treated.

TABLE OF CONTENTS/OUTLINE
We will review the subtypes of ankle impingement, including anterolateral, anteromedial, anterior, posterior, and posteromedial. For each subtype, we will discuss the following:
• Mechanism of injury and pathogenesis
• Pertinent anatomy and anatomic risk factors (for example, prominent Stieda process in posterior impingement)
• Demographics
• Clinical symptoms and associated injuries
• Imaging findings
• Surgical treatment and complications

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Felix S. Chew, MD - 2012 Honored Educator
Felix S. Chew, MD - 2016 Honored Educator
Comprehensive Assessment of Normal Synovium Anatomy of Knee Joint and Review of Selected Synovial Pathologies

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
To understand the detailed synovial anatomy of the knee joint with an emphasis on 'hidden' areas through MRI images and corresponding graphical images. To diagnose pathological processes involving the synovium on standard MR images and to differentiate them from common confounders.

TABLE OF CONTENTS/OUTLINE

Background: Knee pain due to synovial causes poses a significant diagnostic dilemma to referring clinicians, musculoskeletal radiologists, and radiology residents. MRI is an established modality for diagnosis of synovial pathologies of the knee, their differentials e.g. internal derangements, muscular cases, referred pain, etc. and their mimickers like bursal inflammations, popliteal cysts, cartilage pathologies. Findings and procedure details: MRI has revolutionised synovial imaging. This presentation is a lucid description of normal synovial structures viz., recesses, plicae, bursae with corresponding graphical representations and diverse pathologies like post-traumatic synovitis, inflammatory/infective synovitis, synovial cysts, bursitis, loose bodies, pigmented villonodular synovitis, and tumoral changes. Conclusion: Thorough knowledge of synovial anatomy is a must for diagnosis of its pathologies and their mimickers. MRI remains a luminary imaging modality for delineation of synovial anatomy and the pathological entities involving it.
Method of Image Generation for Diagnosing Internal Derangement of the Knee only by CT Examination

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
Understand the problems that arise in the diagnosis of internal derangement of the knee using CT imaging. Examine variations in CT values by voltage for the meniscus, anterior cruciate ligament, and posterior cruciate ligament. Propose a method of CT display for internal derangement of the knee.

TABLE OF CONTENTS/OUTLINE
Using Dual Energy technology, CT image data of 78 knee joints were analyzed. Using Virtual Monochromatic Imaging, variations in CT values for the meniscus, anterior cruciate ligament, posterior cruciate ligament, and femoral cartilage were measured; data was taken in 5 keV increments from 40 keV to 140 keV. Variations in CT values of the meniscus and distal femoral cartilage were compared. The best display method for the meniscus, anterior cruciate ligament, and posterior cruciate ligament was proposed.
Athletic Pubalgia: Using MRI to Differentiate Causes of Groin Pain in Collegiate Athletes

All Day Room: MK Community, Learning Center

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TEACHING POINTS
Review the anatomy and biomechanics of the symphysis pubis and muscle attachments Describe common and uncommon patterns of injury in college athletes Illustrate MRI findings of different pathologic processes and their significance Discuss correlation of imaging findings to decision points in treating athletes

TABLE OF CONTENTS/OUTLINE
Athletic Pubalgia: Using MRI to Differentiate Causes of Groin Pain in Collegiate Athletes
Anatomy and Biomechanics of Injury
Pathophysiology
MRI findings - Common with illustrative cases - Pubic symphysis - Adductor/rectus injury - Inguinal/nerve entrapment - Acute vs chronic
Unusual presentations - cases
Injury specific treatment
Postoperative changes - imaging correlation
Beyond the Sacroiliac Joints: Vertebral Involvement of Axial Spondylarthitis and SAPHO

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Awards
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TEACHING POINTS
- Back pain in spondylarthropathy is often related to involvement of posterior vertebral elements, especially in early stages of the disease.
- Inflammatory changes of posterior vertebral elements can readily be diagnosed on MRI and at earlier stage than classical syndesmophytes and ankylosis. These appear as multilevel involvement of the vertebral corners, pedicles, and costovertebral and facet joints.
- Coronal and axial fluid-sensitive fat-suppressed MRI are essential for diagnosis of posterior vertebral involvement.
- SAPHO is a systemic disease with vertebral involvement similar to axial spondylarthropathy.
- Vertebral involvement in SAPHO is distinguishable from spondylarthropathy by prevertebral soft tissue thickening and anterior thoracic joint involvement.

TABLE OF CONTENTS/OUTLINE
1. Technical Considerations:
   - Conventional Radiographs
   - Computed Tomography
   - MRI: Sequences and Planes.
2. Ankylosing Spondylitis:
   - Arthritis of the facet joints
   - Arthritis of the costovertebral joints
   - Enthesitis of spinal ligaments (supra-spinal, interspinal, ligament flava)
   - Spondylitis
   - Syndesmophytes/Ankylosis
3. SAPHO:
   - Marginal bone marrow edema
   - Anterior corner erosion and bridging ossification
   - Paravertebral soft tissue thickening
   - Disc height narrowing and inflammation

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Ali Guermazi, MD, PhD - 2012 Honored Educator
A Guided Tour of the Anterior Knee: Challenges Posed by Normal and Variant Anatomy

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS
This exhibit will provide an interactive illustrated review of the anatomy of the anterior knee, the variety of anatomical variants encountered there, and a discussion of their significance as an interpretative pitfall, potential pain generator, differential consideration, easy to miss subtle finding, or surgical consideration. A discussion of controversy associated with specific entities will also be provided where appropriate.

TABLE OF CONTENTS/OUTLINE
Original medical illustrations, 3T MR cases overviewing the anatomy of the anterior knee, emphasizing interpretive pitfalls of normal findings. Review anatomical variants encountered in the anterior knee with illustrative cases, review controversial points, and provide examples of differential considerations. Discussion of the clinical significance of these variants in both diagnosis and treatment. Fat pads Hoffa Quadriceps PrefemoralPlica Superapatellar Infrapatellar MedialLigaments Transverse intermeniscal Oblique intermeniscal Anterior meniscofemoral Patellar retinaculum Anteromedial Anterolateral Bursae Prepateellar Pes anserine Pretibial Adventitious Suprapatellar Tendons Quadriceps Patellar IT bandBone Sulcus terminalis Trochlear morphology Patellar morphology Tibial tuberosity
TEACHING POINTS

CT is an important tool in musculoskeletal imaging, specifically for preoperative planning. Not only is CT superior to plain radiography, it is also complementary to magnetic resonance imaging. In many of these preoperative CT examinations, measurements and angles are often requested that are confusing, and can potentially be performed incorrectly. The goal of this exhibit is to educate the radiologist about commonly requested preoperative CT examinations for evaluation ranging from arthroplasties to patellar tracking disorders. Specific protocols, measurement techniques, measurement ranges and their significance will be discussed, and the value of 3-D reconstruction will be detailed.

TABLE OF CONTENTS/OUTLINE

Knee Arthroplasty – CT for evaluation of rotational malalignment, CT scan for robotic-arm assisted surgery
Hip Arthroplasty – CT for evaluation of acetabular cup position and femoral component version, CT for robotic-arm assisted surgery
CT Evaluation of patellofemoral measurements and relationships for patellar maltracking
CT of the Shoulder and the value of 3-D Reconstruction in traumatic and non-traumatic etiologies
Role of CT before removal of hardware used for internal fixation of fractures and arthrodesis
CT scanogram for evaluation of limb alignment and length
Review of metal artifact reduction techniques
Ischialgia: Imaging Review of Pain Related to the Ischial Tuberosity

All Day Room: MK Community, Learning Center

Awards
Cum Laude

Participants
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TEACHING POINTS

Pain in the medial thigh (groin or buttck) may be associated with pathologies related to the ischial tuberosity. As we review MR imaging for patients with thigh pain, both common and uncommon conditions are encountered in and around the ischial tuberosity.

Teaching points:
1. Review of normal anatomy – including the origins of muscles/tendons, ligaments, and neurovascular structures related to Ischial tuberosity.
2. Familiarize with pathological conditions related to Ischial tuberosity using a multimodality approach (MRI, CT, and Ultrasound).
3. Recognize characteristic MRI, CT and ultrasound imaging findings of these conditions focusing on advantages of each modality.

TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline
1. Overview and definition of medical conditions presenting with medial thigh pain.
2. Review of normal anatomy including origins of quadratus femoris, semimembranosus, conjoined, and adductor magnus tendons, ischiofemoral space, and pudendal neurovascular bundles at sacrotuberous ligament.
3. Indications of MRI, CT, and Ultrasound
4. Case presentations with discussion Femoroischial impingement with muscle hernia Semimembranosus tendon rupture Conjoined tendon rupture/avulsion Adductor magnus tendinopathy Ischial tuberosity stress fracture Pudendal nerve entrapment
4. Summary
Acute osseous avulsions of the deep medial meniscofemoral ligament (deep MCL) at its femoral footprint are strongly correlated with concomitant tears of the anterior cruciate ligament (ACL) and to a lesser extent other components of the medial collateral ligament complex including the tibial collateral ligament (superficial MCL) and the posterior oblique ligament (POL). Osseous avulsion of the deep MCL may serve as an ancillary sign of ACL tear.

**Background:** In this exhibit, 15 cases of osseous avulsion of the deep medial meniscofemoral ligament will be presented, 13 of which (87%) had ACL tears on follow-up MR imaging. Imaging Features & Anatomy: Radiographs, CT, and MRI. Other associated injuries: Superficial MCL, POL, Meniscal tears. Chronic-appearing features of this lesion. Differential diagnosis for soft tissue calcifications/ossifications adjacent to the medial femoral condyle. Significance: Detection of an osseous fragment in the soft tissues adjacent to the femoral footprint of the deep medial meniscofemoral ligament on initial radiographs should prompt clinical correlation for MCL and ACL injuries and further evaluation with MRI. Acute osseous avulsion of the deep medial meniscofemoral ligament at its femoral footprint is strongly correlated with and may serve as an ancillary sign for a concomitant ACL tear.
Elbow Fracture in Children: A Radiological Practical Review

Participants
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Melissa Buenrostro, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To learn normal developmental anatomy of the pediatric elbow Provide a systematic evaluation of elbow lines and signs to identify abnormalities To know the types of fractures and luxations around the elbow and its classification with the respective lesion mechanism Propose a practical radiological reporting system in traumatic pediatric elbow injuries

TABLE OF CONTENTS/OUTLINE
Embriology Anatomy Bones Ossifications centers Appearance, closing and mean age of ossification centers visualization in boys and girls Soft tissues - Fat pads First line imaging methods and complementary studies X ray US CT MRI Anatomical lines Anterior humeral line Radiocapitellar line Mechanism of injury Hiperextension with vertical stress and rotation Hyperextension with valgus or varus stress Blows to the posterior elbow Avulsion forces on the proximal ulna Fractures type and classification and treatment Supracondylar Lateral condyle Medial epicondyle avulsion Proximal fracture of radio Dislocation of radial head Olecranon Transphyseal of distal humeral Monteggia Coronoid Distal humeral Capitulum Radiological report structure
Pain in the Butt: An Overview of Soft Tissue Lesions in the Gluteal Region

All Day Room: MK Community, Learning Center

Participants

Pramod K. Gupta, MD, Plano, TX (Presenter) Nothing to Disclose
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Vidisha V. Ghole, MD, Irving, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this scientific exhibit is:-To familiarize the viewer with the anatomy of the gluteal region with emphasis on CT imaging findings.-To review the imaging findings of various gluteal lesions based on the case examples.-To help the viewer learn an imaging pattern-based approach to develop a reasonable differential diagnosis of abnormalities arising in the gluteal region and in many cases make the specific diagnosis.

TABLE OF CONTENTS/OUTLINE

TEACHING POINTS

Many radiologists are familiar with the pre and post-operative imaging assessment of patients with labral tears, rotator cuff pathology, and glenohumeral and acromioclavicular arthritis. The second line and augmentation procedures performed for refractory shoulder instability and the extra-articular surgeries may challenge even the experienced musculoskeletal radiologist. Knowledge of the uncommon shoulder girdle reconstructions and repairs will aid the radiologist in both the pre and postoperative assessment of the injured shoulder.

TABLE OF CONTENTS/OUTLINE

- Review (1) Preoperative imaging and indications for (2) Normal post-operative appearance and (3) complications of
- Biceps Tenodesis  - Remplissage Procedure  - Latarjet and Bristow Coracoid Transfer Procedure
- Capsular Shift  - Os Acromiale Internal Fixation  - Coracoclavicular ligament Reconstruction
- Humeral Head Allograft
Deep Muscles of the Back: A Review of Normal and Abnormal Findings of the Paraspinal Muscles

All Day Room: MK Community, Learning Center

Participants
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Philip A. Araoz, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Describe the normal anatomy and appearance of the paraspinal muscles
2) Describe common and uncommon abnormalities of the paraspinal muscles

TABLE OF CONTENTS/OUTLINE
Overview of paraspinal muscular anatomy
Paraspinal definitions and nomenclature
Overview of paraspinal embryology and development
Three subdivisions of the paraspinal muscles
Divisions of the surrounding thoracolumbar fascia
Actions of the paraspinal muscles
Role in upright posture
Stabilization of vertebral column
Normal imaging appearances of the paraspinal muscles
Common and uncommon abnormalities of the paraspinal muscles
Hematologic and lymphoproliferative diseases
Metastatic involvement of the paraspinal muscles
Inflammatory and infiltrative conditions
Degenerative and atrophic conditions
Acute and chronic postoperative changes
Miscellaneous conditions
Role of Diffusion Weighted Imaging in Diabetic Foot Magnetic Resonance Imaging

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
1. Learn the diffusion weighted imaging (DWI) protocol and related technical considerations in extremity imaging.
2. Discuss the incremental value of DWI in the diagnosis of soft tissue infections, devitalized tissue and abscess over conventional MR imaging (MRI).
3. Learn the role of DWI in osteomyelitis, Charcot foot and detection of intra-osseous abscess.

TABLE OF CONTENTS/OUTLINE
1. Brief discussion of the prevalence and potential consequences of diabetic foot.
2. Review the imaging protocol, technique and challenges, specifically focusing of DWI in the extremity.
3. Comparative imaging (DWI with ADC maps, conventional MRI, and contrast enhanced MRI) findings of soft tissue infection, abscess, devitalized tissue, Charcot foot, osteomyelitis, intra-osseous abscess and neuromuscular findings with respective case examples.
4. Presentation of diagnostic algorithm for the evaluation of diabetic foot infection and summary.
Functional MRI for Extracellular Matrix Evaluation of Hyaline Cartilage: A Different Pathophisiological Approach

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Teodoro Martin, MD, Jaen, Spain (Presenter) Nothing to Disclose
Marta Gomez Cabrera, MD, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Luna SR, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose
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Pedro M. Martinez Hurtado, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose
Joan C. Vilanova, MD, PhD, Girona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Explain, from an educational point of view, the pathophysiological basis of T2 mapping, dGEMRIC, DWI, magnetization transfer imaging and sodium image.
2. Review the technical adjustments necessary to perform these sequences for hyaline cartilage evaluation.
3. Analyse the role of these different sequences in clinical practice.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Pathophysiological explanation of MR techniques for cartilage evaluation
   a. Extracellular matrix cartilage composition
   b. T2 mapping
   c. Delayed Gadolinium Enhanced MRI Cartilage (dGEMRIC)
   d. Diffusion Weighted Imaging (DWI)
   e. Magnetization transfer imaging and chemical exchange saturation transfer
   f. Sodium cartilage image
3. Clinical role of functional MR cartilage image
   a. Morphological MRI cartilage techniques limitations
   b. Osteoarthritis and degenerative cartilage disease evaluation
   c. Treatment monitoring
Uncovering the Humeral Head: Imaging the Postoperative Rotator Cuff

All Day Room: MK Community, Learning Center

Participants
Mohammed A. Razvi, MD, Hershey, PA (Abstract Co-Author) Nothing to Disclose
Cristy Gustas, MD, Hershey, PA (Abstract Co-Author) Nothing to Disclose
Jonelle M. Petsavage-Thomas, MD, MPH, Hummelstown, PA (Presenter) Consultant, Medical Metrics, Inc

TEACHING POINTS
Understand different types/techniques of rotator cuff tendon repair Illustrate normal postoperative MR and ultrasound imaging appearance of rotator cuff repair Understand when to use arthrography Demonstrate imaging examples of postoperative complications

TABLE OF CONTENTS/OUTLINE
Type of rotator cuff repair Open and Mini-open Arthroscopic Single vs. double row Transosseous tunnels Tendon to tendon repair Normal imaging appearance Radiographs acromioplasty Mumford procedure anchors MR and MR arthrogram increased T2 signal of tendon acromioplasty loss of subacromial peri-bursal fat Mumford procedure fluid in subacromial-subdeltoid bursa susceptibility artifact Ultrasound echotexture changes of tendon loss of subacromial peri-bursal fat fluid in subacromial-subdeltoid bursa anchors/sutures Complications seen on imaging Recurrent tear Suture displacement Subacromial spur reformation Infection Adhesive capsulitis Deltoid detachment Acromial fracture
Secondary Signs of Hip Impingement and Hip Instability: Subtle Findings to Incorporate into the Diagnosis of at-Risk Patients

All Day Room: MK Community, Learning Center

Participants
Thomas Wong, BA, Aurora, CO (Presenter) Nothing to Disclose
Mary Kristen Jesse, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose
Omer Mei-Dan, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review conventional signs of hip impingement and instability To highlight subtle radiographic findings of hip impingement and instability that may be incorporated into the assessment of patients with borderline morphology To present and propose novel secondary findings of hip pathology that may help direct earlier and more accurate diagnoses of symptomatic patients

TABLE OF CONTENTS/OUTLINE
Review conventional evaluations for hip impingement and instability Unconventional hip impingement morphology: cranial retroversion lateralized femoral torsion Secondary signs of hip impingement include: pincer trough synovial herniation pits intralabral calcifications acetabular rim stress fractures Hip instability evaluations may benefit with diagnostic inclusion of: hypertrophic labrum thickened lateral cartilage upsloping lateral sourcil** At our institution, we evaluated the utility of an upsloping lateral sourcil as a subtle marker of hip instability in a chart review of 316 patients with borderline morphology.
How to Wash the Pain Away: Ultrasound-Guided Lavage for the Treatment of Calcific Tendinitis of the Shoulder

All Day Room: MK Community, Learning Center

Awards
Cum Laude

Participants
Jason I. Blachman, MD, Madison, WI (Presenter) Nothing to Disclose
Scott Sheehan, MD, Fitchburg, WI (Abstract Co-Author) Editor, Reed Elsevier
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Kenneth S. Lee, MD, Madison, WI (Abstract Co-Author) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier

TEACHING POINTS
To review the clinical presentation, natural history and diagnostic imaging features of calcific tendinitis of the shoulder. To discuss the indications, contraindications, interventional methods, potential complications and expected outcomes of ultrasound-guided lavage for the treatment of calcific tendinitis of the shoulder. To highlight the single versus double-needle ultrasound-guided lavage techniques.

TABLE OF CONTENTS/OUTLINE
Anatomy Pathophysiology Clinical Findings Differential Diagnosis and Pitfalls Diagnostic Imaging Features Technique(s) and Patient Positioning Follow-up Management Outcomes (including Complications)

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
The Radiology of Rock Climbing

All Day Room: MK Community, Learning Center

Participants
Chad Wilcox, MD, New York, NY (Presenter) Nothing to Disclose
Tony T. Wong, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Understand epidemiological shifts in rock climbing injuries and why chronic overuse injuries are becoming more common.
2. Understand how biomechanics specific to rock climbing account for radiological differences in new presentations of common injuries.
3. Learn how to diagnose the most common injuries using advanced imaging modalities, including ultrasound of small joints.
4. Understand how radiology is key for early diagnosis, best management and fast return to play.
5. Gain functional knowledge of rock climbing vocabulary and concepts.

TABLE OF CONTENTS/OUTLINE
Pictorial Review of Normal Variants and Pitfalls at Shoulder MR Arthrography

All Day Room: MK Community, Learning Center

Participants
Lily C. Yang, MD, Irvine, CA (Presenter) Nothing to Disclose
Andrew L. Chang, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Farzad Rezai, MD, Long Beach, CA (Abstract Co-Author) Nothing to Disclose
Christopher Wen, MD, Cerritos, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To provide a pictorial overview of common anatomic variants, normal structures, and iatrogenic findings that should not be mistaken for pathology on shoulder MR arthrography.
2. To present examples of diagnostic pitfalls that may be seen at shoulder MR arthrography.
3. To deliver a short self-assessment of the material covered.

TABLE OF CONTENTS/OUTLINE
1. Common anatomic variants and normal structures that should not be mistaken for pathology
   - Labrum: Sublabral recess
   - Buford complex
   - Junctional zone undercutting the labrum
   - Tendons: Biceps anchor mimicking a labral tear
   - Biceps vincula
   - Accessory biceps tendon
   - Bone: Normal indentation posterior to the greater tuberosity simulating a Hill Sachs lesion
   - Red marrow
2. Iatrogenic findings mimicking pathology
   - Lidocaine in the deltoid muscle mimicking muscle edema
   - Intracapsular gas injected at arthrography mimicking intra-articular bodies
   - Iatrogenic contrast extravasation into the myotendinous junction mimicking a tear
3. Diagnostic pitfalls
   - Varices mimicking a paralabral cyst
   - Bursal fluid simulating a full thickness rotator cuff tear
   - Subscapular recess mimicking a paralabral cyst
   - Noncommunicating paralabral cyst demonstrating the value of T2 weighted imaging
Imaging Characteristics of Vascular, Perivascular Tumors and Mimic Lesions

Participants
Ryota Inai, MD, Hamburg, Germany (Presenter) Nothing to Disclose
Takashi Tanaka, MD, Okayama, Japan (Abstract Co-Author) Nothing to Disclose
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Susumu Kanazawa, MD, Okayama, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To exhibit image findings including rare types of Vascular tumors (Kaposiform, Pseudomyogenic hemangioendothelioma) To show the best cases and variants referring to 9 Solitary fibrous tumors and 6 Alveolar soft-part sarcomas as mimic lesions. To explain the characteristics of each lesion including atypical cases.

TABLE OF CONTENTS/OUTLINE
Classification of Vascular, Perivascular tumor, and mimic lesions - Vascular: Hemangioma, Angiomatosis, Kaposiform hemangioendothelioma, Pseudomyogenic hemangioendothelioma, Epithelioid hemangioendothelioma, Angiosarcoma of soft tissue - Perivascular: Glomus tumor Glomangiomatosis, Malignant glomus tumor, Myopericytoma, Angioleiomyoma - Mimic lesions: Solitary fibrous tumor, Alveolar soft-part sarcoma - Image findings of each lesion in Vascular tumors - Focus on the rare type of hemangioendothelioma - Image findings of each lesion in Perivascular tumors - Typical cases - Variants
Unusual Spinal Masses; MRI Findings and Key Points

All Day Room: MK Community, Learning Center

Participants
Mecit Kantarci, MD, PhD, Erzurum, Turkey (Presenter) Nothing to Disclose
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Akin Levent, MD, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review spinal MRI and MRI findings of common spinal masses
2. Learn the atypical MRI findings of common spinal masses
3. Improve differential diagnosis for spinal masses
4. Be familiar with unusual spinal masses

TABLE OF CONTENTS/OUTLINE
Spinal MRI and MRI findings of common spinal masses discussed. After discussion of the common spinal masses, cases are presented in a quiz format. MRI findings of relevant case are discussed after all case presentation. Cases are consisted of solitary fibrous tumor, aneurysmal bone cyst, infantile hemangiopericytoma, neuroenteric cyst, cystic schwannoma, intradural hemangioma, mediastinal germ cell tumor, extraosseous Ewing’s sarcoma, and anaplastic ependymoma.
Participants
Alexandre A. Caland, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Ciro Armani, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Vitor B. Masselli, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Valdo L. Barros Junior, Sorocaba, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, 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
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understanding pitfalls and normal variants and how to differentiate them from pathology. Create a pictorial essay that can work as a quick visual guide to help the radiologist on a daily basis.

TABLE OF CONTENTS/OUTLINE
MRI is the method of choice in the evaluation of most of the shoulder internal derangements. Pitfalls and normal variants may simulate disease and lead us to false positive diagnosis when we are reporting on a daily basis, so their knowledge is of paramount importance. We will emphasize on less common conditions like: aponeurotic expansion of the supraspinatus and biceps vincula that can simulate biceps tear, rotator cable simulating supraspinatus tendon tear, sulcus between supraspinatus tendon and articular cartilage that can mislead us to report it as a tear, Assaki tubercule and bare area simulating cartilage lesion, redundancy of posterior capsule simulating posterior labral tear and others. Examples of common pitfalls like magic angle, Buford complex, labral sulcus, hyaline cartilage, variations of the glenohumeral ligaments, distinct types of bicipital attachments and coracoacromial ligament mimicking spur will also be presented. The study will be presented as a digital atlas for quick and easy access to these pitfalls and variants.
US of Sports Injuries about the Hip: Diagnostic Landmark Approach, Management and Return to Play

All Day Room: MK Community, Learning Center

Awards
Identified for RadioGraphics

Participants
Eugen Lungu, MD, MSc, Montreal, QC (Presenter) Nothing to Disclose
Johan Michaud, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Nathalie J. Bureau, MD, MSc, Montreal, QC (Abstract Co-Author) Equipment support, Siemens AG

TEACHING POINTS
Using a compartmentalized approach tailored to address patient symptomatology, US can be used to diagnose hip injuries, adapt management and assist prognostic evaluation of return to play. - xRays are a useful adjunct to exclude osseous lesions. - To present an anatomic landmark approach to perform an efficient hip US exam. - To review hip injuries based on patient clinical presentation, and discuss their management. - To identify imaging features that impact return-to-play guidelines.

TABLE OF CONTENTS/OUTLINE
Participants
Diane Szafarski, MD, Mineola, NY (Presenter) Nothing to Disclose
Siavash Behbahani, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Michael K. Brooks, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Joseph P. Mazzie, DO, Mineola, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review common and uncommon locations for HADD (hydroxyapatite deposition) and their appearances on radiographs, sonography and MRI.
2. To review the different stages of HAAD and review common pitfalls.
3. To present and review the current literature and treatment options for patients with HADD.

TABLE OF CONTENTS/OUTLINE
- Review of the definition of calcific tendinosis, epidemiology and how it is diagnosed based on varying appearance during dynamic phases.
- Review of common and uncommon locations where calcific tendinosis can be seen based on cases seen at our institution.
- Review of the pitfalls of diagnosis and the disease entities which can resemble calcific tendinosis.
- Review of the treatment strategies available including ultrasound guided needle aspiration. Overview of how this procedure is performed and treatment results at our institution.
Awards
Certificate of Merit

Participants
Elena Barcina-Garcia, MD, Madrid, Spain (Presenter) Nothing to Disclose
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Elena Roa, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the normal anatomy of the posterior ankle and hindfoot. To review the optimal imaging methods for the evaluation of the posterior ankle and hindfoot, including plain radiograph/CT usefulness and limitations, US technique, and optimized MRI protocols. To illustrate the spectrum of imaging findings of the most prevalent painful conditions of the heel classified according to anatomic origin, correlating the radiologic findings with clinical presentation, and emphasizing MRI features that suggest a specific diagnosis. To emphasize pitfalls, diagnostic difficulties and differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Hey, I Was Here First! A Review of Secondary Musculoskeletal Tumors

Participants
Shari Friedman, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Malka B. Finkelstein, MD, New Rochelle, NY (Abstract Co-Author) Nothing to Disclose
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Shlomit Goldberg-Stein, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
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Bang Hoang, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The viewer of this exhibit should:(1) become familiar with the types of benign and malignant musculoskeletal (MSK) tumors that may arise in pre-existing conditions(2) become familiar with the types of conditions in which secondary MSK tumors occur(3) understand the role of imaging and tissue sampling in identifying secondary MSK tumors

TABLE OF CONTENTS/OUTLINE
Participants
Annie M. Wang, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Tanya L. Tivorsak, MD, Marina Del Rey, CA (Abstract Co-Author) Nothing to Disclose
Jason R. Jones, MD, Cheshire, CT (Presenter) Nothing to Disclose

TEACHING POINTS
1. Hydroxyapatite deposition disease (HADD) is very common and can be initially diagnosed by imaging as well as treated by the radiologist via ultrasound-guided aspiration and lavage.
2. Knowledge of the appearance, location, and different phases is essential for diagnosis.
3. Recognition of typical and atypical locations and appearances in multimodality imaging will greatly aid referring physicians in diagnosis and management of these patients.

TABLE OF CONTENTS/OUTLINE
1. Pathophysiology and symptomatology of hydroxyapatite deposition disease.
2. Imaging findings on radiographs, CT, MRI and ultrasound in all phases of HADD.
3. Location of typical and atypical locations of the disease (shoulder, hip, elbow, wrist, hand, ankle, foot, longus coli, pectineus major)
4. HADD presenting with intra-articular deposition
5. Treatment (conservative, ultrasound guided aspiration and lavage, surgery).
6. Imaging of healing and complications.
Getting to the Core: Performing a Bone Marrow Aspiration and Biopsy Using Fluoroscopic Guidance and a Battery-Powered Drill

All Day Room: MK Community, Learning Center

Participants
Jeremiah R. Long, MD, Ft Belvoir, VA (Presenter) Nothing to Disclose
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Michael V. Friedman, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jack W. Jennings, MD, Saint Louis, MO (Abstract Co-Author) Speakers Bureau, DFINE, Inc Consultant, DFINE, Inc

TEACHING POINTS
Bone marrow aspiration and core biopsy is a common and valuable diagnostic procedure. Radiologists can perform bone marrow aspiration and biopsy at the posterior iliac bone using fluoroscopic guidance and a battery-powered drill. Fluoroscopically guided bone marrow aspiration and biopsy at the posterior iliac bone can be performed quickly and easily and is well tolerated by patients.

TABLE OF CONTENTS/OUTLINE
Purpose/Aim:
The purpose of this exhibit is to describe a technique for percutaneous bone marrow aspiration and biopsy at the posterior iliac bone using fluoroscopic guidance and a battery-powered drill. Content Organization: Review the general clinical indications for a bone marrow aspiration and biopsy. Spotlight the relevant anatomy of the posterior pelvis for procedural planning. Provide step-by-step instructions for performing a bone marrow aspiration and biopsy using fluoroscopic guidance and a battery-powered drill. Highlight the advantages of this technique with respect to patient safety and ease of performance.
Summary:
Bone marrow aspiration and core biopsy is commonly performed for a variety of reasons. Using fluoroscopic guidance, radiologists can safely and quickly perform this procedure at the posterior iliac bone, thereby offering a valuable service to referring physicians and their patients.
Fracture-Dislocations of the Hip Joint: What the Surgeon Wants to Know

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Jared Meyer, MD, Winston Salem, NC (Presenter) Nothing to Disclose
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Bahram Kiani, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Leon Lenchik, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Anna N. Miller, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Maha Torabi, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Understand the mechanism of injury for fracture-dislocations of the hip joint.
2. Review current classification systems and how they impact operative planning.
3. Recognize common pitfalls of CT interpretation.
4. Learn various approaches to surgical management.
5. Provide an approach to postoperative imaging.

TABLE OF CONTENTS/OUTLINE
Introduction
Epidemiology of fracture-dislocations of the hip joint
Associated injuries
Short and long term consequences
Optimizing CT protocol
2 mm true axial images
0.625 mm reconstructions
3D renderings
CT Interpretation
Pipkin classification system for femoral head fractures
Type I – Fracture line inferior to fovea
Type II – Fracture line extends superior to fovea
Type III – Any femoral head fracture with a femoral neck fracture
Type IV – Any femoral head fracture with an acetabular fracture
Other classification systems
4. Pitfalls in reporting
Impaction versus displacement of acetabular fragment
Relation of femoral head fracture to fovea
Fracture management
Conservative treatment
Surgical treatment: How urgent?
What is important on post-operative CTs?
Conclusions
References
Unusually Stressed? Stress Fractures of the Upper Body

All Day Room: MK Community, Learning Center

Participants
Jeremiah R. Long, MD, Ft Belvoir, VA (Presenter) Nothing to Disclose
David V. Holland, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
James D. Stensby, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Stress fractures are most commonly encountered in the lower extremity, but can occur in the upper body as well. The imaging appearance of stress fractures in the upper body is similar to that of stress fractures in the lower extremity. Recognizing the possibility of a stress fracture in the upper body will help radiologists recognize and correctly diagnose these injuries when encountered in clinical practice.

TABLE OF CONTENTS/OUTLINE
Purpose/Aim:
The purpose of this exhibit is to spotlight several stress fractures which can occur in the upper body using example cases from our institution. In each case, an emphasis will be placed on imaging findings and relevant clinical history.

Content Organization: Review the basic pathophysiology behind stress fractures. Highlight several described sites of stress fractures in the upper body including the: hamate hook, ulna shaft, olecranon process, acromion, first rib and sternum. For each spotlighted fracture, we will provide an example case with clinical presentation and imaging findings.

Summary:
Stress fractures are common osseous injuries encountered in practice. While typically found in the lower extremity, they can occur in the upper body as well. When evaluating patients with upper body pain, considering a stress fracture within the differential diagnosis is beneficial to radiologists.
Skeletal manifestations of hematologic disorders have been historically recognized since the early use of the time-honored bone radiograph. Currently, increasing use of most sophisticated morphologic, functional and metabolic imaging modalities display a wide spectrum of abnormalities that range from the minor to the relevant. The purpose of this exhibit is: To review common and uncommon skeletal manifestations of various hematologic disorders through a multimodality approach. To provide pathophysiologic basis for the imaging findings. To discuss respective weaknesses and merits of the different imaging modalities.

TABLE OF CONTENTS/OUTLINE

Introduction
Anemias: Sickle Cell Disease, Thalassemia
Metabolic and deposit disorders: Gaucher, Niemann Pick, Erdheim Chester
Myeloproliferative disorders: Leukemias, Polycythemia Vera, Myelofibrosis
Lymphomas: Primary bone Lymphoma and systemic Lymphoma
Plasma Cells: Multiple Myeloma, Plasmocytoma, POEM Syndrome
Metastasis
Others: Langerhans Cells Histiocytosis, Mastocytosis, Hemophilia
Differential diagnosis and potential pitfalls: bone marrow reconversion, bone infarcts, pathologic fracture
The Atlantoaxial Segment: Making a Long Story Short

All Day Room: MK Community, Learning Center

Participants
Marcela De la Hoz Polo, MD, London, United Kingdom (Presenter) Nothing to Disclose
Ceri Davies, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jadesola Ekpe, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Lesley Honeyfield, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
RACHEL WADDINGTON, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Elizabeth A. Dick, MD, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ynyr Hughes-Roberts, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Yaron J. Berkowitz, MBChir, MRCS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Dimitri Amiras, Fremantle, Australia (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To provide an overview of the anatomy of the C1-C2 joint using cadaveric specimens and different imaging modalities. To review a series of challenging cases, common in daily practice, specially in the trauma setting, in which a knowledge of the main radiologic findings can improve diagnosis. To understand the trauma mechanisms and their management.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Normal C1-C2 anatomy using cadaveric specimens, X-Ray, CT and MRI
3. Anatomical variants
4. Mechanisms of trauma
5. Clinical examples of traumatic and non-traumatic cases presented in a Quiz format: Reumatoid arthritis and CPPD involvement. Infection Metastases and bone tumors C1 and C2 vertebral fractures (posterior arch fracture, Hangman fracture, Jefersson fracture, Peg fracture, avulsion fracture anterior arch of C1) Ligamentous injuries
6. Review of the main radiologic findings of each case presented
7. Summary
Participants
Alap Desai, Brooklyn, NY (Presenter) Nothing to Disclose
Justin Holder, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Dennis Cummings, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Srinivas Kolla, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Scott A. Lehto, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the normal anatomy of the calcaneus
2. Briefly discuss the mechanism of calcaneal fractures
3. Describe various calcaneal fracture classification systems
4. Discuss important calcaneal fracture findings to relay to clinicians and how they affect treatment management

TABLE OF CONTENTS/OUTLINE
This exhibit will review pertinent calcaneus anatomy, which is needed to accurately classify calcaneus fractures. The mechanism behind calcaneal fractures will be reviewed. There are several classification systems for calcaneal fractures; the Sanders, Essex Lopresti, and Rowe classifications will be discussed and correlated with pertinent radiographic and cross-sectional imaging. A novel algorithm for easily categorizing complex fractures will be presented, with an emphasis on classification's impact on clinical management.
MK218-ED-X

Stress Fractures of the Foot and Ankle: Imaging and Management

All Day Room: MK Community, Learning Center

Awards
Cum Laude

Participants
Jacob C. Mandell, MD, Waltham, MA (Presenter) Nothing to Disclose
Bharti Khurana, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Christopher Chiodo, MD, Jamaica Plain, MA (Abstract Co-Author) Nothing to Disclose
Stacy E. Smith, MD, Weston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Understand the pathophysiology of stress fractures related to bony remodeling, host bone quality, and patient activity. Recognize the imaging findings of stress fractures of the foot and ankle on radiography, CT, and MR. Understand implications for treatment of stress fractures based on location, patient factors, and specific imaging findings.

TABLE OF CONTENTS/OUTLINE

Define the terminology of stress fractures, including fatigue fracture and insufficiency fracture. Discuss the pathophysiology of stress fractures related to bony remodeling, stress response, and patient specific factors, including special considerations in highly athletic individuals. Provide a multimodality pictorial review of the typical anatomical sites of stress fractures of the foot and ankle, focusing on key imaging features to guide management. Specific locations discussed include the tibia, medial malleolus, fibula, sesamoids, 2nd-4th metatarsals, 5th metatarsal, navicular, cuboid, and calcaneus. Review the management of stress fractures, including a discussion on the indications for surgical versus conservative management. Potential complications of surgery such as nonunion or hardware failure are also reviewed.

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Bharti Khurana, MD - 2014 Honored Educator
How to Clinically Use High-Resolution 3D Isotropic MRI of the Wrist

All Day Room: MK Community, Learning Center

Participants
Albert Y. Yang, MD, Chicago, IL (Presenter) Nothing to Disclose
Michael J. Wang, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Donald von Borstel, DO, Orange, CA (Abstract Co-Author) Nothing to Disclose
Taiki Nozaki, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Saya Horiuchi, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Yoshioka, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review optimization and routine protocol of high-resolution 3D isotropic MRI of the wrist.
2. To demonstrate how to clinically use oblique coronal MRI using MPR images.
3. To review clinical cases of high-resolution 3D isotropic MRI and MR arthrogram of the wrist.

TABLE OF CONTENTS/OUTLINE
1. How to optimize high-resolution 3D isotropic MRI of the wrist
   - Effect of slice thickness/voxel size
   - Effect of echo train length
   - Effect of inversion time for fat suppression
   - Driven equilibrium technique
   - Parallel imaging technique
2. How to use multi-planar reconstruction (MPR) images from original isotropic images
   - Oblique coronal MRI to evaluate ulnar attachment of the triangular fibrocartilage complex (TFCC)
3. Review clinical cases of high-resolution 3D isotropic MRI and MR arthrogram of the wrist
Musculoskeletal Steroid Injections: When, Where, Why and How?

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS

Background: Many radiology practices report an increasing volume of requests for imaging-guided musculoskeletal (MSK) corticosteroid injections (CSI). Some practices may be unfamiliar with steroid administration, indications, complications and follow up. After review of this exhibit, the learner will be able to:

1. Describe common indications for CSI
2. List both local and systemic side effects and complications of CSI
3. Discuss evidence-based recommendations for treating the following: patients on systemic CS therapy; pregnant and breastfeeding patients; children; elite child athletes; patients with steroid allergies
4. Define appropriate doses to inject into each joint
5. Explain the pros and cons of different steroid formulations

TABLE OF CONTENTS/OUTLINE

Introduction
Types of injections: Large and small joints, tendon sheath, bursa, Baker cyst, ganglion, Morton Neuroma
Pharmacology/Mechanism of Action
Differences among different corticosteroid formulations
Indications
Contra-indications
Side effects and complications
Recommended doses for each injection type
Efficacy: Review of literature and clinical experience in our practice for each injection type
Clinical decision making for the radiologist
Follow up: What is the radiologist's role?

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
Vertebral hemangiomas are common incidental benign lesions of the spinal column with well-recognized imaging features; however, a rare subtype of vertebral hemangioma may behave as an aggressive neoplasm. Identification of this subtype at imaging is not always straightforward with an atypical appearance complicating diagnosis and adding to the interpretive challenge. Atypical or aggressive vertebral hemangiomas may present with symptomatic neural compression. They are characterized by bone expansion, extra-osseous extension, low fat contents, and increased vascularity. These findings mimic primary osseous neoplasms such as lymphoma, metastatic lesions, and infectious processes such as tuberculosis. Recognition of this entity is essential prior to biopsy given the highly vascular nature of these lesions.

**TABLE OF CONTENTS/OUTLINE**

Aggressive hemangiomas may represent a diagnostic dilemma. This exhibit reviews the role of diagnostic imaging, specifically CT, MRI, and nuclear medicine, using data from five cases of aggressive hemangioma diagnosed at our institution. It will further highlight the common pitfalls, the important differential diagnoses, and potential treatment options.
Atypical Septic Arthritis and Important Non-Infectious Mimics in the Knee: What Clinicians and Radiologists Need to Know

All Day Room: MK Community, Learning Center

Participants
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Daria Motamedi, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Review imaging of atypical septic arthritis with different infectious pathogens in the knee
2. Highlight pitfalls in diagnosis including non-infectious mimics
3. Demonstrate a role for MR imaging in the diagnostic workup of subacute to chronic monoarticular joint pain

TABLE OF CONTENTS/OUTLINE

1.) Review the topic of atypical septic arthritis with emphasis on the specific clinical manifestations and risk factors associated with different non-pyogenic etiologies.
2.) Discuss the diagnostic workup and the role of imaging in the setting of subacute to chronic monoarticular joint pain.
3.) Present the characteristic MRI findings of atypical septic arthritis in the knee with specific case depictions of tuberculosis, coccidiomycosis, sporotrichosis and HIV.
4.) Discuss pitfalls in diagnosis including differentiation from non-infectious mimics such as inflammatory arthritis, crystal deposition, benign synovial proliferative processes and neoplasms.
Dual-Energy CT with Iodine Map: Spectrum of Hand Psoriatic Arthritis

All Day Room: MK Community, Learning Center

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TEACHING POINTS

Contrast enhanced MR imaging is widely used for evaluation of the hand psoriatic arthritis (H-PsA). However, it has some disadvantages such as low spatial resolution, unable to obtain true sagittal image of each finger, vulnerable to artifacts. Dual-Energy CT with iodine map (DE-CT-IM) can potentially overcome these problems with accentuated iodine contrast. It also enables to detect "classical" and "functional" enthesitis with increased iodine accumulation. Major "functional" enthesitis in H-PsA are at the dorsal aspect of the finger joints and flexor tendon sheath at each pulley. "Functional" enthesitis at the dorsal site of the joint is not included in the current scoring system (OMERACT psoriatic arthritis magnetic resonance imaging scoring system) because of poor inter-reader reliability with MRI. However, it can be evaluated reliably with DE-CT-IM. Joint synovitis is shown as enhanced joint capsule and periarticular inflammation is present as iodine accumulation in extra-articular soft tissue. DE-CT-IM delineate improvement of abnormal iodine accumulation accordance with symptom improvement suggest its validity for evaluating responsiveness to therapy.

TABLE OF CONTENTS/OUTLINE

Introduction
Principle of DE-CT-IM
Classical and functional enthesitis
Joint capsule synovitis
Periarticular inflammation
Evaluation of response to therapy
Conclusion
Boning up on Hyperparathyroidism: A Multi-Modality Imaging Review

All Day Room: MK Community, Learning Center

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TEACHING POINTS
Hyperparathyroidism is a common disease, defined by the overproduction of parathyroid hormone (PTH), which acts to maintain calcium and phosphorous homeostasis. If left untreated, this syndrome can have severe deleterious effects on the musculoskeletal system. The aims of this exhibit are to briefly review the etiologies, pathophysiology, clinical manifestations and non-musculoskeletal imaging findings of hyperparathyroidism followed by an in depth review of the radiologic changes it causes in the musculoskeletal system across multiple imaging modalities. Surgical and medical approaches related to the management of hyperparathyroidism and its complications will also be briefly reviewed.

TABLE OF CONTENTS/OUTLINE
Parathyroid hormone metabolic pathways in normal and pathologic states Pathogenesis, etiology, clinical presentation and epidemiology of primary, secondary and tertiary hyperparathyroidism Primary hyperparathyroidism: multimodality imaging findings Secondary and tertiary hyperparathyroidism: multimodality imaging findings Brown tumors Surgical and medical management considerations in hyperparathyroidism
**Participants**

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**TEACHING POINTS**

To review the normal anatomy of the knee. To explain no bone cystic lesions on the knee are a common finding, and have a wide prognostic and therapeutic variability. To learn their radiological findings on MRI and show how the functional techniques such as diffusion and dynamic studies after intravenous contrast can help to characterize these lesions.

**TABLE OF CONTENTS/OUTLINE**

Cystic structures around the knee joint have a diverse etiology that may be presented similarly, being on many occasions an incidental finding. Knowledge of normal anatomy is essential for a reliable diagnosis. MRI is the best imaging technique to confirm the cystic nature of the lesions, to determine its location, to define its relationship to adjacent structures and to identify additional findings that may exist. We have made the following classification, some with pathologic confirmation: bursae, Morel-Lavalle lesion, ganglions, recesses (popliteal tendon, gastrocnemius-semimembranosus tendon, horizontal cleft in the infrapatellar fat pad), cystic masses (meniscal cysts, infrapatellar fat cysts, mucosum ligament cyst, anterior cruciate ligament and posterior cruciate ligament), anterior cruciate ligament mucoid degeneration, inflammatory lesions (pigmented villonodular synovitis and gouty tophus) and cystic-like tumors (hemangiomas, myxofibrosarcomas, myxomas, giant cell tumor)
MK228-ED-X

MR Imaging of Hip Injuries in Runners

All Day Room: MK Community, Learning Center

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TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
1. Normal anatomy and normal MRI of the hip. 2. Epidemiology and etiology of hip injuries in runners. 3. Illustration of hip injuries in runners: Osseous Avulsion and apophyseal injuries Slipped capital epiphysis Stress fractures Articular Osteochondral injuries Labral tears and femoroacetabular impingement Osteoarthritis Myotendinous Flexors Adductors External rotators Abductors Hamstrings Bursae Greater trochanteric Iliopsoas Other

Honored Educators
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Ali Guermazi, MD, PhD - 2012 Honored Educator
Usual and Unusual Pattern of Rotator Cuff Tear: MR Imaging Compared to Arthroscopy

All Day Room: MK Community, Learning Center

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TEACHING POINTS

The purpose of this exhibit is:
1. To comprehend and familiarize arthroscopic view of rotator cuff tears in correlation with MR imaging
2. Case-based review of usual and unusual rotator cuff tears
3. To enable radiologists to communicate with surgeons in terms of arthroscopic findings about rotator cuff tears

TABLE OF CONTENTS/OUTLINE

Basics of shoulder MRI axis and arthroscopic views
Cases with imaging-arthroscopic correlation
Usual rotator cuff tears
  - Full thickness tears
    - Crescent tear, Triangular defect (Reverse L shape, L-shaped tear)
    - Bursal-surface partial tear
  - Partial thickness tears
    - Articular-surface partial tear
    - Delaminating tears with flipped pattern
    - Large punch-hole like tear in the tendon
    - Concealed interstitial delamination
    - Reverse PASTA Pearls for radiologist to communicate with arthrosocist
Limitations of shoulder MR imaging compared to arthroscopy and vice versa
Take home messages
Navigating through the Neglected Corner-MRI of Posteromedial Corner (PMC) Injuries

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
The purpose of this imaging exhibit is- To describe the anatomy of posteromedial corner (PMC) of the knee as seen on Magnetic resonance imaging. - To enumerate the biomechanics and functions of the components of PMC. - To describe the imaging appearance of various components of posteromedial corner using an image rich interactive format.

TABLE OF CONTENTS/OUTLINE
1. Anatomy of Posteromedial corner(PMC) injury as seen on MRI.
2. Biomechanics and functions of the components of PMC.
3. Materials and methods.
Secondary Osteosarcomas: A Clinical and Radiological Overview

All Day Room: MK Community, Learning Center

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TEACHING POINTS

Osteosarcoma developing in Pagetic bone should be suspected in patients presenting with pain, swelling and a palpable mass. In these patients, imaging studies demonstrate a lytic destructive mass within a Pagetic bone (most commonly pelvis and humerus) with common aggressive features such as cortical destruction and associated soft-tissue mass. Location of a lesion within a bone in a previously irradiated area, a latency period of least two years (average: 11-15 years) after the radiotherapy, and imaging identification of osteoid matrix are clues that help to establish the diagnosis of post-radiation osteosarcoma. Post-radiation osteosarcoma may be confused radiologically with blastic metastases, mainly in patients with a history of prostate or breast irradiated cancer.

TABLE OF CONTENTS/OUTLINE

Definition of Secondary Osteosarcoma
Histological findings
Radiation-induced Osteosarcoma: Epidemiology Clinical findings Imaging features Prognosis factors
Pagetic Osteosarcoma: Epidemiology Clinical findings Imaging features Prognosis factors
Osteosarcoma associated to other conditions
Role of MRI in Evaluation of Anterior Cruciate Ligament (ACL) Graft Reconstruction

All Day Room: MK Community, Learning Center

Participants
Ameya M. Kulkarni, MBBS, MD, MUMBAI, India (Presenter) Nothing to Disclose
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TEACHING POINTS
Anterior Cruciate ligament (ACL) is the most commonly reconstructed ligament in the Knee and MR imaging plays an important role in evaluating integrity of the ACL graft. MRI imaging also helps in diagnosing complications associated with ACL reconstruction. Graft reconstruction of the anterior cruciate ligament (ACL) has become an accepted treatment for symptomatic ACL deficiency post injury during the past 3 decades. Femoral tunnel ganglion had not been described in literature, which was found in our study in 2 patients.

TABLE OF CONTENTS/OUTLINE
A total of 112 patients were included in our study who underwent postoperative MRI in a period of 2 years in 2014 and 2015. Patients undergoing ACL reconstruction are increasing in number with recent surgical advances. It has become essential for a radiologist to be familiar with these procedures and associated complications. MRI is the imaging modality of choice to image patient with ACL reconstruction surgery. Here, we have reviewed MRI findings in patients with ACL reconstruction and provided an overview of normal imaging findings as well as common complications in these patients.
TEACHING POINTS

To describe and illustrate the spectrum of pathological findings related to patellar resurfacing on plain-film X-rays in patients with total knee arthroplasty. To familiarize radiologists with uncommon and often forgotten complications of patellar resurfacing in total knee arthroplasty.

Background

The prevalence of knee implants is increasing with the aging of the population. Patellar resurfacing is performed in about 45% of patients undergoing total knee arthroplasty. It is important for radiologists to recognize complications of patellar resurfacing following knee arthroplasty. Review of imaging findings: 1. Normal plain film findings and pitfalls 2. Pathologic plain-film findings (with sample cases): asperos rectangular instability dislocation or luxation and rupture of the prosthetic patellar component osteolytic patellar lesions osteonecrosis

Summary
Imaging of Juvenile Pre-arthritic Hip Conditions and Their Long Term Evolution

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS
1. Review juvenile pre-arthritic hip conditions
2. Show imaging appearances of their long term evolution in adolescents/young adults including development into femoroacetabular impingement and early onset osteoarthrosis

TABLE OF CONTENTS/OUTLINE
Pre-test questions
Overview of normal hip anatomy and embryology
Juvenile pre-arthritic hip conditions Cause, clinical symptoms, imaging diagnosis (including radiograph, CT, MRI, and US), and treatment
Developmental dysplasia of the hip (DDH) Avascular necrosis including Legg-Calve-Perthes (LCP) Slipped capital femoral epiphysis (SCFE) Long term evolution of these conditions with follow up imaging after initial diagnosis, including future development of: Femoroacetabular impingement Early onset osteoarthrosis
Post-test questions
Ankle Tendon and Ligament Surgeries: What the Radiologist Needs to Know

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS
The purpose of this exhibit is: To review the basic principles and indications on surgical reconstruction techniques of ankle ligaments and tendons To demonstrate most common reconstruction techniques by original medical illustrations and correlate expected anatomy with MR and US findings To demonstrate most common complications related to surgery To become familiar with ankle tendon and ligament surgeries to avoid diagnostic pitfalls and ensure accurate assessment of the osseous and soft tissue structures

TABLE OF CONTENTS/OUTLINE
Anatomy of the ankle ligaments and tendons Most common ankle ligaments and tendons lesions Surgical reconstruction techniques of ankle ligaments and tendons Radiologic evaluation of the postoperative foot and ankle, with emphasis on MRI Original medical illustrations Sample cases and mimics Future directions
MR Imaging Findings in Spondyloarthropathies: What Clinicians Want to Know

All Day Room: MK Community, Learning Center

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TEACHING POINTS
Brief review of spondyloarthropathies (SpA) and their manifestations
Review the MR imaging findings in the spondyloarthropathies
Discuss the utilization of specific MRI sequences to improve the sensitivity and specificity of the MRI for early diagnosis of spondyloarthropathies

TABLE OF CONTENTS/OUTLINE
Review spondyloarthropathies and the subtypes
Learn about the burden of disease and the importance of early diagnosis to initiate treatment to avoid irreversible complications
Review the heterogeneous manifestation of spondyloarthropathies that oftentimes make the diagnosis challenging. Discuss the approach to interpret the MR imaging to narrow the differential diagnosis. Review various imaging findings of SpA such as enthesis, sacroiliitis, Romanus lesion, Anderson lesion, fatty metaplasia lesions, sacroiliitis, and ankylosis.
Discuss the utilization of specific MRI sequences to improve the diagnostic yield of MR imaging in the diagnosis of SpA.
Case presentation of selected examples of pathologies showing incremental value of MR imaging over conventional imaging techniques.
Ankle Ligaments: Review of Anatomy and Commonly Encountered Traumatic Pathology

All Day Room: MK Community, Learning Center

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TEACHING POINTS
The goals of this exhibit are: Present a practical review of ankle ligaments about the tibiotalar joint including normal anatomy, MRI appearance and function Review the basic mechanism and imaging appearance of injury The structures contemplated in this exhibit are the syndesmotic inferior tibiofibular ligaments, lateral collateral ligaments, medial collateral ligament and the spring ligament complex.

TABLE OF CONTENTS/OUTLINE
1- Introduction
2- Lateral collateral ligaments: Anatomy and function review of the anterior talofibular, posterior talofibular and calcaneofibular ligaments Imaging of traumatic pathologies related
3. Medial collateral (deltoid) ligaments: Anatomy and function review addressed to the superficial and deep deltoid layer components Imaging of traumatic pathologies related
4. Plantar Calcaneonavicular (Spring) Ligaments Anatomy and function review Imaging of traumatic pathologies related
5. (Inferior) Tibiofibular Syndesmotic Ligaments Anatomy and function review of the anterior (inferior) tibiofibular, posterior (inferior) tibiofibular, inferior transverse and intraosseous tibiofibular ligaments Imaging of traumatic pathologies related
6. Conclusion
Malinal Peripheral Nerve Sheath Tumor in Neurofibromatosis Type 1 Patients: An Overview with Emphasis on Imaging Strategies

Participants
Consuelo M. Grassi, Barcelona, Spain (Presenter) Nothing to Disclose
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Jose Luis Vercher-Conejero, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Malignant Peripheral Nerve Sheath Tumors (MPNST) occur in up to 50% of NF-1 patients. Unexpected growth of a preexisting neurofibroma, or the occurrence of unexplained pain should suggest the diagnosis. MRI cannot differentiate MPNST from benign neurofibromas, but the absence of signs such as fascicular, target and split-fat signs may suggest MPNST.
PET-CT is sensitive and specific for differentiating MPNST from benign neurofibroma in NF-1 patients. Percutaneous US/CT-guided biopsy performed in the area of intralesional higher SUV helps to confirm the diagnosis and to plan treatment strategy.

TABLE OF CONTENTS/OUTLINE
Clinical overview of NF-1. Epidemiology of MPNST in NF-1. Clinical features. Pathologic features - Neurofibroma - Atypical neurofibroma - MPNST. Imaging: - Imaging criteria are not specific in differentiating MPNST from benign neurofibroma. - Larger size and rapid growth should suggest the diagnosis. - MRI helps differentiate MPNST from benign neurofibromas, but cannot provide definitive diagnosis.
- Increased uptake in FDG-PET, with average SUV of 5.4-7.6 is found to be characteristic of MPNST, but can overlap between benign neurofibromas and MPNST.
- Percutaneous CT-guided biopsy performed in the area of higher SUV helps to confirm the diagnosis and to plan treatment strategy.
Some Strings Attached: Head to Toe Overview of Tendon Imaging

All Day Room: MK Community, Learning Center

Awards
Magna Cum Laude

Participants
Matthew G. Pipho, MD, Madison, WI (Presenter) Nothing to Disclose
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Jason W. Stephenson, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
After viewing this exhibit, participants will:
1. Understand the normal imaging appearance of tendons on radiographs, CT, MRI, and ultrasound.
2. Regard the relationship between the biochemical composition of tendons, their normal imaging appearance, and commonly encountered tendon imaging artifacts including anisotropy on ultrasound and magic-angle phenomenon on MRI.
3. Appreciate how disturbances of this underlying biochemistry also explain the appearance of abnormal tendons on imaging.
4. Diagnose common tendon pathology on MRI and ultrasound images.

TABLE OF CONTENTS/OUTLINE
Radiology: The One Stop Shop for the Diagnosis and Treatment of Hip Pain

All Day Room: MK Community, Learning Center

Participants
Davis Rierson, MD, Charlottesville, VA (Presenter) Nothing to Disclose  
Erin McCrum, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose  
Jennifer Pierce, MD, Portsmouth, VA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Hip pain is a frequent indication for radiologic evaluation and can be a treatment dilemma for many patients and their physicians. However, targeted ultrasound guided intervention can provide important diagnostic information and significant local symptom relief with minimal systemic side effects. After reviewing this exhibit, the viewer will be able to: 1. Describe the normal ultrasound appearance of the hip. 2. Recognize radiologic hallmarks of various causes of extra-articular hip pain on various imaging modalities including ultrasound, MRI, and plain film radiography. 3. Understand the technical aspects and benefits of performing targeted ultrasound guided intervention for the treatment of hip pain.

TABLE OF CONTENTS/OUTLINE
Bone Marrow across the Ages: An Overview of Normal versus Pathologic Bone Marrow Patterns on MRI

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
1. The conversion of red to yellow marrow from infancy to adulthood follows a predictable pattern.
2. Radiologists should be aware of normal bone marrow patterns to avoid mistaking normal bone marrow patterns for pathology.
3. Various pathologic processes result in the reconversion of yellow marrow to red marrow, which occurs in the opposite order of normal marrow conversion.
4. Pathologic processes can also cause focal or diffuse abnormalities in the appearance of bone marrow on MRI.

TABLE OF CONTENTS/OUTLINE
1. Brief introduction and background.
2. Normal conversion pattern of red marrow to yellow marrow. Normal pattern of conversion: diaphysis, epiphyses, distal metaphysis, proximal metaphysis. Description and examples of normal bone marrow patterns on MRI at various ages: infancy, childhood, adolescence, adulthood.
3. Abnormal bone marrow. Reconversion of yellow marrow to red marrow in opposite order of normal conversion. Pathologic processes that result in bone marrow reconversion. Examples of marrow reconversion on MRI.
4. Additional pathologic processes that result in abnormal appearance of bone marrow with examples.
5. Conclusion.
TEACHING POINTS

After reviewing this exhibit, learners will 1) acquire introduction to Digital Tomosynthesis (DT) as a new technique for musculoskeletal imaging including basic concept and current limitations, 2) Learn about new advanced DT reconstruction and visualization methods (such as volume rendering and multiplanar reconstruction), 3) Understand clinical utility of these advanced post-processing methods in various MSK radiology cases (trauma, hardware failure, osteoarthritis, rheumatoid arthritis, etc)

TABLE OF CONTENTS/OUTLINE

A. Limitations of Current Imaging Modalities
   i. Limitations of conventional radiography in MSK imaging
   ii. Limitations of CT for MSK imaging
B. Introduction to Conventional digital tomosynthesis (DT)
   i. DT acquisition and image reconstruction
   ii. Comparison of DT to conventional radiography and CT for MSK imaging
C. Advanced DT post processing Methods
   i. Multi-planar Reconstruction Methods
   ii. 3D Volume Rendering Visualization Methods
   iii. Super Resolution Reconstruction Methods
D. MSK Applications of advanced DT methods and Comparison to Standard of Care
**Imaging Features of Shoulder Prosthesis Complications**

All Day Room: MK Community, Learning Center

**Participants**
Andrey Rupasov, DO, Rochester, NY *(Presenter)* Nothing to Disclose
Scott R. Schiffman, MD, Rochester, NY *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**
The purpose of this exhibit is:
1. To review the radiographic appearance of shoulder prosthesis variants and their attendant complications, utilizing image-rich cases and illustrative schematics.
2. To review the incidence and pathophysiology of each complication.
3. To emphasize techniques that may increase sensitivity and aid in recognition of prosthesis complications.

**TABLE OF CONTENTS/OUTLINE**
- Arthroplasty variants
  - Humeral head resurfacing
  - Hemiarthroplasty
  - Total shoulder arthroplasty
  - Reverse shoulder arthroplasty
- Imaging of Complications
  - Periprosthetic fracture
  - Prosthetic instability
  - Prosthetic failure
  - Humeral component loosening
  - Glenoid component loosening
  - Scapular notching
  - Particle disease
  - Infection
TEACHING POINTS

1. To understand the clinical indications for calcium phosphate injection and the basic steps of the surgical procedure.
2. To recognize the MRI features of calcium phosphate bone substitute and how they evolve over time through a case-based approach.
3. To distinguish between expected post-operative MRI findings and similar appearing pathologic processes including avascular necrosis.

TABLE OF CONTENTS/OUTLINE

1. Introduction
   - Review the pathophysiology and incidence of subchondral fractures
   - Discuss the indications for calcium phosphate bone injection
2. Surgical approach
   - Differences between various bone synthetic substitutes
   - Explanation of the surgical procedure for their injection
3. Post-operative imaging evaluation
   - Illustrate the post-operative MRI features of patients after calcium phosphate injection procedures through a case-based interactive approach
   - Compare the post-operative MRI features of calcium phosphate injection with similar appearing pathologies and illustrate ways to differentiate between them
   - Avascular necrosis
   - Osteoporotic fracture
   - Osteomyelitis
Fibrous Dysplasia: A Pictorial Review

All Day Room: MK Community, Learning Center

Participants
Tetiana Glushko, MD, Darby, PA (Presenter) Nothing to Disclose
Sergiy Kushchayev, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Yevgeniya Kushchayeva, Washington, DC (Abstract Co-Author) Nothing to Disclose
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Alison M. Boyce, MD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose
Sri Harsha Tella, MD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To describe the physiopathology of fibrous dysplasia.
2. To illustrate the broad spectrum of radiological imaging features of fibrous dysplasia, in both its monostotic and polyostotic forms, using a multimodality approach with conventional radiography, computed tomography, magnetic resonance and nuclear scans.
3. To discuss clinical and radiological features of the syndromes associated with fibrous dysplasia (McCune-Albright, Mazabraud’s, cherubism).

TABLE OF CONTENTS/OUTLINE
1. Introduction: fibrous dysplasia
2. Physiopathology of fibrous dysplasia
3. Imaging finding: Radiographs, CT, MRI, Nuclear Medicine Scans.
4. Pictorial review of fibrous dysplasia depending on location (skull, spine, upper extremity, lower extremity).
5. Radiological features of monostotic and polyostotic forms.
7. Complications of the fibrous dysplasia.
Crystal Arthropathies: Getting to Know the Main Entities, Which Joints are Involved and Specific Imaging Features

All Day Room: MK Community, Learning Center

**Participants**
Valdo L. Barros Junior, Sorocaba, Brazil (Presenter) Nothing to Disclose
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**TEACHING POINTS**
Review of the most common crystal arthropathies and their main clinical aspects.
Summary of the most common involved joints in each group and their MR and CT imaging findings.

**TABLE OF CONTENTS/OUTLINE**
Crystal arthropathy refers to a group of diseases characterized by precipitation of crystals in the joint, synovial sheath, bursae and soft tissue, causing secondary inflammatory which leads to arthropathy and soft tissue masses. This article will discuss the three most common crystal arthropathies, caused by deposition of monosodium urate, calcium pyrophosphate dihydrate and calcium hydroxyapatite. MRI is the imaging modality of choice in derangement of joints due to its capability of studying osseous structures, articular and periarticular tissues. As a drawback, MRI has low sensitivity in identifying small calcifications, which somewhat limits MRI in diagnosing crystal arthropathies. CT is superior in characterizing calcifications and small erosions. Each diagnostic entity presents different imaging aspects and affected sites, which will be debated in this exhibit. The purpose of this exhibit is to review these entities, to recognize and summarize their specific MR and CT imaging findings.
Awards
Cum Laude

Participants
Jeffrey D. Stevens, MD, Temple, TX (Presenter) Nothing to Disclose
Ricardo D. Garza-Gongora, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
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Connie C. So, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To provide a radiologic depiction of certain soft tissue tumors which demonstrate specific MR signal and morphologic characteristics or "signatures", which are highly specific and occasionally allow for diagnosis without biopsy. 2. In most cases, a specific diagnosis is not obtainable by imaging alone. This exhibit will also provide a systematic approach to narrow the differential for those lesions that remain indeterminate.

TABLE OF CONTENTS/OUTLINE
Although commonly encountered in normal daily practice, soft tissue tumors of the extremities remain a challenging diagnosis. While MR imaging is far superior to other modalities in characterizing soft tissue tumors, in the majority of cases, a specific diagnosis is not obtainable by imaging alone. Several soft tissue tumors and non-tumor masses have specific MR signal and morphologic characteristics or "signatures", which are highly specific, occasionally allowing for diagnosis without biopsy. This exhibit will provide a systematic approach to narrow the differential of those lesions that are incompletely characterized by imaging, while also providing the reader with a radiologic depiction of certain soft tissue tumors of the extremities and their "signatures".
Kneecap Know-How: A Profusion of Patellar Pathology

All Day Room: MK Community, Learning Center

Participants
Kishore K. Chundru, MD, New York, NY (Presenter) Nothing to Disclose
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Carlos L. Benitez, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review the spectrum of pathologies that affect the patella and the peripatellar structures.
2. To demonstrate the radiologic features of multiple patella-specific pathologies.
3. To review normal variants that may be mistaken for patellar pathology.

TABLE OF CONTENTS/OUTLINE
1. Brief review of anatomy of the patella and structures relevant to various disease processes.
2. Review of normal variants that may mimic findings from trauma or degenerative disease, with examples of each.
   * dorsal patellar defect
   * multipartite patella
   * patellar plica
3. Review of key peripatellar diagnoses that may lead to pain/other symptomatology.
   * patellar tracking disorder
   * distal quadriceps tendinosis
   * patellar tendinosis
   * Sinding-Larsen-Johansson disease/ jumper's knee
4. Brief review of the spectrum of degenerative changes seen in the patella.
   * cartilage fissure
   * cartilage delamination
   * subchondral cystic change
5. Review of most common traumatic injuries seen in the patella.
   * patellar fracture
   * patellar dislocation
   * bony contusion
Radiographic and Surgical Findings of Type 1 Obturator Hernias

All Day Room: MK Community, Learning Center

Participants
Daniel D. Droukas, MD, New York, NY (Presenter) Nothing to Disclose
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Mark Zoland, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Devon A. Klein, MD, MPH, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The goal of this educational exhibit will be to familiarize readers with the radiographic findings of type 1 obturator hernias, as well as with the surgical defect observed at laparoscopic repair. A brief overview of the clinical presentation, anatomy, and imaging pitfalls will be discussed.

TABLE OF CONTENTS/OUTLINE
Obturator hernias are a significant and under-diagnosed cause of groin pain. Type 1 obturator hernias containing only preperitoneal fat are commonly overlooked at the time of imaging. A clear understanding of the anatomy and radiographic findings will help to reduce lengthy workups and to promote effective surgical planning. Multiplanar MR sequences without fat suppression provide the greatest diagnostic sensitivity, while CT and ultrasound offer supplementary utility in certain clinical circumstances. Intro/clinical presentations Anatomy and defect variants Imaging findings in multiple modalities and planes Sample cases with surgical correlation Discussion
Approach to the Sonographic Evaluation of Soft Tissue Masses

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Netanel Berko, MD, Bronx, NY (Presenter) Nothing to Disclose
Jenna N. Le, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Beverly A. Thornhill, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Classification of soft tissue masses based on location and sonographic features is helpful in accurately assessing soft tissue masses. Sonographic features can often differentiate benign from malignant lymphadenopathy. Color Doppler imaging helps differentiate cystic from solid masses and is a standard part of the evaluation of soft tissue masses. Ultrasound-guidance allows for targeted biopsy of suspicious areas within a mass.

TABLE OF CONTENTS/OUTLINE

Examination technique Transducer selection Color Doppler imaging Use of gel standoff pad Approach to the assessment of soft tissue masses Location Shape Echogenicity Size Vascularity Soft tissue masses with characteristic sonographic appearance Lipoma Giant cell tumor of tendon sheath Elastofibroma Nerve sheath tumor Morton neuroma Plantar fibromatosis Pilomatricoma Subcutaneous granuloma annulare Dermatofibrosarcoma protuberans Rheumatoid nodule Bursitis (olecranon; prepatellar) Lymphadenopathy (benign and malignant) Sonographic features suggestive of malignant lesions Limitations of ultrasound in the assessment of soft tissue masses Ultrasound-guided biopsy of soft tissue masses
Participants
Andrew L. Chiang, MD, Maywood, IL (Abstract Co-Author) Nothing to Disclose
Marko E. Marbella, MD, Maywood, IL (Presenter) Nothing to Disclose

TEACHING POINTS
A wide variety of bony and soft tissue masses, both benign and malignant, occur in the foot and ankle. Imaging can help to establish a diagnosis or limited differential diagnosis and to guide medical decision-making. Imaging characteristics of common and uncommon lesions of the foot/ankle will be reviewed, with emphasis on MRI, CT, ultrasound, and conventional radiography.

TABLE OF CONTENTS/OUTLINE
Review of Foot and Ankle Anatomy Imaging Approach and Techniques Sample Cases with MRI, CT, Ultrasound, Radiographs Bony, muscular, neural, subcutaneous, tendon-based, miscellaneous masses Summary
Ischiofemoral Impingement: An Important Cause of Hip Pain

All Day Room: MK Community, Learning Center

TEACHING POINTS

Ischiofemoral anatomy and impingement pathophysiology. Description of imaging findings. Report uncommon quadratus femoris extrinsic compression causes.

TABLE OF CONTENTS/OUTLINE

The quadratus femoris is one of the muscles involved in external rotation and adduction of the hip and the thigh. Its origin is located at the ischial tuberosity, anteriorly to the semimembranosus tendon, and it inserts at the posteromedial aspect of the proximal femur, specifically at the quadrate tubercle and at the intertrochanteric crest. Its muscle belly courses through the ischiofemoral space, which is located between the lesser trochanter and the ischial tuberosity. Narrowing of the distance between these bony landmarks is termed ischiofemoral impingement and can be congenital or acquired. This condition frequently presents with hip movement-related pain and may cause irritation of the adjacent ischiatic nerve, which in turn may lead to distal pain irradiation to the lower limb. Magnetic resonance imaging is able to quantify these changes and plays an important role on differentiating ischiofemoral impingement from other pathologic conditions with similar clinical symptoms. The purpose of this paper is to be a concise guide about the normal anatomy of the ischiofemoral space and to describe the imaging findings related to ischiofemoral impingement syndrome.
Teaching Points

Imaging-guided percutaneous biopsies are playing an increasing role in diagnosis, staging, and management of MSK tumors, infections, and inflammatory conditions. A multidisciplinary approach whereby the radiologist works closely with the clinicians/pathologist is necessary to maximize the possibility of definitive diagnosis while minimizing potential complications. To accomplish these goals, radiologists must be familiar with indications, anatomical details, appropriate procedure planning, and proper specimen handling. Post-biopsy follow-up is crucial to ascertain pathology concordance. This exhibit systematically reviews the fundamentals of MSK biopsies and recent advances using a step-by-step approach.

Table of Contents/Outline

Indications: Diagnosis, staging, treatment response, guiding management, molecular profiling
Patient preparation, Pain management
Selection of biopsy approach [compartmental anatomic guidelines in upper/lower extremities in anticipation of (limb sparing) surgery], Imaging guidance modality, Biopsy needles Spine biopsy: Osseous (transpedicular, transcostovertebral, parapedicular), intervertebral disc biopsy
Specimen handling: Routine & Special solutions Special considerations: Osteoblastic lesions, Unusual biopsy sites Specifics of infection biopsies Pitfalls Advances in biopsy equipment and advantages (Powered drill systems, large gauge needles)
**Awards**  
**Certificate of Merit**

**Participants**  
Wenli Cai, PhD, Boston, MA (*Presenter*) Nothing to Disclose  
Gordon J. Harris, PhD, Boston, MA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Stockholder, IQ Medical Imaging LLC;

**TEACHING POINTS**

In this exhibit, we present an overview about the state-of-the-art volumetric tumor quantification techniques of Neurofibromatosis (NF) in MRI. The teaching points of this exhibit are: Volumetric tumor quantification is an objective, sensitive, and accurate imaging biomarker to detect small changes in tumor size. Current image segmentation techniques allow for accurate quantification of the volumetric size of NF tumors in MRI. Volumetric quantification of NF tumors has been recommended to monitor tumor growth and assess tumor response in clinical trials and daily clinical practices. A perfect solution, i.e. an accurate and efficient segmentation method, to NF quantification is still under investigation.

**TABLE OF CONTENTS/OUTLINE**

Participants
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TEACHING POINTS
Describe the anatomy and MR imaging characteristics of the normal postoperative anterior cruciate ligament (ACL) graft reconstruction. Based on the understanding of the normal ACL graft reconstruction MR appearance, learn how to identify postoperative ACL graft complications. Review the postoperative complication clinical history timeline to help aid in diagnosis.

TABLE OF CONTENTS/OUTLINE
ACL graft reconstruction for symptomatic ACL deficiency is a commonly performed procedure to alleviate symptoms of joint instability. Postoperative complications of primary ACL reconstruction are readily diagnosed on MR imaging and are important to recognize as the rate of recurrent instability after surgery ranges from 1-8%. We will perform a case-based review of MR characteristics of postoperative ACL graft reconstruction. After completing this educational exhibit, the reader will be able to recognize the various types of postoperative ACL graft complications. Normal ACL graft reconstruction Complete graft tear Partial graft tear Arthrofibrosis Tunnel cysts Roof impingement Infection Hardware-related complications
MRI of Sacroilitis Associated with Axial Spondyloarthropathy (AxSpA): A Pictorial Review of Imaging Mimics and Pitfalls

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
Review the anatomy of the sacroiliac joint and optimal MR imaging technique. Highlight MR imaging findings of AxSpA including structural and inflammatory change. Demonstrate common imaging mimics of AxSpA including sacroiliac joint infection, sacral insufficiency fracture, normal sacral fatty marrow, osteitis condensans ili and degenerative change. Understand key imaging principles to differentiate AxSpA from imaging mimics.

TABLE OF CONTENTS/OUTLINE
1.) Overview of sacroiliac joint anatomy through illustrative figures and MR images. 2.) Clinical and imaging overview of AxSpA including MR findings of structural and inflammatory change. 3.) Discussion of pitfalls in diagnosis including imaging differentiation of inflammatory sacroilitis from sacroiliac joint infection, sacral insufficiency fracture, normal sacral fatty marrow, osteitis condensans ili and degenerative change. 4.) Self-assessment with unknown cases.
On Bended Knee: Diagnosing Extensor Mechanism and Associated Pathologies

All Day Room: MK Community, Learning Center

Participants
Joseph E. Burns, MD, PhD, Orange, CA (Presenter) Nothing to Disclose
Donald von Borstel, DO, Orange, CA (Abstract Co-Author) Nothing to Disclose
Arash Anavim, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Saema Said, BS, Orange, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the anatomy and pathophysiology of the extensor mechanism and associated structures of the knee. 2. Discuss clinical and imaging presentations of pathologic conditions of the extensor mechanism based on mechanical processes, including those of trauma and degenerative etiology. 3. Discuss clinical and imaging presentations of pathologic conditions of the extensor mechanism based on other processes; including physiologic, metabolic, and infectious.

TABLE OF CONTENTS/OUTLINE
Pelvic Pain Caused by Atypical Pelvis Entrapment Neuropathies

All Day Room: MK Community, Learning Center

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Renata V. Leao, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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Hugo P. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
This study aims to:
• Perform an anatomical review of the pudendal, internal obturator and lateral femoral cutaneous nerves.
• Review and illustrate the main sites of nerve entrapment in the pelvis, using 3 dimensions magnetic resonance imaging (MRI) reconstructions.
• Illustrate the cases of entrapment neuropathies diagnosed by MRI.

TABLE OF CONTENTS/OUTLINE
1. Introduction: the importance and prevalence of neuropathies of pudendal, internal obturator and femoral lateral cutaneous nerves.
2. Anatomic review of each nerve.
3. Review of the compression sites of each nerve: most prevalent compression sites.
4. Imaging findings related to those neuropathies: Case based review using MRI, ultrasound and CT images.
5. Clinical symptoms of each neuropathy.
6. Summary
Awards
Identified for RadioGraphics

Participants
Renata V. Leao, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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TEACHING POINTS
This study aims to illustrate the cases of venous thrombosis diagnosed on magnetic resonance imaging (MRI) in patients with initial
suspicion of musculoskeletal pain, focusing in:1. Illustrate the main imaging findings that must make the radiologist think of a
thrombosis instead of a musculoskeletal pathology2. Illustrate MRI-angiograms and how this sequence may help reaching the
correct etiological diagnosis of muscle pain3. Correlate MRI and Doppler ultrasound and show how this correlation may help reaching
the correct diagnosis

TABLE OF CONTENTS/OUTLINE
1. Introduction:- clinical symptoms and risk factors for thrombosis- importance of the correct diagnosis (risk related to a missed
diagnosis)2. Imaging findings of venous thrombosis in MRI and its correlation with ultrasound.3. Case review: illustration of venous
thrombosis cases that simulated a musculoskeletal pathology4. Conclusion
Osteomyelitis in Known Pediatric Cases of Pulmonary Tuberculosis

All Day Room: MK Community, Learning Center

Participants
Ashwini Sankhe, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
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Arvind Borde, MUMBAI, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Tuberculosis is widespread in Indian subcontinent. Osteomyelitis is a known complication of pulmonary tuberculosis and occurs in 1 to 3% of the population. Tuberculous osteomyelitis is usually hematogenous in origin and most commonly involves bones of the extremities, including the small bones of the hands and feet. In long tubular bones, tuberculosis often involves the epiphyses. In children, metaphyseal foci can involve the growth plate which differentiates tuberculosis from pyogenic infection. Accurate workup of patients can help to detect subclinical or dormant cases of tuberculosis and subsequently aid in effective treatment.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of tuberculous osteomyelitis. MRI findings of tuberculosis osteomyelitis. Imaging features differentiating tuberculous osteomyelitis from the pyogenic osteomyelitis. Summary.
Osteochondritis Dissecans of the Knee: A Multi-stage Disease

All Day Room: MK Community, Learning Center

Participants
Alexandre F. Kanas, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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Vitor S. Louzada, MD, Vitoria, Bahamas (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Introduce the concept and the pathophysiology of osteochondritis dissecans; Describe the varying aspects of osteochondritis dissecans over time and point out the main radiological findings used to identify them; Review the most common osteochondritis dissecans complications; Discuss the main imaging findings that should be described on the radiological report.

TABLE OF CONTENTS/OUTLINE
Epidemiology and pathophysiology of osteochondritis dissecans; Present the main sites of involvement; Case series from a quaternary hospital to demonstrate the different stages of osteochondritis dissecans; Evaluate the main radiography, computed tomography and magnetic resonance findings and discuss the advantages and disadvantages of the different imaging methods; Highlights of the most common complications that should be observed and reported; Summary and conclusion.
Musculoskeletal Pain in Oncologic Patients: Beyond the Tumor

All Day Room: MK Community, Learning Center

Participants
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TEACHING POINTS
LEARNING OBJECTIVESThis study aims to illustrate the many possible etiologies for a musculoskeletal pain - not related to metastasis or to the tumor itself - in patients with a cancer diagnosis: - Establish the many possible causes of a musculoskeletal pain in patients with cancer- Illustrate the musculoskeletal pathologies - not related to the tumor or to metastasis - that have a higher prevalence in cancer patients.- Review the imaging patterns of each differential diagnosis for a musculoskeletal pain in patients with cancer- Illustrate the mentioned differentials based on clinical cases

TABLE OF CONTENTS/OUTLINE
LEARNING OBJECTIVESThis study aims to illustrate the many possible etiologies for a musculoskeletal pain - not related to metastasis or to the tumor itself - in patients with a cancer diagnosis: - Establish the many possible causes of a musculoskeletal pain in patients with cancer- Illustrate the musculoskeletal pathologies - not related to the tumor or to metastasis - that have a higher prevalence in cancer patients.- Review the imaging patterns of each differential diagnosis for a musculoskeletal pain in patients with cancer- Illustrate the mentioned differentials based on clinical cases
**TEACHING POINTS**

- Wide area detector CT allows performing dynamic enhancement study with low radiation.
- New applications are increasing in musculoskeletal disorders. Our main indications are: Help to approach diagnosis of primary bone tumors Targeting for biopsy of bone tumors Osteoid osteoma and relapse post radiofrequency ablation. Evaluate acute osteitis in Charcot arthropathy and chronic osteomyelitis.

**TABLE OF CONTENTS/OUTLINE**

**Basic Principles of CT-perfusion. Protocol of CT-perfusion and Dose-related. Rationale of CT-perfusion in MSK pathology:** DCE of bone tumors has been traditionally studied by MRI. Since appearance of wide area detector CT, we can analyze this enhancement by CT. We use a maximum slope model to calculate blood flow. The Time-Density Graph displays the average image density over time curve in the tissue sample. With perfusion color maps, we have better evaluation of areas with hypervascularity inside the bone. **Indications of CT-perfusion:** It is useful to approach the diagnosis of some bone tumors (like GCT and osteoid osteoma). Identification of more early and intense enhancement areas helps to identify the target zones for percutaneous CT-guided biopsies (avoiding necrosis). We find it useful to evaluate acute osteitis (enhancement inside the bone), e.g. Charcot arthropathy and chronic osteomyelitis.


**Knee Locking in the Young Sportsman: How Can We Make the Correct Diagnosis?**

All Day Room: MK Community, Learning Center

**Participants**

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**TEACHING POINTS**

The objective of this exhibit is:- To describe the most frequent pathologies causing knee locking.- To show the different entities that may cause knee locking using different imaging modalities.

**TABLE OF CONTENTS/OUTLINE**

Knee locking is a common pathology between young sportsmen.- Clinical presentation.- This exhibit shows examples of the most frequent causes of knee locking: discoid meniscus, osteochondritis dissecans, bucket – handle meniscal tears, meniscocapsular tears and intraarticular loose bodies using different imaging modalities.- This exhibit also shows other less frequent causes of knee locking like ganglions or lesions in the Hoffa’s fat pad…- We will explain and show with examples the role of MR and CT arthrography in patient’s with knee locking. These imaging modalities are very useful to characterize small lesions not previously seen.
Extraordinary Cases of Synovial Osteochondromatosis

All Day Room: MK Community, Learning Center

Participants
Sarah M. Deraney, MD, Nashville, TN (Presenter) Nothing to Disclose
Adam R. Militana, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Elizabeth V. Craig, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
John J. Block, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Katherine G. Hartley, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To provide a review of synovial osteochondromatosis (SOC) including pathophysiology, clinical presentation, imaging features, differential considerations and treatment options.
2. To provide a diagnostic strategy for diagnosing synovial osteochondromatosis even when the location and manifestations of the disease process are not typical.

TABLE OF CONTENTS/OUTLINE
Title: Extraordinary Cases of Synovial Osteochondromatosis
Background: Review of disease features
Illustrative Case: Show one or more classic cases of synovial osteochondromatosis to illustrate typical presentation, location, and imaging features.
Extraordinary Cases: Present a series of instructive pathology proven synovial osteochondromatosis cases, from our institution, where the diagnosis was unexpected or not initially considered.
Review/Conclusion: Summarize lessons learned from unique cases that allow for situation appropriate expanded differential diagnoses to include synovial osteochondromatosis.
Participants
Hyun Seok Shim, MD, Ulsan, Korea, Republic Of (Presenter) 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
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review current indications and methods for sacroplasty 2. To demonstrate a step by step procedure of sacroplasty 3. To share the cases of sacroplasty performed at our institution 4. To discuss the outcome, complication, and pitfalls of sacroplasty 5. To provide procedural tips

TABLE OF CONTENTS/OUTLINE
Introduction- What is sacroplasty?- Why do it and how does it work?- Approaches and modalitiesStep by step procedure- Pre-procedural evaluation- Preparation (patient positioning and skin sterilization)- Anesthesia- C-arm flat-panel CT guided needle insertion- Cement preparation and injection- Post-procedural evaluationSample casesComplicationsConclusionReference
Musculoskeletal Findings in Leprosy

All Day Room: MK Community, Learning Center

Participants

Pedro Henrique R. Silva, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Joao L. Marin Casagrande, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hugo P. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
María Angela b. Trindade, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD,PhD, 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

Leprosy is an infectious disease caused by Mycobacterium leprae, most commonly found in tropical countries. It preferably invades skin and peripheral nerves and is considered the most widespread treatable neuropathy in the world. Therefore it’s important for radiologists to recognize its most common imaging findings, mostly on US and MRI, so an accurate diagnosis can be made and treatment can be initiated, thus avoiding severe sequelae. The aim of this exhibit is to 1. review leprosy (Hansen’s disease)’s most common musculoskeletal imaging findings and the differential diagnosis. 2. Illustrate the main imaging findings in Magnetic Resonance Imaging (MRI) and ultrasound (US) with cases diagnosed in our Service. 3. Compare the imaging features of other conditions which may be included in the differential diagnosis, showing the diagnostic challenges/pitfalls and similar findings among them, which may lead to a more accurate diagnosis.

TABLE OF CONTENTS/OUTLINE

- Leprosy (epidemiological and clinical features)
- Normal aspect of the peripheral nerves
- Musculoskeletal findings in leprosy
- Complications
- Differential diagnosis
- Conclusion
Participants
Leonor G. Savarese, MD, Ribeirao Preto, Brazil (Presenter) Nothing to Disclose
Mateus A. Hernandes, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Marcelo N. Simão, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Mauricio E. Yamashita, MD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Nelson F. Gava, MD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Edgard E. Engel, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Marcello H. Nogueira-Barbosa, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the imaging diagnosis appearance of fat-containing soft-tissue lesions, with radiologic-pathologic correlation. 2. Identify the radiologic manifestations that may allow differentiation of the various fat-containing soft-tissue lesions and the implications for diagnosis and treatment.

TABLE OF CONTENTS/OUTLINE
Fat-containing lesions are the most common soft-tissue lesions encountered by radiologists in everyday clinical practice. The imaging appearance of many fatty masses is frequently sufficiently characteristic to suggest a specific diagnosis, such as lipoma. However, there are multiple subtypes of benign and malignant fat-containing tumors, many of them with overlapping imaging features. We illustrate benign and malignant lesions, such as superficial lipoma, intramuscular and intermuscular lipomas, parosteal lipoma, lipoma arborescents, lipomatosis of nerve, lipoma variants (e.g. hibernoma, lipoblastoma), atypical lipomatous tumor, dedifferentiated liposarcoma, myxoid liposarcoma and pleomorphic liposarcoma. This exhibit provides a comprehensive imaging review of the spectrum of appearances of the fat-containing lesions, with radiologic-pathologic correlation, helping the radiologist to develop an adequate and ordered differential diagnosis.
Tendon Slips Passing in the Night- Intersection Syndromes of the Extremities

All Day Room: MK Community, Learning Center

Participants
Stephen E. Ling, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Padmaja A. Jonnalagadda, MD, Wynnewood, PA (Abstract Co-Author) Nothing to Disclose
Sarah D. Fenerty, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Sayed Ali, MD, Aston, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Although upper extremity intersection syndromes are commonly recognized, lower extremity intersection syndromes are less well known. Intersection syndromes occur at the crossing over of tendons in specific locations in the upper and lower extremities. 2. MRI is the imaging modality of choice due to its excellent soft tissue contrast resolution. This pathology is not uncommonly clinically undiagnosed before imaging. 3. Correct radiologic diagnosis allows for patient management utilizing either conservative measures or surgical procedures.

TABLE OF CONTENTS/OUTLINE

Typical locations in the extremities for intersection/crossover syndromes and the involved soft tissues including specific tendons will be discussed. These will include the little known chiasma crurale in the distal lower leg, Master knot of Henry at the plantar foot (jogger’s foot), first and second dorsal extensor compartment tendons in the distal forearm, and second and third extensor compartment tendons at the level of the carpus, as well as proposed distal biceps and brachialis tendons at the elbow. Normal gross and imaging anatomy will be examined at each of these locations. Pathophysiology will be reviewed as well. Abnormal MRI findings will be shown, typically tenosynovitis or peritendinitis and in some cases tendinosis. In addition, treatment options will be briefly discussed.
MR Imaging Correlation after Autologous Matrix-induced Chondrogenesis (AMIC) Treatment for Cartilage Defects in the Knee in Out Centre

All Day Room: MK Community, Learning Center

Participants
Milton C. Rendon Villa, MD, Castelldefels, Spain (Presenter) Nothing to Disclose
Dominguez Rosa, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Antoni Rivas Garcia, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Matias De Albert, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Lourdes Casas Gomila, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Carmen Torrents, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Eva Almazan Mesa, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
David De Bonadona, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Angela P. Salazar Gomez, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Rafael E. Ponciano Pascual SR, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Nayana Joshi Jubert, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To make a summary of the patellar cartilage defects, diagnosis and treatment. To present the radiological outcomes by MRI in patients with patellar cartilage defects treated with a technique that combines surgical microfractures with matrix of collagen type I/III, Autologous Matrix-Induced Chondrogenesis (AMIC). To explain the AMIC technique, advantages and limitations, based on the experience in our hospital.

TABLE OF CONTENTS/OUTLINE
A. Anatomy (include surgical anatomy) B. Pathophysiology C. Diagnostic Imaging (US, CT) D. Review of Indications, Contraindications E. Treatment F. Follow-up Management G. Outcomes (include complications)
Turning Mountains Into Molehills - A Review of Femoroacetabular Impingement Syndrome Radiologic Appearance and Treatment

All Day Room: MK Community, Learning Center

Participants
John G. Whaley, MD, San Diego, CA (Presenter) Nothing to Disclose
Matthew D. Burgess, MD, Chula Vista, CA (Abstract Co-Author) Nothing to Disclose
Pierre A. Pelletier, MD, Coronado, CA (Abstract Co-Author) Nothing to Disclose
Brian Barlow, DO, San Diego, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

• Review the pathoanatomy of femoroacetabular impingement (FAI).
• Review imaging findings suggestive of FAI and associated labral pathology using radiographs, CT, and MRI images.
• Discuss current controversies surrounding FAI.
• Correlate radiographic findings with intraoperative findings in selected cases.

TABLE OF CONTENTS/OUTLINE

• Pathoanatomy of femoroacetabular impingement
• Anatomic findings
  − Characteristic radiographic findings
  − Additional views (ie. Dunn)
  − Detailed pre-operative assessment using CT
• Common associated labral pathologic findings
• Review of treatment of FAI with intraoperative correlation
TEACHING POINTS

1. Detail anatomy: this helps to understanding the common site of labral tear and differentiate normal variants from pathologic tear. 2. Labral function ('seal effect') : this helps to understand the mechanism of tear and combined secondary findings and also helps to understand the different surgical methods of labral tear.

TABLE OF CONTENTS/OUTLINE

1. Introduction of acetabular labrum
2. Image strategy for acetabular labrum
3. Anatomy - gross anatomy/ arthroscopic anatomy/ cellular anatomy/ vascularity/ Nerve innervation
4. Function - stabilizer vs. seal effect - understanding of cascade of labral tear - understanding the arthroscopic treatment
5. Normal variant - perilabral sulcus/ posterior inferior sublabral sulcus/ anterosuperior sublabral cleft/ transverse ligament-labral junction
MK284-ED-X

Cystic-appearing Lesions: Imaging Findings and Systematic Approach

All Day Room: MK Community, Learning Center

Participants
Leonor G. Savarese, MD, Ribeirao Preto, Brazil (Presenter) Nothing to Disclose
Mateus A. Hernandes, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
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Marcelo H. Nogueira-Barbosa, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Describe the imaging findings of cystic-appearing lesions, with radiologic-pathologic correlation in selected cases.
2. Illustrate a systematic approach to help distinguishing truly cystic from solid lesions and narrow the differential diagnosis.

TABLE OF CONTENTS/OUTLINE

Cystic-appearing lesions may represent the manifestation of a wide variety of benign and malignant processes and are commonly seen in clinical practice. Some of these lesions are truly cystic and may be managed conservatively. A broad array of solid benign and malignant masses may also simulate a cyst and exhibit bright signal on T2-weighted MRI, due to their high water content. Cystic-appearing lesions may be classified into truly cystic lesions and “cyst-like” solid lesions, benign and malignant. Evaluation of the nature of the lesion (cystic or solid) can be done by contrast-enhanced MRI or Doppler ultrasonography. In addition, the differential diagnosis may be further narrowed by considering the anatomic location of the lesion or the presence of other characteristic imaging features. This exhibit provides a systematic diagnostic approach to assist the radiologist in establishing optimal diagnosis with significant therapeutic implications.
Magnetic Resonance (MR) Diffusion Weighted Imaging (DWI) of Vertebral Malignant Bone Marrow Lesions

All Day Room: MK Community, Learning Center

Participants
Laura Filograna, MD, ROME, Italy (Presenter) Nothing to Disclose
Nicola Magarelli, MD, Loreto Aprutino, Italy (Abstract Co-Author) Nothing to Disclose
Chiara Carducci, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Leone, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Vincenzo Valentini, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Lorenzo Bonomo, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purposes of this exhibit are: 1. To introduce basic principles of DWI technique and ADC maps. 2. To describe briefly DWI appearances of normal vertebral bone marrow with correlation to ADC values. 3. To describe through review of the literature and case examples the DWI and ADC maps characteristics in vertebral malignant lesions. 4. To provide indications for differential diagnosis between vertebral malignant vs benign lesions with case examples.

TABLE OF CONTENTS/OUTLINE
1. Basic principles of DWI technique and ADC maps. 2. DWI appearances of normal vertebral bone marrow with correlation to ADC values. 3. DWI and ADC maps in vertebral malignant bone marrow lesions: review of the literature and case examples. 4. Differential diagnosis between vertebral malignant vs benign lesions with DWI: case examples.
Magnetic Resonance-guided Focused Ultrasound (MRgFUS) Treatment for Pain Palliation in Bone Metastases

All Day Room: MK Community, Learning Center

Awards
Certificate of Merit

Participants
Cristina Marrocchio, Rome, Italy (Presenter) Nothing to Disclose
Susan Dababou, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Hans Peter Erasmus, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Roberto Scipione, Terracina, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Achieve information on current health burden of bone metastasis, in terms of prevalence in the oncological population, common sites involved and impact on quality of life. Have a comprehensive view of the current treatment options, their efficacy, safety and limitations. Become acquainted with the basic principles of MRgFUS functioning, its current clinical applications and results obtained; the advantages and disadvantages of MRgFUS, essential to make the best decision on treatment in clinical settings. Be informed on current MRgFUS applications in the treatment of bone metastasis: how the bone tissue is affected by the focused ultrasound and what are the current indications for MRgFUS treatment. Have a review of the current results reported in literature on efficacy, safety and long term outcomes. Learn how MRgFUS is evolving in recent years and become updated on the cutting edge applications.

TABLE OF CONTENTS/OUTLINE
Introduction: Prevalence and morbidity of bone metastasis. MRgFUS: Definition of basic principles, Treatment procedure, Technique advantages and disadvantages. MRgFUS applied to bone metastasis: Pathophysiological effects of highly focused ultrasound on bone tissue; Inclusion and exclusion criteria. Current evidence and future perspectives: Current results reported in the literature; What will be the future role of MRgFUS in bone metastasis?
Participants
Christopher D. Kanner, DO, Burlington, VT (Abstract Co-Author) Nothing to Disclose
Vivek Kalia, MD, MPH, Burlington, VT (Abstract Co-Author) Nothing to Disclose
Diego F. Lemos, MD, Shelburne, VT (Presenter) Nothing to Disclose

TEACHING POINTS
Acute osseous avulsions at the tibial footprint of the posterior root ligament of the medial meniscus can occur after a single posttraumatic event. This is a biomechanically significant lesion which behaves as a complete radial tear with loss of hoop strength of the meniscus. The identification of a vertically oriented sliver of bone in the mesial (inner) aspect of the medial femorotibial compartment in trauma radiographs or CT of the knee should be recognized as an avulsion fracture of the posterior root ligament of the medial meniscus at its tibial footprint and follow up MRI should be considered.

TABLE OF CONTENTS/OUTLINE
1. Background: In this exhibit, 4 cases of acute post-traumatic osseous avulsions of the posterior root ligament of the medial meniscus will be presented as well 2 cases of chronic osseous avulsions with development of a medial meniscal ossicle. Normal anatomy and imaging features on radiographs, CT, and MRI will be illustrated.2. Significance: Osseous avulsion of the posterior root ligament of the medial meniscus at its tibial footprint is a biomechanically significant lesion, essentially a complete radial tear resulting in loss of the meniscal hoop strength. No recognition of this injury can carry disastrous consequences for the knee with development of early osteoarthritis. Initial detection should prompt follow up MRI.
Hips Don’t Lie: Detection of Risk Factors and Complications of Total Hip Arthroplasty in Plain Radiograph and CT

Participants
Ana Carballeira Alvarez, MD, Donostia, Spain (Presenter) Nothing to Disclose
Mikel Benistain, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose
Ion Gurutz Esnal, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose
Santiago Correa, MD, Donostia, Spain (Abstract Co-Author) Nothing to Disclose
Amaia Llodio Uribeetxebarria, MD, Donostia, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Explain the different types of hip prosthesis and its components
Recognize the normal findings in plain radiograph and CT
Review the parameters that the radiologist need to know to detect risk factors that may lead to a complication
Detect complications related to the implant, host bones and soft tissues

TABLE OF CONTENTS/OUTLINE
Prosthesis characterization: Types of prosthesis
Types of components and contact surfaces
Artifacts
Fixation to bone
Initial evaluation: Limb length discrepancy
Rotation centers of the acetabular cup
Lateral acetabular inclination
Acetabular anteversion
Femoral stem position
Follow-up and detection of complications: Is the implant intact and well-positioned? Is there a good component fixation? Is there any abnormalities in the host bones or soft tissues?
Modern Imaging of the Brachial Plexus: Techniques and Pathologies

All Day Room: MK Community, Learning Center

Awards
Magna Cum Laude

Participants
Usama I. Salem, MBBCh, MD, Houston, TX (Presenter) Nothing to Disclose
Behrang Amini, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Mylene T. Truong, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
John E. Madewell, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (Abstract Co-Author) Editor, Reed Elsevier;

TEACHING POINTS
1. The brachial plexus arises from the ventral roots of the cervicothoracic spine and provides the motor and sensory supply to the upper limbs. 2. A wide variety of disease processes may adversely affect the brachial plexus, including trauma, malignancy, radiation therapy, infection, inflammation, and vascular abnormalities. 3. Identifying the precise etiology and location of brachial plexus injury is crucial for appropriate therapy; however, this can be problematic given its location and the inherent limitations of imaging this anatomic region. Therefore, an understanding of brachial plexus anatomy and the role of specific imaging techniques is necessary in order for radiologists to guide patient management. 4. Several new MR imaging techniques are currently under investigation, including 3D MRI, MR myelography, diffusion weighted neurography, tractography, and MR spectroscopy, in an effort to decrease scan time and improve the quality of MR images.

TABLE OF CONTENTS/OUTLINE
1. Normal anatomy of the brachial plexus with MRI correlation. 2. Role of imaging in the evaluation of the brachial plexus. 3. Disease processes that may affect the brachial plexus and characteristic imaging features. 4. Future directions and new techniques in imaging of the brachial plexus.

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/

Brett W. Carter, MD - 2015 Honored Educator
Mylene T. Truong, MD - 2015 Honored Educator
"Basivertebral Sclerosis"-A Potentially Useful CT Sign in Spinal Osteoblastoma

**Participants**
Ben Jacob, Gold Coast, Australia (Presenter) Nothing to Disclose
Nolette Pereira, Brisbane, Australia (Abstract Co-Author) Nothing to Disclose
Kieran Frawley, Brisbane, Australia (Abstract Co-Author) Nothing to Disclose
Jason Zhang, Gold Coast, Australia (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
Radiology plays a vital role for diagnosis of osteoblastoma Recognize pattern to aid in radiological diagnosis

**TABLE OF CONTENTS/OVERSE**
Prevalence of Vertebral osteoblastoma Relevant anatomy Known pattern of disease affection Emphasize on Basivertebral sclerosis pattern Important differential considerations
Musculoskeletal Sunday Case of the Day

Sunday, Nov. 27 7:00AM - 11:59PM Room: Case of Day, Learning Center

Participants

Jennifer L. Demertzis, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Stephen A. Currie, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jason W. Stephenson, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Eric B. England, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Hillary W. Garner, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Laura W. Bancroft, MD, Orlando, FL (Abstract Co-Author) Author with royalties, Wolters Kluwer
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Instructor, Dfine, Inc
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Kaitlin M. Peterson, BS, Madison, WI (Abstract Co-Author) Nothing to Disclose
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Jeffrey M. Youngquist, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
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Edward Derrick, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
Raul Loya, MD, Orlando, FL (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.
SSA14

Science Session with Keynote: Musculoskeletal (Metabolic and Systemic Processes: Effects on the Musculoskeletal System and Beyond)

Sunday, Nov. 27 10:45AM - 12:15PM Room: S406A

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

FDA Discussions may include off-label uses.

Participants
Anne Cotten, MD, Lille, France (Moderator) Nothing to Disclose
Linda Probyn, MD, Toronto, ON (Moderator) Nothing to Disclose

Sub-Events

SSA14-01  Musculoskeletal Keynote Speaker: Metabolic and Systemic Disease Targets in the Musculoskeletal System: Imaging Considerations

Sunday, Nov. 27 10:45AM - 11:05AM Room: S406A

Participants
Martin Torriani, MD, Boston, MA (Presenter) Nothing to Disclose

SSA14-03  Defining Sarcopenia with MRI - Establishing Threshold Values within a Large-Scale Population Study

Sunday, Nov. 27 11:05AM - 11:15AM Room: S406A

Participants
Anette Karlsson, Linkoping, Sweden (Abstract Co-Author) Stockholder, AMRA AB
Jennifer Linge, Linkoping, Sweden (Abstract Co-Author) Employee, AMRA AB
Janne West, MSc, PhD, Linkoping, Sweden (Abstract Co-Author) Employee, AMRA AB; Stockholder, AMRA AB
Jimmy D. Bell, PhD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Magnus Borga, PhD, Linkoping, Sweden (Abstract Co-Author) Stockholder, AMRA AB
Olof Dahlqvist Leinhard, PhD, Linkoping, Sweden (Presenter) Stockholder, AMRA AB; Employee, AMRA AB

PURPOSE
To identify gender specific threshold values for sarcopenia detection for lean thigh muscle tissue volume quantified using MRI.

METHOD AND MATERIALS
Current gender-specific thresholds for sarcopenia detection are based on quantification on appendicular lean tissue normalized with height^2 using DXA (7.26 kg/m^2 for men and 5.45 kg/m^2 for women). In this study 3514 subjects (1548 males and 1966 females) in the imaging subcohort of UK Biobank with paired DXA and MRI scans were included. The age range was 45 to 78 years. The total lean thigh volume normalized with height^2 (TTVi) was determined with a 6 minutes neck to knee 2-point Dixon MRI protocol using a 1.5T MR-scanner (Siemens, Germany) followed by analysis with AMRA® Profiler (AMRA, Sweden). The appendicular lean tissue mass normalized with height^2 (ALTMi) was assessed using DXA (GE-Lunar iDXA). Subjects with ALTMi lower than the gender specific threshold were categorized as sarcopenic. Gender specific threshold values were determined for detection of sarcopenic subjects based on TTVi optimizing sensitivity and specificity. Area under receiver operator curve (AUROC) was calculated as well as the linear correlation between TTVi and ALTMi.

RESULTS
A threshold value of TTVi = 3.64 l/m^2 provided a sensitivity and specificity of 0.88 for sarcopenia detection in males. The AUROC was 0.96. Similarly, a TTVi < 2.76 l/m^2 identified sarcopenic female subjects with a sensitivity and specificity of 0.89. The corresponding AUROC was 0.96. The linear correlation between TTVi and ALTMi was 0.93 (99%CI: 0.93-0.94).

CONCLUSION
MRI-based quantification of total lean thigh volume normalized with height^2 could be used to categorize sarcopenia in the study group. Threshold values are suggested.

CLINICAL RELEVANCE/APPLICATION
The study suggests that sarcopenia can be diagnosed using a rapid MRI scan with high sensitivity and specificity.

SSA14-04  Sarcopenia Predicts One-Year Mortality in Elderly Patients Undergoing Emergency Abdominal Surgery: A Pilot Study of Six Computed Tomography Techniques

Sunday, Nov. 27 11:15AM - 11:25AM Room: S406A

Participants
Jennifer W. Uyeda, MD, Boston, MA (Presenter) Nothing to Disclose
Arturo Rios Diaz, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ritam Chowdhury, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Aaron D. Sodickson, MD, PhD, Boston, MA (Abstract Co-Author) Research Grant, Siemens AG; Consultant, Bayer AG
Erika L. Rangel, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Frailty is an independent predictor of mortality in elderly patients undergoing emergency abdominal surgery (EAS), but is difficult to
High BMI is supposed to be a co-morbidity in patients with lumbar spinal stenosis due to the atrophy of the paraspinal musculature. **METHOD AND MATERIALS**

Patients >70 years who had EAS (2006-2011) after preoperative CT were followed for a year. Six distinct methods were used to define sarcopenia based on CT at the L3 level: 1) Average (avg) bilateral psoas cross-sectional area (PSA) normalized for height; 2) Avg bilateral psoas Hounsfield unit (HU); 3) Weighted avg HU based on muscle size; 4) Composite index of HU x PSA; 5) AP x LAT pseudoarea; 6) Pseudoarea x HU. For each method, sarcopenia was defined as the lowest sex-specific quartile. Percent overlap between sarcopenic cohorts were calculated compared with method 1. Cox proportional hazards regression models adjusting for potential confounders assessed 1-year mortality hazard in sarcopenic vs. nonsarcopenic patients independently for each method. **RESULTS**

For the 297 patients (94 deaths) analyzed, patients defined as being sarcopenic differed greatly between methods, with sarcopenia cohort overlap ranging between 28 - 67%. We found no significant differences in age, gender, race, comorbidities, malignancy, American Association of Anesthesiology score, operation urgency and severity, and discharge disposition. Sarcopenic patients had a longer length of stay and greater need for ICU admission (p<0.05). Sarcopenic patients had a higher hazard of mortality in all methods used for defining sarcopenia, with hazard ratios varying between 1.96 - 3.06 (all p<0.003). **CONCLUSION**

In this sample, all sarcopenia assessment methods were predictive of 1-year mortality in elderly patients undergoing EAS, although it is noteworthy that the patients classified as sarcopenic differed substantially between methods. Future studies must examine each method's unique contribution to patient outcome to build a composite sarcopenia measure most predictive of long term mortality. **CLINICAL RELEVANCE/APPLICATION**

Sarcopenia is an objective measure of frailty that can be measured by CT and used to identify vulnerable elderly patients who will benefit from early discussion about goals of care and consideration of less invasive approaches. **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/

Aaron D. Sodickson, MD, PhD - 2014 Honored Educator **SSA14-05 Correlation of Body Mass Index with Paraspinal Muscle Atrophy in Patients with Lumbar Spinal Canal Stenosis**

Sunday, Nov. 27 11:25AM - 11:35AM Room: S406A

Participants
Vartolomeu N. Bolog, MD, Munchenstein, Switzerland (Presenter) Nothing to Disclose
Jakob Burgstaller, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Ulrike Held, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Tim Finkenstaedt, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Filippo Del Grande, MD, MBA, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Johann Steurer, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Gustav Andreisek, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
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**PURPOSE**

Aim of the study was to investigate the degree of paraspinal muscle atrophy assessed with magnetic resonance imaging (MRI) in a large patient group with lumbar spinal stenosis (LSS) and to assess for body mass index (BMI) related differences. **METHOD AND MATERIALS**

MR images of 763 patients (395 female, mean age 73 years) with LSS from the multicenter lumbar stenosis outcome study (LSOS) were analyzed in this institutional review board–approved study. Atrophy of the lumbar paraspinal musculature was staged independently by two radiologists according to an adapted Goutallier classification (grades 0 to 4) and correlation between degree of atrophy and BMI was assessed. **RESULTS**

The mean BMI was 27.5 ± 5.1 (range 15-49.3). The median muscle atrophy grade was 1 (interquartile range 1 to 2). Muscle grade was assessed as follows: grade 0: n=153 (20%), grade 1: n=292 (38%), grade 2: n=245 (32%), grade 3: n=48 6%), grade 4: n=25 3%). Pearson correlation analysis demonstrated a significant positive correlation between BMI and muscle atrophy (p < 0.01). The BMI was significantly higher in patients with remarkable muscle atrophy (grade 2-4) (mean BMI 28.3 ± 5.6) compared to patients without remarkable muscle atrophy (grade 0-1) (mean BMI 26.9 ± 4.6). **CONCLUSION**

The positive correlation between higher BMI and higher degrees of muscle atrophy implies that overweight is an important potential source of paraspinal muscle atrophy in patients with LSS. **CLINICAL RELEVANCE/APPLICATION**

High BMI is supposed to be a co-morbidity in patients with lumbar spinal stenosis due to the atrophy of the paraspinal musculature.
CONCLUSION

Interval change in parameters between baseline and 1 year were respectively. HR for psoas HU was 0.98, 0.93*, 1.14* for baseline, 1 year, interval change respectively. HR for paraspinal HU was 1.00, 0.99, 1.20* for baseline, 1 year, interval change respectively.

RESULTS

Patients diagnosed with colorectal cancer between 2007 and 2011 were included and were followed for at least 5 years. CT at baseline and 1 year after diagnosis were analyzed. Skeletal Muscle Index (SMI) of psoas and paraspinal muscles, and mean Hounsfield Units (HU) were measured at baseline, and at 1 year. Interval change in parameters between baseline and 1 year were calculated. Measurements were taken at L4 level. Univariate Cox proportional hazard regression was used to evaluate relationship to overall and progression-free survival.

RESULTS

The IMCL/EMCL ratio was 0.89 ±0.19 and 1.42±0.34 in control and patients, respectively. The mean baseline foot muscle OEF was 65±13% in control subjects, which is higher than the published value in calf muscle (~40-50%). Even with the difficulties caused by B0 inhomogeneity in peripheral areas and areas close with bones, we are still able to obtain useful 2D CSI and qBOLD data in major foot muscles. DM patients had higher baseline foot muscle OEF (87±1%), consistent with diabetes-related muscle hypoxia. This was further confirmed by the elevated R2* in DM patients (47±4s-1 vs. 39±3s-1).

CONCLUSION

The preliminary study demonstrated the feasibility of using multi-voxel MRS and foot qBOLD as MRI biomarkers of regional muscle hypoxia in DFU. This is a key imaging advance as the foot, not the calf is the clinical location for diabetic complications. DFU patients exhibited an increased IMCL/EMCL ratio as well as elevated OEF and R2*. The elevated level of IMCL/EMCL in DFU patients is consistent with the published findings from calf muscles, which has been associated with insulin resistance caused by mitochondrial dysfunction.

CLINICAL RELEVANCE/APPLICATION

The purpose of this study is to evaluate two potential MRI biomarkers of foot muscle ischemia in diabetic foot ulcers. DM patients had higher baseline foot muscle OEF (87±1%), consistent with diabetes-related muscle hypoxia. This was further confirmed by the elevated R2* in DM patients (47±4s-1 vs. 39±3s-1).

PURPOSE

Diabetic foot ulcer (DFU) is a major source of morbidity and health care cost in patients with diabetes mellitus (DM). DFU can lead to osteomyelits, amputation and even death if un-treated. Hypoxia is associated with diabetic wounds/ulcer and accentuates the infection cascade. The purpose of this study is to evaluate two potential MRI biomarkers of foot muscle ischemia in DFU.

METHOD AND MATERIALS

Functional imaging of the plantar aspect of the forefoot (T1w and T2w anatomical images, chemical shift imaging (CSI), diffusion tensor imaging (DTI), and quantitative BOLD (qBOLD)) was performed in 8 healthy volunteers and two diabetic foot patients at 3T magnets with foot RF coils. The ratio between intra- vs. extra- myocellular lipids (IMCL/EMCL) was estimated from CSI data after incorporating the IMCL/EMCL resonance frequency difference calculated based on the muscle fibers orientation (DTI). MSK qBOLD provided an estimation of foot muscle oxygen extraction fraction (OEF) and transverse relaxation rate (R2*).

RESULTS

The IMCL/EMCL ratio was 0.89 ±0.19 and 1.42±0.34 in control and patients, respectively. The mean baseline foot muscle OEF was 65±13% in control subjects, which is higher than the published value in calf muscle (~40-50%). Even with the difficulties caused by B0 inhomogeneity in peripheral areas and areas close with bones, we are still able to obtain useful 2D CSI and qBOLD data in major foot muscles. DM patients had higher baseline foot muscle OEF (87±1%), consistent with diabetes-related muscle hypoxia. This was further confirmed by the elevated R2* in DM patients (47±4s-1 vs. 39±3s-1).

CONCLUSION

The preliminary study demonstrated the feasibility of using multi-voxel MRS and foot qBOLD as MRI biomarkers of regional muscle hypoxia in DFU. This is a key imaging advance as the foot, not the calf is the clinical location for diabetic complications. DFU patients exhibited an increased IMCL/EMCL ratio as well as elevated OEF and R2*. The elevated level of IMCL/EMCL in DFU patients is consistent with the published findings from calf muscles, which has been associated with insulin resistance caused by mitochondrial dysfunction.

CLINICAL RELEVANCE/APPLICATION

The purpose of this study is to evaluate two potential MRI biomarkers of foot muscle ischemia in diabetic foot ulcers. DM patients had higher baseline foot muscle OEF (87±1%), consistent with diabetes-related muscle hypoxia. This was further confirmed by the elevated R2* in DM patients (47±4s-1 vs. 39±3s-1).

PURPOSE

Sarcopenia (low skeletal muscle mass) is associated with poorer prognosis of colorectal cancer patients. The goal of this study was to evaluate the effect on survival of progressive loss of muscle mass at 1 year follow up after diagnosis.

METHOD AND MATERIALS

Patients diagnosed with colorectal cancer between 2007 and 2011 were included and were followed for at least 5 years. CT at baseline and 1 year after diagnosis were analyzed. Skeletal Muscle Index (SMI) of psoas and paraspinal muscles, and mean Hounsfield Units (HU) were measured at baseline, and at 1 year. Interval change in parameters between baseline and 1 year were calculated. Measurements were taken at L4 level. Univariate Cox proportional hazard regression was used to evaluate relationship to overall and progression-free survival.

RESULTS

*p<0.05148 patients were included, mean (+/-SD) age 65.1 (+/-13.5) years, 51 females. Overall survival: Hazard Ratio (HR) of psoas SMI was 0.60, 0.41*, 7.51* for baseline, 1 year, interval change respectively. HR for psoas HU was 0.98, 0.93*, 1.14* for baseline, 1 year, interval change respectively. HR for paraspinal SMI was 0.67*, 0.58*, 2.19* for baseline, 1 year, interval change respectively. Progression-free survival: HR for psoas SMI was 0.67, 0.59*, 2.45 for baseline, 1 year, interval change respectively. HR for psoas HU was 0.98, 0.95, 1.10* for baseline, 1 year, interval change respectively. HR for paraspinal HU was 1.00, 0.99, 1.20* for baseline, 1 year, interval change respectively.

CONCLUSION

Sarcopenia (low skeletal muscle mass) is associated with poorer prognosis of colorectal cancer patients. The goal of this study was to evaluate the effect on survival of progressive loss of muscle mass at 1 year follow up after diagnosis.

METHOD AND MATERIALS

Patients diagnosed with colorectal cancer between 2007 and 2011 were included and were followed for at least 5 years. CT at baseline and 1 year after diagnosis were analyzed. Skeletal Muscle Index (SMI) of psoas and paraspinal muscles, and mean Hounsfield Units (HU) were measured at baseline, and at 1 year. Interval change in parameters between baseline and 1 year were calculated. Measurements were taken at L4 level. Univariate Cox proportional hazard regression was used to evaluate relationship to overall and progression-free survival.

RESULTS

*p<0.05148 patients were included, mean (+/-SD) age 65.1 (+/-13.5) years, 51 females. Overall survival: Hazard Ratio (HR) of psoas SMI was 0.60, 0.41*, 7.51* for baseline, 1 year, interval change respectively. HR for psoas HU was 0.98, 0.93*, 1.14* for baseline, 1 year, interval change respectively. HR for paraspinal SMI was 0.67*, 0.58*, 2.19* for baseline, 1 year, interval change respectively. Progression-free survival: HR for psoas SMI was 0.67, 0.59*, 2.45 for baseline, 1 year, interval change respectively. HR for psoas HU was 0.98, 0.95, 1.10* for baseline, 1 year, interval change respectively. HR for paraspinal HU was 1.00, 0.99, 1.20* for baseline, 1 year, interval change respectively.

CONCLUSION

Sarcopenia (low skeletal muscle mass) is associated with poorer prognosis of colorectal cancer patients. The goal of this study was to evaluate the effect on survival of progressive loss of muscle mass at 1 year follow up after diagnosis.
Progessive depletion of muscle mass and of muscle quality at 1 year compared to baseline at diagnosis of colorectal cancer is predictive of poorer overall and progression free survival.

CLINICAL RELEVANCE/APPLICATION
This study identifies the importance of changes in skeletal muscle index and muscle density as a biomarker for colorectal cancer prognosis.

SSA14-08 Quantitative Assessment of Trabecular Bone Microarchitecture Using High-Resolution Extremities Cone-Beam CT

Participants
Michael Brehler, Baltimore, MD (Presenter) Research funded, Siemens AG
Eugenio Marinetto, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Qian Cao, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
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Shadpour Demehi, MD, Baltimore, MD (Abstract Co-Author) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;
Jeffrey H. Siewerdsen, PhD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Research Grant, Carestream Health, Inc; Advisory Board, Siemens AG; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Elekta AB;
Wojciech Zbijewski, PhD, Baltimore, MD (Abstract Co-Author) Research Grant, Carestream Health, Inc

PURPOSE
Bone microstructure is a potential biomarker in osteoporosis and osteoarthritis. Extremities cone-beam CT (CBCT) is a compelling platform for in-vivo bone morphometrics owing to the high resolution of flat-panel detectors (FPDs) that supports assessment of trabeculae. Improvement in spatial resolution of extremities CBCT is anticipated with CMOS detectors that offer smaller pixel sizes than FPDs. We investigate performance of FPD- and CMOS-based extremities CBCT in bone morphometry.

METHOD AND MATERIALS
Data were acquired on a CBCT test-bench in the geometry of extremities CBCT with a 0.4 FS x-ray source (90 kVg, 0.25 mAs/frame). A cadaveric hand was imaged with a DALSA Xineos 3030 CMOS detector (100 µm pixels, ~600 µm CsI scintillator) and with a Varian PaxScan 4030CB FPD (192 µm pixels, ~600 µm CsI). Reconstruction voxel size was 75 µm

RESULTS
Enhanced delineation of trabeculae was achieved with CMOS-CBCT compared to FPD-CBCT. The Dice coefficient between the trabecular segmentations obtained from FPD-CBCT and gold-standard micro-CT was 0.52 (median of the ROIs) and increased to 0.59 for CMOS-CBCT. The improved segmentation resulted in better correlation with micro-CT morphometrics for CMOS-CBCT compared to FPD-CBCT. For CMOS-CBCT, the correlation coefficient (measured across all ROIs) was 0.88 for BV/TV and 0.85 for Tb.Sp. Correlations for FPD-CBCT were 0.57 for BV/TV and 0.63 for Tb.Sp.

CONCLUSION
Both CMOS- and FPD-based extremities CBCT allow visualization of trabecular structure and assessment of quantitative metrics of bone architecture. CMOS-CBCT shows better correlation with micro-CT and thus enhanced capability for detecting change in bone health. A clinical prototype of CMOS-based extremities CBCT is under development for applications in early detection of osteoporosis and osteoarthritis.

CLINICAL RELEVANCE/APPLICATION
Major improvement in spatial resolution of extremities CBCT is achieved with a CMOS detector, enabling in-vivo quantitative trabecular morphometry for early detection of osteoporosis and osteoarthritis.

SSA14-09 The Canadian Multicentre Osteoporosis Study (CaMos) and Vertebral Fractures

Participants
Brian C. Lentle, MD, Victoria, BC (Abstract Co-Author) Speaker, Amgen Inc
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William (Bill) Leslie, MD, FRCP, Winnipeg, MB (Abstract Co-Author) Nothing to Disclose
Stephanie Kaiser, MD, FRCP, Halax, NS (Abstract Co-Author) Nothing to Disclose
PURPOSE
We compared the Genant Semi-Quantitative (GSQ) method and Algorithm-based Qualitative method modified to include cortical buckling (mABQ) for diagnosing prevalent and incident vertebral fractures (VF) in 3149 participants with 6927 serial X-rays.

METHOD AND MATERIALS
Spine images (T4-L4) of CaMos men and women > 50 years old at baseline, Year 5, 10 and 16 follow-ups were included. Two trained technologists triaged participants into those with and without GSQ VF (any grade). A single radiologist reviewed serial X-rays for participants with any triaged GSQ VF and a random sample without GSQ VF for presence of VF using GSQ, with or without mABQ signs. Sex stratified linear and logistic regressions, adjusted for age, BMI and height, tested the association of prevalent VF with femoral neck (FN) BMD and incident VF.

RESULTS
Using GSQ, the prevalence of VF was 13.6% (95%CI: 12.1; 15.1) in women and 15.5% (13.0; 18.0) in men; using mABQ it was 6.7% (5.6; 7.8) in women and 4.7% (3.3; 6.2) in men. Incident VF rates (per 1000 person-years) were 5.8 (4.7; 7.2) in women and 4.9 (3.3; 7.2) in men using GSQ, and 5.7 (4.6; 7.2) in women and 4.7 (3.2; 7.0) in men using mABQ. Incident and prevalent VF show different distributions when plotted by vertebral segment (Fig 1). For GSQ-defined VF, the adjusted FN BMD was 0.042g/cm² (0.029; 0.056) lower in women and 0.036 g/cm² (0.013; 0.058) in men. For mABQ-defined VF, adjusted FN-BMD was 0.061g/cm² (0.042; 0.080) lower in women and 0.075g/cm² (0.034; 0.116) in men. Compared with participants with GSQ VF alone, women and men with prevalent mABQ VF had lower FN BMD by 0.037g/cm² (0.012; 0.065) and 0.075g/cm² (0.025; 0.125). Participants with prevalent GSQ VF were 5.1 (3.3; 7.8) times more likely than normals to have incident GSQ VF; those with prevalent mABQ VF were 9.6 (6.0; 16.4) times more likely to have incident mABQ VF than normals.

CONCLUSION
Our 16-year VF data demonstrate reductions in FN BMD in those with VF by mABQ and GSQ methods; more conservative estimates of VF prevalence with mABQ; equivalent estimates of VF incidence with both methods; but a higher likelihood for future VF with the mABQ method.

CLINICAL RELEVANCE/APPLICATION
Given the continuing uncertainty about the diagnosis of vertebral fracturesthis work is intended to provide a preliminary comparison of qualitative and quantitative methods.
Science Session with Keynote: Musculoskeletal (Upper Extremity)

Participants
Laura W. Bancroft, MD, Orlando, FL (Moderator) Author with royalties, Wolters Kluwer nv
Brady K. Huang, MD, San Diego, CA (Moderator) Nothing to Disclose

Sub-Events

SSA15-01  Musculoskeletal Keynote Speaker: Wrist and Shoulder Essentials
Participants
Lyne S. Steinbach, MD, San Francisco, CA (Presenter) Nothing to Disclose

SSA15-03  Accuracy of the MRI Diagnosis of Adhesive Capsulitis in an Academic Musculoskeletal Radiology Division
Participants
Erin F. Alaia, MD, New York, NY (Presenter) Nothing to Disclose
Michael Alaia, MD, New York, NY (Abstract Co-Author) Speaker, Jubilant Life Sciences Ltd
Soterios Gyftopoulos, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate accuracy of MRI for adhesive capsulitis in an academic musculoskeletal radiology division. To examine orthopedic MRI referral for adhesive capsulitis, and whether positive imaging findings impact treatment in the absence of clinical disease.

METHOD AND MATERIALS
150 shoulder MRI reports were assessed for presence of: 1. thickened axillary recess capsule, 2. thickened coracohumeral ligament, 3. subcoracoid fat infiltration, and 4. impression of adhesive capsulitis, with orthopedic clinical diagnosis serving as the reference standard. Sensitivity, specificity, negative predictive value, positive predictive value, and accuracy were calculated, and Fisher exact tests determined whether each MRI finding predisposed to a false positive diagnosis. Follow-up in false positive cases was obtained to determine whether imaging findings impacted treatment, and whether patients subsequently developed clinical adhesive capsulitis.

RESULTS
5% of MRI cases had a clinical diagnosis of adhesive capsulitis, and 21% of MRI cases were interpreted as positive. Sensitivity was 38%, specificity 80%, negative predictive value 96%, positive predictive value 9%, and accuracy was 77%. Infiltration of rotator interval fat, thickening of the joint capsule at the axillary recess, and thickening of the coracohumeral ligament were all significantly (p<0.001) predictive of a false positive MRI diagnosis. In false positive cases, 5% of orthopedic follow-up notes mentioned the imaging diagnosis, and only one patient subsequently developed clinical adhesive capsulitis.

CONCLUSION
Findings previously found to be associated with adhesive capsulitis are present in a high proportion of clinically asymptomatic patients. Radiologists should exercise caution in making an imaging diagnosis without considering clinical findings.

CLINICAL RELEVANCE/APPLICATION
MRI findings of adhesive capsulitis are present in a high proportion of clinically asymptomatic patients.

SSA15-04  Imaging Features of Glenoid Bare Area in a Pediatric Population
Participants
Sahlya Djebbar, MD, NYC, NY (Presenter) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ignacio Rossi, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Christoph A. Agten, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Erin F. Alaia, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jonathan Zember, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The bare area (BA) is a central, well-circumscribed focal defect in the articular surface of the glenoid, with reported adult incidence of 1-2%. The adult literature supports a developmental etiology, however, a recent imaging study, based on a pediatric patient population, suggested a similar incidence of BA but advocated a traumatic origin. The purpose of our study was to reassess the prevalence and MRI appearance of the glenoid bare area in the pediatric population.

METHOD AND MATERIALS
A retrospective review of our digital database from June 2014 to October 2015 was performed at our institution, using the keywords “shoulder” and “MRI” in patients ranging in age from 10 to 25. 4 cases were excluded, with a final cohort of patients divided into 3 age groups: group 1, 10-15 years (n=75), group 2, 15-18 years (n=75) and group 3, 18-25 years (n=75). All cases were reviewed in consensus by 2 MSK radiologists. The bare area was defined as a well marginated, central defect, of increased signal in the articular surface of the glenoid, seen on at least 2 imaging planes, without evidence of underlying glenoid pathology. The presence, location and size of the BA were documented in each group.

RESULTS
A total of 22 BA were identified, 15 (20%) in the younger group, 4 (5%) in the intermediary group and 3 in the older group (4%), with a significantly higher incidence in the younger group (p=0.007 in comparison with group 2, and p=0.002 in comparison with group 3, using Chi Square Test). Location was mainly central (12 (80%) in group 10-15 yo, 3 (75%) in group 15-18 yo, 3 (100%) in group 18-25 yo. The mean size was 3.44 mm, range 1.5-7.5 mm, in the young children group, significantly bigger than in the two older groups (mean size of 2.47 mm, range 1.6-3.2 mm in the intermediary group 2; mean size of 3.23 mm, range 2-4 mm in the young adults group).

CONCLUSION
The incidence of the BA in children ranging from 10-15 years of age is significantly higher than in older children and higher than the reported incidence in adults. The BA is also larger in the younger compared to the older pediatric age group. Our findings may be explained by the centripetal pattern of ossification of the glenoid and, thus, give support to the normal developmental theory.

CLINICAL RELEVANCE/APPLICATION
Familiarity with the MR appearance of the BA should obviate misinterpreting as a pathologic condition in the pediatric patient population.

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

SSA15-05  One-year Survey of Different Treatment Approach to Tendinopathy of the Supraspinatus Tendon: PRP, Needling or Physical Therapy?

Participants
Alice La Marra, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Federico Bruno, 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
Antonio Barile, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, 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 clinical and morphological results 1 year after treatment in patients with chronic tendinopathy of the supraspinatus tendon, treated with Platelet-rich Plasma (PRP), needling or submitted to medical and physical therapy alone.

METHOD AND MATERIALS
We retrospectively evaluated through clinical and MRI examination 60 patients with degenerative disease of the supraspinatus tendon: 20 patients were treated a year before with PRP (group A), 20 with needling (group B) and 20 were submitted over a 1 year period to medical and physical therapy alone (group C). The instrumental evaluation included MRI scans performed before and 1 year after treatment. The patients were also evaluated with both clinical and functional examinations by mean of VAS and Constant scores.

RESULTS
We recorded an improvement in the overall MRI appearance of the supraspinatus tendon in 75% of patients of group A, 63% of group B and in only 20% of group C; in 18% of group A, 52% of group B and 57% of group C MRI findings showed stationary conditions of the tendinopathy. In 7% of patients of group A, 5% of group B and 23% of group C MRI examinations showed worsening of the imaging findings. A VAS improvement of 83.5% in group A, 69% in group B and 25% in group C was observed. Constant score improvement was of 63% in group A, 50% in group B and 15% in group C.

CONCLUSION
PRP injection and needling can delay the degenerative changes of the tendons as documented by pain relief and functional improvement with better results after PRP injection therapy compared to needling. MRI imaging findings are an important evidence of the effectiveness of this therapy, because they confirm the clinical evidence.

CLINICAL RELEVANCE/APPLICATION
Our experience suggests that intratendinous injections of PRP and tendon needling can modify the natural history of supraspinatus tendon tendinopathy compared to medical and physical therapies alone and can be effective and minimally invasive treatments suitable for a large range of patients.

SSA15-06  Carpal Tunnel Syndrome: Diagnosis with Additive Diffusion-Tensor Imaging to Standard MR Imaging
To determine the added value of diffusion-tensor imaging (DTI) to standard magnetic resonance (MR) imaging to diagnose carpal tunnel syndrome (CTS) at 3 T.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and informed consent was waived. From September 2014 through March 2016, 128 patients underwent 3-T MR imaging of the wrist including DTI (b values of 0 and 1200 sec/mm²). Among them 24 patients performed median nerve conduction test and carpal tunnel syndrome was proved in nine patients. First, two independent musculoskeletal radiologists retrospectively scored the standard MR imaging. Second, they measured fractional anisotropy (FA) values and apparent diffusion coefficient (ADC) of the median nerve at three locations: the levels of the distal radioulnar joint, pisiform bone, and hamate bone. Then, they assessed a combination of standard MR imaging and DTI. Interobserver agreement for FA and ADC was assessed using intraclass correlation coefficient (ICC). The receiver operating characteristic curve with areas under the curve (AUC) was obtained.

RESULTS

In quantitative analysis of median nerve DTI at three locations (distal radioulnar joint, pisiform bone, and hamate bone), mean FA values of two readers were 0.64±0.15, 0.54±0.11, and 0.47±0.11, respectively. Mean ADCs were 946±221, 1132±164, and 1211±172 μm²/sec at three locations, respectively. Interobserver agreements of two readers at three locations were substantial (ICC=0.78, 0.74) and very good (ICC=0.86) for FA values; moderate (ICC=0.54) and substantial (ICC=0.71, 0.79) for ADCs, respectively. Sensitivity, specificity and accuracy of each reader were 100%, 20%, and 50%; 67%, 53%, and 58% on standard MR imaging alone, whereas 100%, 73%, and 83%; 67%, 60%, and 63% on standard MR imaging combined DTI, respectively. AUCs of a combination of standard MR imaging and DTI were higher than those of standard MR imaging alone: 0.867 vs 0.600 (P =.0001) for reader 1 and 0.633 vs 0.600 (P=.7684) for reader 2, respectively. With FA cutoff value of 0.64 at distal radioulnar joint level in reader 2, sensitivity, specificity and accuracy were 89%, 80%, and 83%, respectively.

CONCLUSION

The addition of DTI to standard MR imaging improves the diagnostic accuracy for the diagnosis of carpal tunnel syndrome at 3 T.

CLINICAL RELEVANCE/APPLICATION

DTI should be added to standard MR imaging protocol to help diagnose scaphoid fractures.

SSA15-07 Comparison of the Diagnostic Accuracy of Cone Beam Computed Tomography and Radiography for Scaphoid Fractures

Participants

Jokob Neubauer, MD, Freiburg, Germany (Presenter) Nothing to Disclose
Matthias Boenning, MD, Freiburg, Germany (Abstract Co-Author) Nothing to Disclose
Tayfun Yilmaz, MD, Freiburg, Germany (Abstract Co-Author) Nothing to Disclose
Kilian Reising, Freiburg, Germany (Abstract Co-Author) Nothing to Disclose
Claudia Ehritt-Braun, MD, Freiburg, Germany (Abstract Co-Author) Nothing to Disclose
Elmar C. Kotte, MD, MSc, Freiburg, Germany (Abstract Co-Author) Editorial Advisory Board, Thieme Medical Publishers, Inc
Mathias F. Langer, MD, PhD, Freiburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate and compare the diagnostic accuracy of cone beam computed tomography (CBCT) and radiography for the detection of scaphoid fractures.

METHOD AND MATERIALS

Retrospective analysis of patients who received both radiography and CBCT examinations within 5 days to rule out a scaphoid fracture over a 2 year period in our institution. Data relating to age and findings were collected from the hospital imaging database and electronic records. Patients were excluded if the documentation was lacking. 4 blinded radiologist and orthopedic surgeons (1 board approved and 1 senior residents of each specialty) independently rated the images regarding the presence of a scaphoid fracture. The CBCT images were read at least 6 weeks after the radiographs to avoid recall bias. The gold standard was evaluated in a consensus reading of all images and the electronic records by two radiologists. Inter-rater correlation was evaluated with Fleiss’s kappa and compared with Z-test. Pooled sensitivity, specificity and negative predictive values were calculated and compared with McNemar’s test and generalized score statistic. A P-value <.05 was considered to denote statistical significance. Confidence intervals (CI) were stated at the 95% level.

RESULTS

113 patients met the inclusion criteria. The inter-rater correlation was higher in the CBCT with 0.75 compared to radiography with 0.50 (P<.001). Pooled sensitivity was higher for CBCT with 0.92 (CI 0.89-0.95) compared to radiography with 0.87 (CI 0.83-0.91) (P=.03). Pooled specificity was higher for CBCT with 0.97 (CI 0.94-0.99) compared to radiography with 0.78 (CI 0.72-0.83)
The pooled negative predictive value was higher for CBCT with 0.90 (CI 0.87-0.94) compared to radiography with 0.83 (CI 0.78-0.89) (P=.006).

CONCLUSION
CBCT shows a higher diagnostic accuracy for scaphoid fractures than radiography.

CLINICAL RELEVANCE/APPLICATION
In the clinical case of suspected scaphoid fracture and negative radiographs the CBCT as a new low dose technique in trauma imaging of the extremities can have a substantial benefit to the diagnostic workup.

PURPOSE
Objective of this phantom and cadaveric study was to compare effective radiation dose (ED) and image quality (IQ) between C-Arm CT (CACT) and computed tomography (CT) arthrography of the wrist.

METHOD AND MATERIALS
ED was determined with TLD dosimetry according to ICRP 103 using an anthropomorphic phantom representing a 70-kg male (Atom, CIRSinc, Norfolk, USA) placed in the “superman” position. Imaging of the phantom and 10 human cadaveric wrists after tricompartmental injection of diluted iodinated contrast material was conducted using an angiographic system (Artis zeego Q, Siemens Healthcare, Erlangen, Germany) with an ultra-high resolution 1x1 detector binning using a normal (CACT1) and sharp (CACT2) reconstruction kernel. CT was conducted with a standard wrist protocol (LightSpeed 16, GE Healthcare, Chalfont St. Giles, UK). Quantitative IQ was assessed in terms of high and low contrast performance by calculating the modulation transfer function (MTF), image noise and contrast-to-noise ratio (CNR). MTF was assessed in a wire phantom. Image noise and CNR were assessed by 1 reader in the cadaveric wrists and compared with Anova-test. Qualitative IQ was assessed by 3 readers independently in terms of depictability of anatomical wrist structures, and occurrence of artifacts using a 5 point Likert scale, and compared with a Wilcoxon test. Interobserver reliability was calculated using the intra class correlation coefficient (ICC 2,1).

RESULTS
ED of CT was comparable to CACT (male/female 4.1/4.1μSv vs: 3.4/3.6μSv). Best spatial resolution was noted for CACT2 (10% MTF, CT/CACT1/CACT2:11.5/25.0/35.2 lp/cm. Low contrast performance was best for CT and decreased (p<0.001) to CACT1 and CACT2 (Image Noise [HU]:CT:42±8 CACT1:60±9, CACT2:127±10; CNR: MDCT:69±16 CACT1:62±14,CACT2:28±5). Interobserver agreement for assessment of anatomical IQ and artifacts was good (ICC:0.69/0.68). Anatomical IQ was best for CACT2 (1.3±0.5) and decreased (p<0.001) to CACT1 (1.9±0.6) and CT (3.5±0.6). Image artifacts were only reported for CACT and were not significantly different between CACT1 (2.0±0.2) and CACT2 (2.1±0.2).

CONCLUSION
Ultra high resolution C-arm CT arthrography of the wrist allows for a superior depiction of the anatomical structures as compared to CT arthrography at a comparable radiation dose.

CLINICAL RELEVANCE/APPLICATION
Ultra high resolution C-arm CT arthrography of the wrist has the potential to replace CT arthrography in a workflow-optimized procedure.

PURPOSE
To determine the normal motion pattern of distal radioulnar joint (DRUJ) during wrist supination–pronation motion and observer performance of measurements using four-dimensional (4D) CT acquisitions in asymptomatic contralateral joints of patients with unilateral wrist pain.

METHOD AND MATERIALS
In this IRB-approved, retrospective study of patients with chronic wrist pain, 4DCT examination of the bilateral wrists was performed in 10 patients (mean age: 40.1 y/o, M/F: 5/5); the asymptomatic contralateral joints were included in this analysis. Using a double-oblique multiplanar reformation (MPR) technique to define the true axial plane relative to the DRUJ, two independent readers performed measurements for assessment of DRUJ alignment using the modified radioulnar line (mRU) and epicenter (Epi) methods. Wilcoxon rank sum test was used to determine the significance of measurement changes between pronation and supination. Interobserver agreement was assessed using Interclass Correlation Coefficients (ICC).

RESULTS

For the above measurements, volar subluxation of the ulnar corresponds with negative values, whereas dorsal ulnar subluxation corresponds with positive values. DRUJ mRU method measurements obtained in wrist pronation (observer-1: 0.03, 0.0-0.2 (median, range); observer-2: 0.08, 0.0-0.3) were significantly larger than measurements obtained during wrist supination (observer-1: -0.10, -0.2-0.0 p=0.01; observer-2: -0.11, -0.2-0.0 p=0.008). DRUJ Epi method measurements obtained in wrist pronation (observer-1: 0.03, -0.1-0.1; observer-2: 0.05, -0.9-0.13) did not significantly differ from those obtained in wrist supination (observer-1: 0.06, -0.02-0.1; observer-2: 0.06, -0.04-0.1). There was high interobserver agreement between the two observers using both methods in pronation (mRU:(ICC: 0.982; P<0.001), Epi:(ICC: 0.898; P<0.001)), midpoint (mRU:(ICC: 0.994; P<0.001), Epi:(ICC: 0.827; P<0.005)) and supination (mRU:(ICC: 0.989; P<0.001), Epi (ICC: 0.972; P<0.001)) positions.

CONCLUSION

Using 4D CT acquisition, DRUJ kinematics in asymptomatic wrists demonstrate increased volar ulnar subluxation with supination as calculated by the mRU method but not the Epi method. Both methods showed high interobserver agreements.

CLINICAL RELEVANCE/APPLICATION

4DCT with MPR technique provides reliable assessments of DRUJ during active wrist motions. This study provides normal range of expected changes in DRUJ measurements in asymptomatic wrists.

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
Assessment of Ultrasound versus MRI of the Temporomandibular Joint (TMJ) as a Screening Tool for TMJ Dysfunction

METHOD AND MATERIALS
The patient population consists of 61 patients exhibiting TMJ dysfunction and ranging from 13 to 67 years old with a mean age of 40. Patients were assessed first using US, and then confirmed with MRI as the gold standard. US screening is achieved using a previously-presented technique in which the US probe positions correspond to a clock face at 7 o'clock, 9 o'clock, and 11 o'clock when evaluating the left, with a corresponding mirror image on the right.

RESULTS
US screening produced no false positive results and only 6 false negative, corresponding to a sensitivity of 100%, specificity of 79%, and estimated positive predictive value of 84% and negative predictive value of 100%. Half of the false negative cases were for medially-displaced disc pathology. Pathology could successfully be seen using US while providing the ability to converse with patients, identify the exact pain locations, and enable real-time identification of crepitus, clicking, motion, locking and unlocking of the jaw, and snapping sensations. Effusions are more easily seen on US compared to MRI. Active inflammation was readily identified using Doppler in all cases; MRI required prior suspicion of inflammatory process and modification of imaging protocol to include gadolinium contrast.

CONCLUSION
US is a both a sensitive and specific screening tool for TMJ dysfunction. Advantages remain its inexpensive, relatively short scan time, real-time analysis, lack of ionizing radiation, no need for contrast, portability, and adaptability to procedures. Disadvantages are the long learning curve, operator dependence, and difficulty in assessing medially-displaced discs.

Magnetic Resonance Angiography with Digital Subtraction and Fusion Images in Assessment of Synovitis in the Hands: Advances in the Assessment of Synovitis

METHOD AND MATERIALS
The patient population consists of 61 patients exhibiting TMJ dysfunction and ranging from 13 to 67 years old with a mean age of 40. Patients were assessed first using US, and then confirmed with MRI as the gold standard. US screening is achieved using a previously-presented technique in which the US probe positions correspond to a clock face at 7 o'clock, 9 o'clock, and 11 o'clock when evaluating the left, with a corresponding mirror image on the right.

RESULTS
US screening produced no false positive results and only 6 false negative, corresponding to a sensitivity of 100%, specificity of 79%, and estimated positive predictive value of 84% and negative predictive value of 100%. Half of the false negative cases were for medially-displaced disc pathology. Pathology could successfully be seen using US while providing the ability to converse with patients, identify the exact pain locations, and enable real-time identification of crepitus, clicking, motion, locking and unlocking of the jaw, and snapping sensations. Effusions are more easily seen on US compared to MRI. Active inflammation was readily identified using Doppler in all cases; MRI required prior suspicion of inflammatory process and modification of imaging protocol to include gadolinium contrast.

CONCLUSION
US is a both a sensitive and specific screening tool for TMJ dysfunction. Advantages remain its inexpensive, relatively short scan time, real-time analysis, lack of ionizing radiation, no need for contrast, portability, and adaptability to procedures. Disadvantages are the long learning curve, operator dependence, and difficulty in assessing medially-displaced discs.
**PURPOSE**

The inflammatory arthritides are systemic, inflammatory disorders which have the potential for long term deformity and disability. Early detection of disease and advances in treatment with increasingly effective use of DMARDS (disease modifying anti-rheumatic drugs) and biologic agents has reduced the occurrence of severe long term sequelae in this disease group. We describe our initial experience and evaluate the additional benefit of performing time resolved angiographic imaging in the assessment of synovitis within the hands with the addition of fusion images.

**METHOD AND MATERIALS**

Retrospective data was collected for patients undergoing imaging to assess for synovitis. Standard MR images including T1, T2 fat saturation and T1 fat saturation with contrast in axial and coronal sequences were reviewed for erosions, bone marrow oedema and synovitis assessed using the OMERACT scoring method. Images were obtained on GE 3T Discovery 750 using Time Resolved Imaging of Contrast KineticS (TRICKS) GE Healthcare. Time resolved MRA images of the same patients obtained during the same data acquisition were scored independently and the imaging finding compared. In addition fusion images of the T1 coronal images with early subtracted MR angiographic sequences were reviewed.

**RESULTS**

The fused images were generally good quality and able to identify areas of synovitis demonstrated on the post contrast sequences. Most patients were able to tolerate the scan and able to remain still during the aquisition. Most reviewers felt comfortable reporting the MRA sequences after appropriate training.

**CONCLUSION**

Time Resolved Imaging of Contrast KineticS (TRICKS) is a very useful sequence that does not significantly increase scanning time and is technically feasible on current technology. The fusion of these angiographic sequences to the anatomical sequences increases the spatial localisation of the angiographic sequences.

**CLINICAL RELEVANCE/APPLICATION**

MRA sequences alone of the hands are quick to perform hence performing MRA sequences alone would significantly reduced scanning time for patients and increase the productivity of the scanner. The fusion of the MRA sequences to the anatomical T1 images allows for accurate anatomical localisation of the areas of synovitis with clinicians and patients better able to understand the images.

**MK292-SD-SUA3**

**CRMO Revisited: Do MRI Features Correlate with Clinical Response?**

**PURPOSE**

Chronic recurrent multifocal osteomyelitis (CRMO) is a rare auto-inflammatory disorder that manifests with non-specific bone pain. Diagnosis is challenging and evaluation of clinical improvement after therapy has not been well established. MRI has been shown to be useful at initial evaluation, but data regarding utility of MRI at follow-up is scant. The purpose of this study is to evaluate the correlation between clinical course of CRMO lesions and their changes on follow-up MRI.

**METHOD AND MATERIALS**

Independent, retrospective chart review was performed of 8 patients with biopsy-proven CRMO who were managed by pediatric rheumatologists. Initial and follow-up MRIs were reviewed by two musculoskeletal fellowship-trained radiologists in regard to changes in marrow edema, periosteal edema, soft tissue edema, and enhancement. Changes in clinical findings were compared to changes on MRI. Statistical analysis of logistic regression was then performed.

**RESULTS**

8 patients with diagnosis of CRMO were included with mean age of 14 years (SD ±7.27, range 4-30). There were 5 females and 3 males. Of the 34 total lesions identified, 22 lesions were in the lower extremities, 5 in the upper extremities, and 7 in the axial skeleton. Among the 18 clinically improving lesions, 14 demonstrated decreased bone marrow edema (specificity 100%, p<0.01) and 9 demonstrated decreased periosteal edema (specificity 82%, p=0.059). Since IV contrast was not administered in a majority of the follow up MRI studies, no statistical analysis could be performed for correlation with enhancement. However, if there was improvement in any one of the MRI changes listed above, there was a greater likelihood of clinical improvement when compared to no improvement at all on imaging (p=0.01). Moreover, clinically silent lesions were identified with the help of whole body MRI, including sacral lesions that were then treated and responded well.

**CONCLUSION**

Changes in bone marrow edema and periosteal reaction are MRI findings that best correlate with clinical response of CRMO lesions. MRI is also useful in the identification of clinically silent lesions.

**CLINICAL RELEVANCE/APPLICATION**

Our study demonstrates that MRI is a valuable tool for clinicians in the long term management of CRMO patients.

**MK293-SD-SUA4**

**Diagnostic Performance of Wrist MR Arthrography: Comparison of Three-dimensional Isotropic T1-weighted Fast Spin-Echo MR Arthrography and Two-dimensional MR Arthrography**

**PURPOSE**

...
To compare the diagnostic performance of direct wrist MR arthrography (MRA) with 2D T1-weighted FSE sequence and with 3D isotropic T1-weighted FSE sequence for the detection of central perforation of triangular fibrocartilage (TFC), scapholunate ligament (SLL) injury, and lunotriquetral ligament (LTL) injury.

**METHOD AND MATERIALS**

Institutional review board approval was obtained, and the informed consent requirement was waived. Twenty-six patients who had undergone preoperative wrist MRA with the 2D T1-weighted FSE sequence and the 3D isotropic T1-weighted FSE sequence and subsequent arthroscopy were included. Each MR imaging sequence was independently scored by two readers retrospectively for the presence of central perforation of TFC, and tears of SLL and LTL. Sensitivity, specificity, and accuracy of two sequences for diagnosing the injury of each structure were calculated, with arthroscopic finding as a standard reference, and compared each other.

**RESULTS**

Arthroscopic surgery revealed 21 central perforation of TFC, 7 SLL tears and 3 LTL tears. Sensitivity, specificity, and accuracy of both sequences for diagnosing the injury of each structure were not statistically significantly different (TFC, 90.5%/80%/88.5% for both readers, both sequences; SLL, 100%/89.5%/92.3% for both readers’ 2D and reader 1’s 3D, 85.7%/89.5%/88.5% for reader 2’s 3D; LTL, 66.7%/100%/96.2% for both readers’ 2D, 33.3%/100%/92.3% for both readers’ 3D). Interobserver agreements were substantial to excellent (TFC, 0.783, both sequences; SLL, 1.00 for 2D, 0.913 for 3D; LTL, 1.00 for both 2D and 3D).

**CONCLUSION**

The diagnostic performance of 3D isotropic T1-weighted FSE wrist MR arthrography is comparable to that of 2D T1-weighted FSE wrist MR arthrography in the diagnosis of central perforation of TFC, and tear of SLL and LTL.

**CLINICAL RELEVANCE/APPLICATION**

3D isotropic T1-weighted FSE wrist MR arthrography is comparable to 2D T1-weighted FSE wrist MR arthrography in the diagnosis of central perforation of TFC, and tear of SLL and LTL, and 3D isotropic T1-weighted FSE MR arthrography can be alternative.

**TABLE OF CONTENTS/OUTLINE**

- To describe the normal anatomy of the main structures of the foot, including the plantar plate complex and the metatarsophalangeal joint environment- To illustrate and discuss the specific pathologies potentially diagnosed using ultrasound in selected cases of foot pain.
1. Ultrasound assessment of forefoot structures: description of the ultrasound technique, including static and dynamic assessment (videos included).

2. MRI Appearance of Postoperative Total Hip Arthroplasty 'Pseudotumor': A Review of Terminology (Pseudotumor, ALTR, ALVAL, Metallosis, Particle Disease) and the MR Imaging Similarities and Distinctions between Potential Etiologies

**TEACHING POINTS**

1. Understand the radiographic assessment of adult spinal deformity (ASD) and the major causes for morbidity.
2. Highlight the concepts behind regional and global spinal alignment.
3. Learn the current adult spinal deformity classification system used by surgeons.
4. Describe how to assess pelvic parameters and sagittal compensation maneuvers.
5. Provide suggested reporting parameters for the radiologist’s interpretation of adult scoliosis with an emphasis on the surgical implications.

**TABLE OF CONTENTS/OUTLINE**

1. SRS-Schwab ASD Classification Components.
2. Technique and examples for measuring coronal curve and sagittal modifier.
3. Technique and examples for measuring spinopelvic parameters such as pelvic tilt, pelvic inclination, sagittal vertical axis, and T1 pelvic angle.
4. Discussion and technique for assessing coronal and sagittal imbalance.
5. Discussion of sagittal imbalance compensation utilizing radiographic samples.
6. Systematic algorithmic approach for analyzing and reporting these findings using a suggested sample report.

**MK009-EB-SUA**

MRI Appearance of Postoperative Total Hip Arthroplasty 'Pseudotumor': A Review of Terminology (Pseudotumor, ALTR, ALVAL, Metallosis, Particle Disease) and the MR Imaging Similarities and Distinctions between Potential Etiologies

**Participants**

Justin Fiske, MD, Milwaukee, WI (Presenter) Nothing to Disclose

Vipul Sharma, MD, Pewaukee, WI (Abstract Co-Author) Nothing to Disclose

Joseph Davies, MD, Grafton, WI (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

Review the sometimes overlapping terminology ("pseudotumor", adverse local tissue reaction ALTR, aseptic lymphocytic vasculitis associated lesion ALVAL, metallosis, particle disease) and the most current consensus terminology. Review potential etiologies of postoperative THA "pseudotumor" and their MR imaging similarities and distinctions. Review the MRI appearance of periprosthetic infection and the normal expected postoperative THA appearance. Example demonstrating the value of MRI metal suppression sequences for the evaluation of total hip arthroplasty (case of the same patient receiving two separate MRI of the hip, with and without metal suppression, demonstrating a periprosthetic fluid collection obscured by artifact on the non-metal suppression study).

**TABLE OF CONTENTS/OUTLINE**

"Pseudotumor": Terminology "Pseudotumor": MR Imaging Findings "Pseudotumor" due to adverse local tissue reaction ALTR/aseptic lymphocytic vasculitis associated lesion ALVAL "Pseudotumor" due to metallosis/particle disease MRI appearance of periprosthetic infection and normal postoperative THA appearance Sample cases Value of MRI metal suppression sequences Sample case of the same patient with a periprosthetic fluid collection not well seen on the initial MRI performed without metal suppression Clinical perspective from the performing surgeon
**MODIC 1 SIGNAL EVOLUTION AFTER INTRADISCAL GLUCOCORTICOID INJECTION (VERSUS SHAM-PROCEDURE) FOR PATIENTS WITH CHRONIC LOW BACK PAIN**

**PURPOSE**

Assessment of the Modic signal evolution after intradiscal steroid injection versus sham-procedure for patients with chronic low back pain associated with active discopathy (defined by a Modic 1 MRI pattern).

**METHOD AND MATERIALS**

Ninety chronic low back pain patients with active discopathy on MRI (Modic 1) and failure of first line treatments were included in a double-blinded, multicentric trial. Patients were randomized for an intradiscal injection of glucocorticoid (25 mg of prednisolone acetate) during a discography (group 1) or for a sham-procedure (group 2). MRI before and twelve months after discography were assessed for evolution of the Modic type, the Modic extension (volume, maximal height and antero-posterior diameter), the Modic signal intensity and the disc space narrowing, blinded to the procedure.

**RESULTS**

At the 12 months evaluation, no significant difference were observed on MRI about the Modic signal changes between the 45 patients treated with an intradiscal glucocorticoid injection and the 45 patients who had a single discography. The rate of persisting Modic 1 was similar in both groups (80% in group 1 vs 73% in groupe 2, p = 0.62). The extent of endplate oedema did not change differently between the two groups, neither in volume (increase of 830 mm³ in group 1 versus decrease of 99 mm³ in group 2, p=0.60), nor in maximal height (-5% in group 1 vs -1.7% in group 2, p=0.43), nor in maximal antero-posterior diameter (-6.1% in group 1 vs -6.4% in group 2, p=0.95). The signal intensity changes after discography did not differ between the 2 groups. The disc space narrowing at 12 months was similar in both groups (5% in group 1 vs 3.9% in group 2, p=0.61).

**CONCLUSION**

Evolution of the vertebral body endplate oedema was similar between patients treated with intradiscal injection of corticosteroids and patients having a sham-procedure. Considering the significant decrease of low back pain in patients treated with intradiscal injection of corticosteroids in this cohort, MRI should not be used as a predictive tool in the follow-up of patients with active discopathy.

**CLINICAL RELEVANCE/APPLICATION**

MRI should not been used as a propostic tool in the follow-up of patients with low back pain associated with an active discopathy.
METHOD AND MATERIALS

Between 2013 and 2015, 40 pre-operative hip aspirations (n=19 EG; n=21 FG) were performed at our Institution on 39 patients who underwent revision surgery for implant loosening. Musculoskeletal Infection Society (MSIS) criteria were used as the “gold standard” for the evaluation of hip infection.

RESULTS

Aspirations performed under UG revealed better sensitivity (83% vs 50%), specificity (100% vs 85%), PPV (100% vs 60%), NPV (93% vs 80%) and accuracy (95% vs. 75%) compared with FG aspirations.

CONCLUSION

UG should be considered as a valid alternative for hip aspiration compared with FG in the diagnosis of peri-prosthetic infections, showing better clinical results.

CLINICAL RELEVANCE/APPLICATION

Hip aspiration performed under UG can be a valid option to detect peri-prosthetic infections compared to FG. UG aspiration has the advantage of being easier to perform, do not use ionizing radiations and shows good clinical results with lower costs.

MK297-SD-
SUB3

Presence of MRI-defined Intra-articular Inflammatory Markers Two Years after Anterior Cruciate Ligament Injury Increases Risk for Tibio-femoral Osteoarthritis at Five Years

Station #3

Participants

Frank W. Roemer, MD, Boston, MA (Presenter) 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
Stefan Lohmander, Lund, Sweden (Abstract Co-Author) Nothing to Disclose
Jingbo Niu, Boston, MA (Abstract Co-Author) Nothing to Disclose
Richard Frobell, Lund, Sweden (Abstract Co-Author) Nothing to Disclose

PURPOSE

The aim of this study was to compare risk of radiographically-defined and MRI-defined patello-femoral (PF) and tibiofemoral (TF) osteoarthritis (OA) at 5 years after anterior cruciate ligament (ACL) injury for knees that have persistent MRI-detected signs of Hoffa-synovitis and effusion-synovitis at 2 years vs. those that do not show inflammation.

METHOD AND MATERIALS

The KANON study includes 121 subjects with an acute ACL injury in a previously un-injured knee. Subjects were randomly assigned to structured rehabilitation plus early ACL reconstruction or to structured rehabilitation plus optional delayed ACL reconstruction. The current analysis focuses on baseline (BL), 2 year and 5 year MRI regardless of treatment arm. MRI was performed using a 1.5 T system. All available MRIs were read with the semi-quantitative ACLOAS scoring system by one musculoskeletal radiologist. Logistic regression was performed to assess the associations of presence of any inflammatory MRI markers (Hoffa-synovitis and joint effusion-synovitis) with risk of radiographic and MRI-defined PF and TF OA at 5 years. Adjustment was performed for age, sex, body mass index (BMI) and 3-level treatment group (early ACL reconstruction, delayed ACL reconstruction, rehabilitation).

RESULTS

111 patients were included that had MRIs available for all three time points. Mean age was 26.3 ± 5.1 years and 12 (19%) were female. Mean body mass index was 24.4 ± 3.2. Patients with positive inflammatory markers at 2 years (i.e. any Hoffa-synovitis or effusion synovitis ≥ grade 1) did not show increased risk for radiographically defined TF or PF OA at 5 years. However, patients with positive inflammatory markers did have an increased risk of MRI-defined TF OA (Hoffa-synovitis OR 5.44, 95% CI [1.10,26.95] and effusion-synovitis OR 9.40 95% CI [1.14,77.48]). No statistically significant association were observed for risk of PFJ OA.

CONCLUSION

Inflammatory changes observed distant to the initial trauma seem to play a role in OA development at 5 years. While no increased risk was observed for development of radiographically defined PF or TF OA, the risk of MRI-defined TF OA was markedly increased in patients with signs of Hoffa- and effusion synovitis at 2 years.

CLINICAL RELEVANCE/APPLICATION

While X-ray defined OA shows structural changes only in late disease stages the MRI definition of OA may be helpful in diagnosing patients with unfavorable outcomes more early.

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
**MK298-SD-SUB4**

**Progressive Depletion of Skeletal Muscle and of Muscle Quality Predicts Survival of Colorectal Cancer Patients**

**Participants**

Colm J. McMahon, MBCh, Boston, MA (Abstract Co-Author) Nothing to Disclose
Yu-Ching Lin, MD, Tao Yuan, Taiwan (Abstract Co-Author) Nothing to Disclose
ChihYing Deng, Tao Yuan, Taiwan (Presenter) Nothing to Disclose
Kun-Yun Yeh, Keelung, Taiwan (Abstract Co-Author) Nothing to Disclose
Yun-Chung Cheung, MD, Kwei Shan, Taiwan (Abstract Co-Author) Nothing to Disclose
Jim S. Wu, MD, Boston, MA (Abstract Co-Author) Research Grant, Kaneka Corporation

**PURPOSE**

Sarcopenia (low skeletal muscle mass) is associated with poorer prognosis of colorectal cancer patients. The goal of this study was to evaluate the effect on survival of progressive loss of muscle mass at 1 year follow up after diagnosis.

**METHOD AND MATERIALS**

Patients diagnosed with colorectal cancer between 2007 and 2011 were included and were followed for at least 5 years. CT at baseline and 1 year after diagnosis were analyzed. Skeletal Muscle Index (SMI) of psoas and paraspinal muscles, and mean Hounsfield Units (HU) were measured at baseline, and at 1 year. Interval change in parameters between baseline and 1 year were calculated. Measurements were taken at L4 level. Univariate Cox proportional hazard regression was used to evaluate relationship to overall and progression-free survival.

**RESULTS**

*p = p<0.05
148 patients were included, mean (+/-SD) age 65.1 (+/-13.5) years, 51 females. Overall survival: Hazard Ratio (HR) of psoas SMI was 0.60, 0.41*, 7.51* for baseline, 1 year, interval change respectively. HR for psoas HU was 0.98, 0.93*, 1.14* for baseline, 1 year, interval change respectively. HR for paraspinal SMI was 0.67*, 0.58*, 2.19* for baseline, 1 year, interval change respectively. HR for paraspinal HU was 1.00, 0.99, 1.18* for baseline, 1 year, interval change respectively.

**CONCLUSION**

Progressive depletion of muscle mass and of muscle quality at 1 year compared to baseline at diagnosis of colorectal cancer is predictive of poorer overall and progression free survival.

**CLINICAL RELEVANCE/APPLICATION**

This study identifies the importance of changes in skeletal muscle index and muscle density as a biomarker for colorectal cancer prognosis.

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**MK299-SD-SUB5**

**Role of MRI to Assess Skeletal Age in Pediatric Celiac Disease**

**Participants**

Silvia Bernardo, MD, Rome, Italy (Presenter) Nothing to Disclose
Ernesto Tomei, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Milvia Martino, MS, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Corrado Tagliati, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Andrea Laghi, MD, Rome, Italy (Abstract Co-Author) Speaker, Bracco Group Speaker, Bayer AG Speaker, General Electric Company Speaker, Koninklijke Philips NV

**PURPOSE**

Coeliac children are often subject to weight loss and lower somatic growth rate, compared to healthy children of the same age. The purpose of this study was to assess the feasibility of magnetic resonance imaging (MRI) of the hand and the wrist to assess skeletal age and growth delay.

**METHOD AND MATERIALS**

We enrolled in our study 39 coeliac children (13 males and 26 females) affected by histological proven coeliac disease, with a chronological age ranged between 5 years and 1 month and 16 years and 4 months (mean age of 10 years, +/- 3 years and 8 months standard deviation). A single MRI sequence (T13D SE, acquisition time: 1 minute 31 seconds) of the hand and wrist in coronal plane was performed of each patient to estimate the skeletal age. Patients' data were compared with a population of normal subjects.

**RESULTS**

The preliminary results showed a delay in skeletal age in children affected by coeliac disease in 85.7% of the simple study, with a delay of maturity of 0.83 years (+/-2.2 years of SD). Only 3 children showed advance MRI skeletal age when compared to normal subjects.

**CONCLUSION**

MRI of hand/wrist to assess skeletal age may be considered as a reliable indicator of somatic growth. MRI, without radiation exposure, can be an used as a diagnostic tool in skeletal delay. It could play an important role in the follow up of coeliac children, after gluten-free diet.

**CLINICAL RELEVANCE/APPLICATION**

MRI of hand/wrist skeletal age is a powerful, radiation-free, tool for the evaluation of bone age and follow-up in coeliac children.
TEACHING POINTS
This exhibit will use multimodality imaging and original high-quality medical illustrations, presented in an engaging comic book style format, to teach the following: Spectrum of carpal fractures Ligamentous anatomy of the carpus Spectrum of carpal dislocations The various instability patterns in the wrist Common management strategies and potential complications for all of the above

TABLE OF CONTENTS/OUTLINE
Detailed review of carpal fracture assessment, relevant classifications, management strategies, and complications with illustrative cases and diagrams. Interactive review of the intrinsic and extrinsic ligamentous anatomy of the carpus on MR. The spectrum of carpal dislocations, their discriminating features, and associated ligamentous injuries specific to each with illustrative cases and diagrams. Overview of the vast array of instability patterns in the wrist, how to evaluate them, and common management strategies with illustrative cases and diagrams.

MK206-ED-SUB8 | Ultrasound Evaluation of the Hand Joints in Inflammatory Diseases

TEACHING POINTS
Review the most common ultrasonographic findings in common hand joint arthropathy. The role of ultrasound in diagnosis and management of different hand joint arthropathies

TABLE OF CONTENTS/OUTLINE
IntroductionObjectiveMaterial and MethodsRheumatoid ArthritisPsoriatic arthritisOsteoarthritisSystemic lupus erythematosus arthropathyGeneral arthropathyDiscussionBibliography

MK246-ED-SUB9 | Show Me the Money! A "Slot-Machine Approach" to MRI Interpretation of Pathologic Conditions Involving the Femoral Head and Neck

TEACHING POINTS
Demonstrate key MR imaging features and ancillary findings of common pathologic conditions involving femoral head and neck. Apply algorithmic approach to evaluation of femoral head bone marrow edema to arrive at specific diagnosis on MRI. Review differential diagnosis of look-alike conditions in a systematic manner.

TABLE OF CONTENTS/OUTLINE
Interpretation of Musculoskeletal Radiographs: A Master Class

The learning goal of this course is to sharpen skills in interpretation of plain radiographs of the musculoskeletal system and will focus on subtle or difficult radiographic findings which, if missed, may lead to delay in or misleading clinical diagnosis. The course is geared toward both the general radiologist as well as the more experienced musculoskeletal radiologist. Often radiographs are the first line of choice when a clinical dilemma is encountered. As such, correct assessment is crucial to guide further workup and treatment. Yet, radiographic interpretation skills have fallen by the wayside compared to those of more advanced cross sectional imaging. In this course the presenters will alert the participants to easily missed plain radiographic findings which are paramount for correct interpretation. The course will have 5 sections, the first 4 will focus on the following joints in this order: the ankle, the shoulder, the wrist and the knee; the last section will focus on various other joints. At the end of the course the participants should enhance their skills when interpreting plain radiographs of the musculoskeletal system.

Sub-Events

**RC104A**  Ankle

Participants
Zehava S. Rosenberg, MD, New York, NY  (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

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

**RC104B**  Shoulder

Participants
Robert J. Ward, MD, Boston, MA, (robert.ward@tufts.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

**RC104C**  Wrist

Participants
Catherine N. Petchprapa, MD, New York, NY, (Petchc01@nymc.org)  (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC104D**  Knee

Participants
Anne Cotten, MD, Lille, France, (anne.cotten@chru-lille.fr ) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

With the development of MRI, knee radiographs are less and less frequently performed and taught to residents. Nevertheless, knowledge of subtle radiographic findings may be particularly useful for the management of many disorders. The aim of this lecture
is to raise awareness among radiologists of easily overlooked features by presenting many illustrative cases (subtle avulsion fractures or cortical depressions, subtle signs of trochlear dysplasia, subchondral or marginal changes, ...).

**Participants**

Mary G. Hochman, MD, Boston, MA, (mhochman@bidmc.harvard.edu) (Presenter) Stockholder, General Electric Company; Stock options, Nomir Medical Technologies, Inc; Author, UpToDate, Inc

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**
Sunday Afternoon Plenary Session

Sunday, Nov. 27 4:00PM - 5:45PM Room: Arie Crown Theater

Participants
Richard L. Baron, MD, Chicago, IL (Presenter) Nothing to Disclose

Sub-Events
PS12A  Report of the RSNA Research and Education Foundation

Participants
Burton P. Drayer, MD, New York, NY (Presenter) Advisor, Hologic, Inc

Abstract
The R&E Foundation exemplifies the 2016 Annual Meeting theme “Beyond the Image” as each and every year, R&E grant recipients pursue projects that go beyond radiologic sciences and touch every area of healthcare delivery and discovery. In the annual address of the R&E Foundation, Board of Trustees Chairman Burton P. Drayer, MD will report on this year’s record funding of 101 research and education awards totaling over $4 million, and why the need to support the Foundation is greater than ever. With a 30% funding rate of its applicants, the RSNA R&E Foundation provides a critical source of early support for so many young investigators and educators. It is through their awards that these individuals become engaged in research and excited about the prospect of pursuing a career in academic radiology. R&E grant recipients are poised to lead research efforts in the future that will extend beyond radiology into every area of patient care. To support these efforts and continue forth on this path, the Foundation launched Inspire – Innovate – Invest: The Campaign for Funding Radiology’s Future at RSNA 2014. The Campaign is moving steadily toward the Campaign goal of $17.5 million with the support of individuals, private practice groups and our corporate colleagues. For the future of radiologic research to belong to the next generation of radiologists, the specialty must put its financial support squarely behind its Foundation—our Foundation. During the meeting week, please take time to visit the R&E Foundation Booth, located on Level 3 of Lakeside Center to learn more about the 2016 grant recipients, their innovative projects and the many available opportunities to support the Foundation through our Campaign.

PS12B  Image Interpretation Session

Participants
Ronald J. Zagoria, MD, San Francisco, CA, (ron.zagoria@ucsf.edu) (Presenter) Nothing to Disclose
John Eng, MD, Cockeysville, MD (Presenter) Nothing to Disclose
Ellen M. Chung, MD, Bethesda, MD (Presenter) Nothing to Disclose
Nancy J. Fischbein, MD, Stanford, CA, (fischbein@stanford.edu) (Presenter) Nothing to Disclose
John R. Leyendecker, MD, Dallas, TX, (john.leyendecker@utsouthwestern.edu) (Presenter) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Presenter) Nothing to Disclose
Gautham P. Reddy, MD, Seattle, WA (Presenter) Nothing to Disclose

Honored Educators

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Gautham P. Reddy, MD - 2014 Honored Educator
Musculoskeletal Monday Case of the Day

Monday, Nov. 28 7:00AM - 11:59PM Room: Case of Day, Learning Center

Participants
Jennifer L. Demertzis, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Stephen A. Currie, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jason W. Stephenson, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Eric B. England, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Hillary W. Garner, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Laura W. Bancroft, MD, Orlando, FL (Abstract Co-Author) Author with royalties, Wolters Kluwer nv
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Instructor, DFine, Inc
Kimberly Beavers, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
Kaitlin M. Peterson, BS, Madison, WI (Abstract Co-Author) Nothing to Disclose
Michael V. Friedman, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Matthew G. Pipho, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Jeffrey M. Youngquist, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Michael Burch, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Kurt F. Scherer, MD, Windermere, FL (Abstract Co-Author) Nothing to Disclose
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Edward Derrick, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
Raul Loya, MD, Orlando, FL (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™: Winter is Coming

Monday, Nov. 28 7:15AM - 8:15AM Room: E451B

Participants
Adam E. Flanders, MD, Narberth, PA, (adam.flanders@jefferson.edu) (Presenter) Nothing to Disclose
Sandeep P. Deshmukh, MD, Philadelphia, PA, (sandeep.deshmukh@jefferson.edu) (Presenter) Nothing to Disclose
Christopher G. Roth, MD, Philadelphia, PA (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.

ABSTRACT

URL
Participants

Sub-Events

**SPSH20A  MR Diffusion in the MSK System**

Participants
Mark R. Robbin, MD, Cleveland Hts, OH, (mark.robbin@uhhospitals.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

- Apply MRI physics concepts of diffusion-weighted imaging techniques to clinical imaging
- Describe the current techniques and applications of diffusion-weighted imaging in evaluating musculoskeletal neoplasms
- Examine new techniques and applications of diffusion-weighted imaging.

**SPSH20B  Quantitative Techniques to Characterize MSK Tissue Structure and Function**

Participants
Martin Torriani, MD, Boston, MA, (mtorriani@mgh.harvard.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Introduce concepts of how to perform quantitative musculoskeletal techniques focusing on 1H-MR spectroscopy.
2) Review current applications of MR spectroscopy with focus on muscle (sarcopenia, fatty infiltration, atrophy).

**ABSTRACT**

**URL**

**SPSH20C  Quantitative Musculoskeletal Ultrasound Elastography: Shear Wave Speed Measurements**

Participants
Kenneth S. Lee, MD, Madison, WI, (klee2@uwhealth.org) (Presenter) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier

**LEARNING OBJECTIVES**

1) Introduce the basic concepts of quantitative musculoskeletal ultrasound elastography using shear wave speed measurements.
2) Review the current applications of quantitative musculoskeletal elastography using shear wave speed measurements with focus on the tendon and muscle.

**Active Handout:** Kenneth S. Lee

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

Participants
Lynne S. Steinbach, MD, San Francisco, CA, (lynee.steinbach@ucsf.edu) (Moderator) Nothing to Disclose
Soterios Gyftopoulos, MD, New York, NY, (Soterios.Gyftopoulos@nyumc.org) (Moderator) Nothing to Disclose
Stacy E. Smith, MD, Weston, MA (Moderator) Nothing to Disclose
Marcelo R. Abreu, MD, Porto Alegre, Brazil (Moderator) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

Participants
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom, (andrewgrainger@nhs.net) (Presenter) Speaker, General Electric Company; Equipment support, Siemens AG; Consultant, Medivir AB; Medical Advisor, Medivir AB

Active Handout: Andrew J. Grainger


PURPOSE

To describe the relationship of meniscal integrity with cartilage morphology and biochemistry in 7 cadaveric knees.

METHOD AND MATERIALS

7 fresh-frozen human cadaveric knees (mean age at death = 78 years) were screened for osteoarthritis with CT, and prospectively investigated (IRB exempt study) with magnetic resonance imaging (MRI). The meniscus (WORMS grading) and cartilage (International Cartilage Repair Society) were morphologically graded on conventional MR images. Ultrashort echo time (UTE) and standard quantitative MRI (qMRI) sequences (T2*, T2) were performed to quantitatively evaluate the meniscus and cartilage biochemical status (ICRS grade 2 or lower). UTE T2* and T2 measurements were acquired using constant TR and variable TE method with mono-exponential decay curve fitting. Formal statistical analysis was not performed due to small sample size.

RESULTS

Three cartilage - meniscus relationships were identified. Group 1: normal menisci (n=3) with normal cartilage (morphologic / qMRI) (mean T2* meniscus = 7.44 ms; mean T2 cartilage = 38 ms), Group 2: posterior horn meniscal tear with altered cartilage morphology (n=5) and / or altered qMRI (n=3) in subjacent meniscal covered femorotibial surfaces (mean T2* meniscus = 14.10 ms; mean T2 cartilage = 46 ms), Group 3: meniscal degeneration with altered chondral morphology / qMRI (n=4) occurring in central, meniscal uncovered surfaces of the same compartment (mean T2* meniscus = 12.23 ms; all cartilage scores ICRS 3 or 4 so no qMRI values).

CONCLUSION

This study demonstrated the correlation between meniscal and cartilage integrity. The type of meniscal pathology was related to the degree and location of mechanical axis alteration (meniscal tear subjacent cartilage / meniscal degeneration central cartilage) expressed by loss of cartilage integrity. Cartilage evaluation may serve as a potential surrogate for determination of intact
mechanical axis of the meniscus. T2* data correlates with severity of meniscal pathology.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative MRI of femorotibial cartilage has potential to serve as a surrogate to assess meniscus mechanical axis.

**RC204-03 The Healing Process of Anterior Cruciate Ligament (ACL) Graft, as Evaluated by Longitudinal PET-MRI**

**Monday, Nov. 28 9:00AM - 9:10AM Room: E451B**

**Participants**

Minggian Huang, MD, Syosset, NY (Presenter) Nothing to Disclose
Michael J. Salerno, BS,MBA, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Erik Lawrence, BS, East Setauket, NY (Abstract Co-Author) Nothing to Disclose
Seth Korbin, MD, Setauket- East Setauket, NY (Abstract Co-Author) Nothing to Disclose
Mark E. Schweitzer, MD, Stony Brook, NY (Abstract Co-Author) Consultant, MMI Munich Medical International Gmbh Data Safety Monitoring Board, Histogenics Corporation
James M. Paci, MD, Setauket- East Setauket, NY (Abstract Co-Author) Nothing to Disclose
Paul Vaska, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

ACL graft placement is among the most common orthopedic procedures. The biointegration of the graft has been shown in animal models to consist of revascularization, cell repopulation and metaplasia of tendon to ligament. We sought to use longitudinal PET MRI to better understand this process.

**METHOD AND MATERIALS**

11 patients (mean age: 36y; range: 19-55y SD 11.8 y) who underwent autograft of semitendinosus ACL reconstruction were recruited in this ongoing IRB-approved study. Simultaneous 18F-FDG PET (5 mCi IV) and MRI of both knees were obtained at 3 months (11 scans), 6 months (5 scans) and 12 months (1 scan) post operatively using Siemens mMR tomograph. First, whole-knee ROIs were placed on both knees to characterize changes at the organ scale. Then, for each tunnel (in femur & tibia), MRI images were resliced using PMOD to align the tunnels perpendicular to the image plane and circular ROIs were manually drawn on each plane with diameter equal to the tunnel diameter. The same reslicing was applied to associated PET images. Average PET uptake was normalized to measurements from the posterior cruciate ligament of same knee. Sequential knee MRI images were reviewed by musculoskeletal fellowship trained radiologist for morphological changes.

**RESULTS**

Our study demonstrated a higher PET uptake in postoperative knee compared to contralateral knee and the difference decreased over time - at 3 months 47% higher (8% SD) and at 6 months 22% higher (12% SD). Within the femoral & tibial tunnels, activity generally had a focal, rather than uniform distribution. Average activity in the tunnels exhibited a decreasing trend from 3 to 6 months (average -12%, p=0.11, including a decrease in 4 out of 5 subjects). The subject who had 3, 6 and 12 months postoperative scans also demonstrated decreased activity (-22%) from 6 to 12 months. No focal graft related complication was seen on MR portion of the study.

**CONCLUSION**

Longitudinal simultaneous PET MRI of knee in postoperative ACL graft can demonstrate both morphologic as well as physiologic data about the healing process.

**CLINICAL RELEVANCE/APPLICATION**

Simultaneous PET MR imaging of the knee may provide a better understanding of ACL graft integration and thus improve management of postoperative recovery.

**RC204-04 Postoperative Evaluation of Knee: ACL**

**Monday, Nov. 28 9:10AM - 9:30AM Room: E451B**

**Participants**

Lynne S. Steinbach, MD, San Francisco, CA, (lynee.steinbach@ucsf.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1. Understand the MR appearance of ACL reconstruction
2. Review most common surgical techniques for ACL reconstruction
3. Recognize various complications of ACL reconstruction

**ABSTRACT**

Normal ACL grafts are straight, of uniform caliber, and low signal intensity. The hamstring grafts may have some striation. Approximately 3-12 months following surgery the graft may undergo ligamentization which represents cellular remodeling and revascularization. On MRI, the graft may show intermediate signal intensity on all imaging sequences. This should not be misinterpreted for an abnormality. By 12-18 months, most grafts again demonstrate low signal intensity, although some normal grafts can demonstrate intermediate to high signal intensity. Those who have had patellar tendon grafts demonstrate a defect in the middle third of the inferior patella and the patellar tendon. The normal postoperative patellar tendon thickens and is of uniform low signal intensity. This should not be mistaken for tendinosis. Except for the rare finding of scarring, it is difficult to identify the harvest site of hamstring grafts. Tunnels for the ACL graft should be positioned in a certain manner to restore knee homeostasis and provide functional stability. On coronal images, the femoral tunnel extends from the lateral femoral metadiaphysis to the roof of the intercondylar notch. In the right knee it should enter the tunnel at approximately 10-11 o’clock position and in the left knee it should enter at the 1-2 o’clock position. The lateral edge of the tibial tunnel should be parallel to the lateral tibial spine and the graft should be angulated 60-65 degrees to the joint line. On sagittal images the femoral tunnel should enter the intercondylar notch at the junction of the posterior femoral cortex with the intercondylar notch approximately 1-2 mm from the cortical rim. The tibial tunnel should enter the tibia parallel and posterior to a line drawn along the roof of the intercondylar notch (Blumensaat’s line). Anterior translation of the tibia may persist following successful ACL reconstruction. Complications of ACL graft include
improper positioning of the tibial and femoral tunnels, graft impingement, graft tear, cyclops lesions, arthrofibrosis, mucoid degeneration in the graft and tunnels and hardware failure.

**LEARNING OBJECTIVES**

1) Review types of procedures commonly used following ACL injury. 2) Become familiar with the normal appearance of the ACL graft of MRI Identify complications of ACL grafting as seen on MRI.

**RC204-05  Postoperative Imaging after Subchondroplasty in the Knee**

Monday, Nov. 28 9:30AM - 9:40AM Room: E451B

Participants
Christoph A. Agten, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Daniel J. Kaplan, New York, NY (Abstract Co-Author) Nothing to Disclose
Christopher J. Burke, MBCChB, New York, NY (Presenter) Nothing to Disclose

**PURPOSE**

Subchondroplasty is an increasingly used minimally-invasive procedure to treat painful bone marrow edema in the knee by injecting synthetic calcium phosphate into the lesion. The purpose of this study was to describe the postoperative imaging findings after subchondroplasty in the knee.

**METHOD AND MATERIALS**

The study was IRB-approved and informed consent was obtained from all participants. Nine patients (4 female, 5 male, mean age 56±10 years) undergoing subchondroplasty were included. Bone marrow edemas on preoperative MRI were assessed regarding etiology and location. On postoperative imaging (radiographs, computed tomography, MRI - depending on availability) we assessed visibility of the injected calcium phosphate (yes/no), matching of the calcium phosphate deposits with the bone marrow edema location on preoperative MRI (yes, partially, no), and leakage of injected calcium phosphate into the soft tissues (yes/no). Clinical outcome was assessed by comparing pre- and postoperative International Knee Documentation Committee (IKDC) scores (0-100, higher scores=better outcome).

**RESULTS**

Bone marrow edema were related to osteoarthritis (n=5) and insufficiency fractures (n=4) and were located in the medial tibia plateau (n=5), medial femoral condyle (n=3), and lateral femoral condyle (n=1). Postoperative imaging was only available in 5 patients. The injected calcium phosphate was depicted on all postoperative radiographs. The site of the injected calcium phosphate matched with preoperative MRI bone marrow edema in 4/5 patients, and matched only partially in one patient. Leakage in the soft tissues was noted in 3/5 patients (along the needle approach). The median improvement in IKDC scores 1 year after subchondroplasty was 20.7 points (range -1.1 to 65.6).

**CONCLUSION**

Radiologists should be familiar with the typical postoperative imaging appearance after subchondroplasty. On postoperative imaging, soft tissue contamination with injected calcium phosphate can be observed and should not be mistaken as trauma-related or heterotopic ossification.

**CLINICAL RELEVANCE/APPLICATION**

The radiologist should be familiar with the anticipated postoperative imaging appearances following subchondroplasty and the potential complications, to ensure accurate imaging interpretation.

**RC204-06  Upsloping Lateral Sourcil: A Novel Radiographic Finding in Clinically Unstable Hips**

Monday, Nov. 28 9:40AM - 9:50AM Room: E451B

**PURPOSE**

While radiographic findings of frank hip dysplasia are well defined, there is a lack of diagnostic criteria for patients with radiographically "normal" hips who have borderline morphologic deficit and clinical instability. In this study, we evaluate the upsloping lateral sourcil (ULS) as a novel radiographic finding in the evaluation of these patients.

**METHOD AND MATERIALS**

316 patient charts were reviewed for: AP-pelvis radiographs with confirmed standard quality parameters, lateral center edge (LCE) angles, the presence of upsloping lateral sourcils, and clinical instability as elucidated from notes by a hip preservation surgeon. Chi-square statistical analysis was used to evaluate the association of the ULS with clinical hip instability. Patients with gross dysplastic deformity, marked inclination of the acetabular roof, or femoral head subluxation were removed from analysis.

**RESULTS**

Our review consisted of 104 males (32.9%) and 212 females (67.1%), with a mean age of 34y. The prevalence of the ULS correspondingly increased with the degree of dysplasia and was found in 65.2% of dysplastic hips (LCE<20°), 29.6% of “borderline” hips (LCE 20°-25°), 14.9% of normal hips (LCE 25°-40°) and 0% of pincer hips (LCE >40°). Of the hips displaying ULS, 77.9% had clinical instability (p-value = 0.0258). The ULS radiographic finding demonstrated 89.0% specificity for clinical instability.
CONCLUSION

Advancements in hip preservation surgery garner substantial attention towards accurate diagnosis of borderline hip dysplasia and clinical hip instability. The ULS is a novel radiographic finding that may be useful as a secondary identifier of borderline hip dysplasia and hip instability. Incorporation of this finding into the routine assessment of the painful hip will allow for an earlier and more accurate identification of at-risk patients and help to guide clinical referral and treatment.

CLINICAL RELEVANCE/APPLICATION

The upsloping lateral sourcil is a novel radiographic characteristic that may help to identify clinical instability in borderline patients who demonstrate "normal" morphology.

RC204-07 Preoperative Evaluation of Hip

Monday, Nov. 28 10:00AM - 10:20AM Room: E451B

Participants
Donna G. Blankenbaker, MD, Madison, WI, (dblankenbaker@uwhealth.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply the most appropriate imaging technique in the assessment of the painful hip. 2) Identify and examine the cause for the painful hip. 3) Develop a checklist in the imaging assessment of the hip.

ABSTRACT

RC204-08 More than Half of the Patients Eligible for Joint Preserving Surgery of the Hip Present with Abnormal Femoral Torsion

Monday, Nov. 28 10:20AM - 10:30AM Room: E451B

Participants
Till Lerch, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Florian Schmaranzer, Bern, Switzerland (Presenter) Nothing to Disclose
Inga Todorski, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Simon D. Steppacher, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Stefan Werlen, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Klaus A. Siebenrock, MD, PhD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Moritz Tannast, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE

Torsional deformities are increasingly recognized as an additional factor in the setting of femoroacetabular impingement (FAI). Decreased femoral torsion can worsen an anterior FAI conflict while an increased torsion can be beneficial with the same configuration. It is unknown how often torsional deformities are present in young patients presenting with groin pain that are eligible for joint preserving surgery. We questioned what is the prevalence of an abnormal femoral torsion in hips with FAI or hip dysplasia and which hip disorders are associated with an abnormal torsion?

METHOD AND MATERIALS

An IRB-approved retrospective study of 463 consecutive symptomatic FAI patients (538 hips) and a MRI or CT scan on which femoral torsion could be measured was performed ("study group"). Out of 915 MRI we excluded 377 hips. All patients had an AP pelvic view. Coxometric parameters were assessed with a previously validated software. The study group was divided into 10 groups: Dysplasia (< 22° LCE), retroversion, anteverted hips, overcoverage (LCE angle 36-39°), severe overcoverage (LCE>39°), cam (>50° alpha angle), mixed FAI, varus-, valgus- and Perthes-hips. The 'control group' of normal hips consisted of 35 asymptomatic patients (35 hips) without radiographic signs of osteoarthritis. Femoral torsion was measured on axial MRI and CT scans. Normal femoral torsion was defined according to Tönnis et al. (10-25°) while abnormal and severely abnormal torsion was defined as <10° and >25° respectively <0° and >35°. ANOVA analysis was performed for statistical analysis.

RESULTS

52% of the patients presented with abnormal values for femoral torsion. Severely abnormal torsion was measured in 17% of all 538 hips eligible for joint preserving surgery. Abnormal femoral torsion was present in 90% of Perthes hips, in 63% of dysplastic hips, 58% of hips with overcoverage and in 75% of valgus hips. Significant differences (p<0.001) in torsion between normal hips (mean 17°) and hips with dysplasia (26°), valgus hips (27°) and Perthes hips (32°) could be found.

CONCLUSION

More than half of the patients which are eligible for joint preserving surgery of the hip present with abnormal femoral torsion.

CLINICAL RELEVANCE/APPLICATION

Though the exact contribution of altered femoral torsion to patients symptoms and outcome are currently unknown, femoral torsion should be measured in patients eligible for hip-preserving surgery.

RC204-09 Utility of 3D Print Models for Pre-operative Planning in Femoroacetabular Impingement

Monday, Nov. 28 10:30AM - 10:40AM Room: E451B

Participants
Tony T. Wong, MD, New York, NY (Presenter) Nothing to Disclose
Thomas S. Lynch, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Charles A. Popkin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jonathan K. Kazam, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
PURPOSE
To establish 3D print models as a useful tool in pre-operative planning for FAI surgery.

METHOD AND MATERIALS
This is a retrospective review with IRB approval. The electronic medical record was queried for patients with a clinical diagnosis of FAI that had CT, MRI, and radiographs available for review from 2013-2015. This yielded a study group of 10 consecutive patients. 3D print models for the femora and acetabuli of each patient were created. The clinical information and imaging for each patient were reviewed independently by two orthopedic surgeons. They anticipated the bone resection required on the femur and acetabulum as per routine pre-surgical planning. They were then shown the 3D models and decided whether the extent of this anticipated resection changed. On the femoral side, the assessment was made in regards to direction (superior, inferior, medial, and lateral femoral neck) and depth. On the acetabular side, the assessment was made in regards to direction (anterior and posterior rim), depth, and involvement of the anterior inferior iliac spine (AIIS).

RESULTS
On a per patient basis, the 3D models changed the amount of bone resection for at least one reader in 9/10 (90%) femoral cases and 10/10 (100%) acetabular cases. The proportions of anticipated femoral resection change by position were (95% CI): 25% (9.4%-52%) superior, 20% (6.1%-49%) inferior, 25% (9.4%-52%) medial, 55% (29%-79%) lateral, and 55% (29%-79%) depth. Cohen’s kappa was: 0.348 (p = 0.26) superior-inferior, 0.737 (p = 0.016) medial-lateral, and 0.600 (p = 0.058) depth. The proportions of anticipated acetabular resection change by position were (95% CI): 75% (56%-88%) anterior, 40% (19%-65%) posterior, 60% (40%-77%) depth, and 35% (18%-57%) AIIS. Cohen’s kappa was: -0.176 (p = 0.49) anterior-posterior, 0.091 (p = 0.49), depth, and 0.000 (p = 1.0) AIIS. Proportion of position changes in: Cam lesion > 60 deg vs. < 60 deg: 55% vs. 20% (p = 0.0030)Neg. crossover vs. pos. crossover: 79% vs. 44% (p=0.0075)

CONCLUSION
Our results show that 3D print models can change the anticipated degree of required femoroplasty and acetabuloplasty in FAI surgery. They may be particularly useful for cases with larger cam lesions and no crossover sign. Inter-rater agreements ranged from fair to good in the femur and poor in the acetabulum.

CLINICAL RELEVANCE/APPLICATION
3D models can alter the surgical plan in patients with FAI.
The presence of tarsal coalitions such as calcaneonavicular (CNC), intra-articular middle facet talocalcaneal (MFTCC), posterior facet talocalcaneal (PFTCC), extra-articular posteromedial talocalcaneal (EATCC) and other rare coalitions were also evaluated.

RESULTS
187 patients were included in this study (age range 14-91 years; mean ± SD age; 50 ± 17 years), 47.1% males and 52.9% females. Overall AALTF prevalence was 31.55% (59/187), 41.91% in men, and 23.23% in women. AALTF average length was 4.5±1.1mm, and average height was 8.9±3.4mm. AALTF was found to be significantly associated with lateral talocalcaneal osseous changes such as cortical thickening and cystic changes (34/59 and 24/59 respectively, P< 0.01). At least one type of coalition was identified in 37.43% of study population (70/187). The most common type was CNC (52.86%) followed by EATCC (35.71%). Intra-articular MFTCC (12.86%) was found to be more common than PFTCC (5.71%). Other rare coalitions were present in less than 3%. There was a significant association between AALTF and the presence of EATCC (19/59, P < 0.01) and MFTCC (7/59, P < 0.05). No association was found with CNC, PFTCC or other rare coalitions. AALTF was also found to be significantly associated with sinus tarsi edema on MRI (45 of 59, P< 0.05).

CONCLUSION
AALTF is common and significantly associated with tarsal coalitions, specifically EATCC and MFTCC. When a coalition is identified, special attention should be made to evaluate for other associated pathologies. Failure to recognize an AALTF may result in persistent symptoms if only the coalition is treated.

CLINICAL RELEVANCE/APPLICATION
Imaging interpreter must be aware of possible association between AALTF and tarsal coalition to aid appropriate clinical and surgical decisions.

RC204-13  Metal Artifact Reduction Sequence MRI of Total Ankle Arthroplasty Implants: Compressed Sensing Accelerated SEMAC MRI versus Conventional High-Bandwidth MRI

Monday, Nov. 28 11:30AM - 11:40AM Room: E451B

Participants
Jan Fritz, MD, Baltimore, MD (Presenter) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG
Lucas Fonseca, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Mathias Nilftka, PhD, Erlangen, Germany (Abstract Co-Author) Employee, Siemens AG
Wesley Gilson, PhD, Baltimore, MD (Abstract Co-Author) Employee, Siemens AG
Cesar de Cesar Netto, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

PURPOSE
Metal artifact reduction sequence (MARS) MRI is helpful for the assessment of pain and dysfunction following arthroplasty. Conventional SEMAC MRI affords powerful metal suppression, but it is time consuming. Compressed sensing (CS) accelerated data sampling based on k-space sparsity, however, affords the time-neutral use of SEMAC when compared to high-bandwidth (high-BW) MRI. Thus, we prospectively compared an 8-fold accelerated CS-SEMAC sequence prototype with high-BW MRI in patients with total ankle arthroplasty implants (TAA).

METHOD AND MATERIALS
Following IRB approval and written informed consent, 20 asymptomatic volunteers and 10 symptomatic patients [18 women, 12 men; age, 62 (41-81) years] with TAA underwent CS-SEMAC (30 min) with 19 encoding steps and high-BW (30 min) MARS MRI at 1.5 Tesla. For each technique, intermediate-weighted and fat-suppressed axial, sagittal and coronal MR images were obtained. Three experienced physicians evaluated image quality, metal suppression, bone-implant interfaces, synovium, tendons, ligaments, bone and joints. Kruskall-Wallis and intraclass correlation coefficient (ICC) were applied. Bonferroni-corrected p-values ≤ 0.01 were considered significant.

RESULTS
There was a good agreement between observers (ICC=0.79; 95% CI, 0.78-0.80). Metal artifact reduction was significantly better (p<0.01) on CS-SEMAC images (very good) than on high-BW images (poor-to-adequate). Tissue contrast, fat suppression, and fluid brightness were statistically similar, whereas image sharpness was higher on high-BW MR images (p<0.01). At implant levels, tendons, ligaments and synovium were significantly better seen (p<0.01) on CS-SEMAC images than on high-BW images. Abnormal findings included fractures (n=2), tendon tears (n=2), osteolysis (n=2), medial tibiotalar overload (n=3), synovial fibrosis (n=2), non-specific synovitis (n=2), and subtalar and midfoot arthrosis (n=2), which were equally well or better seen on CS-SEMAC MR images (p<0.01).

CONCLUSION
Time-equivalent CS-SEMAC MRI outperforms high-BW MRI in the degree of metal artifact reduction as well as visibility and diagnosis of abnormalities along the bone implant interfaces and at the level of the tibiotalar joint line.

CLINICAL RELEVANCE/APPLICATION
Sparsity-driven, compressed sensing acceleration affords the time-neutral use of SEMAC MRI and higher image and diagnostic quality than traditional high-BW MRI for the diagnosis of periprosthetic abnormalities in patients with TAA.
Postoperative Evaluation of Ankle

Participants
Hilary R. Umans, MD, Ardsley, NY (Presenter) Nothing to Disclose

Active Handout:Hilary Ruth Umans

LEARNING OBJECTIVES
1) Review MRI technical considerations in imaging the post-operative ankle. 2) Review normal and abnormal post-operative MR appearance of various procedures, including lateral collateral ligament reconstruction, tendon transfers and tenodesis and treatment of osseous/osteocartilaginous pathology.

ABSTRACT
**Sub-Events**

**RC213-01 Overuse Injuries in the Pediatric Athlete**

**Participants**
Andrea S. Doria, MD, Toronto, ON (Moderator) Research Grant, Bayer AG; Research Grant, Novo Nordisk AS;
Jennifer Stimec, MD, Toronto, ON (Moderator) Nothing to Disclose
Sarah D. Bixby, MD, Boston, MA (Moderator) Nothing to Disclose
Lynn A. Fordham, MD, Chapel Hill, NC, (fdh@med.unc.edu) (Moderator) Nothing to Disclose

**PURPOSE**
To improve the early detection of radial physeal stress injury using MRI and to provide quantitative measures useful for classification and prognosis.

**METHOD AND MATERIALS**
15 gymnasts (10 with wrist pain and 5 without wrist pain) and 1 non-gymnast control, aged 12-17 years, were included for the first analysis of this ongoing study. All participants underwent radiography and MRI of the wrist. MRI was performed on a 3T scanner and included coronal PD images with and without fat saturation, as well as 3D WATSc and T1-weighted and T2-weighted Dixon series. Besides evaluation of appearance of the physis by an experienced musculoskeletal radiologist, 3D reconstructions of the physis were created using ITK-SNAP. The water fraction in the adjacent metaphyseal bone was quantified using Dixon water-only images. MR images of symptomatic gymnasts were compared with those of asymptomatic gymnasts and of non-gymnast controls, matched on skeletal age and sex.

**RESULTS**
The median calendar ages and skeletal ages were 13 years (range 12-15 years) and 13 years (range 11.5-15 years) for symptomatic gymnasts and 15 years (range 12-17 years) and 14 years (range 11.5-18 years) for asymptomatic gymnasts, respectively. The initial results show that the median volume of the physis was 1216 mm³ (range 680-3045 mm³) in symptomatic gymnasts and 1199 mm³ (range 616-2370 mm³) in asymptomatic gymnasts (p>0.05). The median water fraction in the metaphysis was 40% (range 21-56%) in symptomatic gymnasts and 33% (range 10-49%) in asymptomatic gymnasts (p>0.05). Various abnormalities were identified in both symptomatic and asymptomatic gymnast MR images, such as metaphyseal intrusions and disruption of the physeal layers, that were not recognized on radiographic images.

**CONCLUSION**
Subtle changes due to early physeal stress injury may be better visible on MRI. Initial results of this study show that physeal volume and metaphyseal water fraction measurement are promising and non-invasive methods to quantify physeal stress injury of the wrist.

**CLINICAL RELEVANCE/APPLICATION**
This study emphasizes the importance of MRI in the early diagnosis of physeal stress injury and shows the utility of a broadly applicable, easy to implement MRI protocol in this diagnostic process.
PURPOSE
To examine the impact of high intensity rock climbing in adolescents on finger health and development.

METHOD AND MATERIALS
This IRB approved prospective ultrasound study was performed in 19 adolescent rock climbers (ages 11-18) and 6 non-climbing, age-matched controls (ages 11-15). A Siemens S3000 with 9-18 MHz linear transducer (n=12) and Sonoscaner U-lite with 8MHz linear transducer (n=3) were used to examine the third and fourth digits of the right hand to assess for differences in thickness of soft tissue, flexor and extensor tendon, and volar plate as well as bony and physeal deformities. Number of hours/week (range: 4-15 h), years of climbing (range: 1-10 years) and preferred climbing technique were used to group the climbers in 3 levels (3=most intense training). Mann-Whitney test was used for statistical analysis.

RESULTS
Compared with non-climbing controls, climbers demonstrated significantly thicker flexor tendons; volar plates of the DIP and MCP; and soft tissues (for all p<0.05). Increased thickness of extensor tendons and PIP volar plates did not achieve significance. Larger bony tubercles at flexor digitorum profundus insertion were observed in climbers but not in controls. Joint effusions were found in 13/19 (68%) climbers. Significant phalangeal malalignment was seen in 10/19 (53%) climbers. Physeal deformities were identified in 4 climbers, all of whom were level 3.

CONCLUSION
Participation in high-intensity rock climbing in a group of adolescents resulted in physiologic adaptations, including significant soft tissue hypertrophy of the flexor compartment and bony remodeling compared to controls. 53% of climbers also demonstrated overuse injuries, likely due to repetitive trauma and imbalance of mechanical forces. The long-term effects of these changes require further investigation.

CLINICAL RELEVANCE/APPLICATION
Competitive rock climbing is among the fastest growing sports among youth in the United States. The sport demands repetitive, high-intensity training, the effect of which is relatively unknown.

RC213-04 Skeletal Maturation and Stress Injury of the Growth Plate at the Base of the Coracoid Process: MRI Features

Participants
Erin F. Alaia, MD, New York, NY (Presenter) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ignacio Rossi, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Johannes B. Roedl, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Lynne P. Pinkney, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lynne S. Steinbach, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Jonathan Zemmer, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Assess, utilizing MRI, the normal maturation and stress injury to the coracoid process and bipolar growth plate, at the interface with the underlying scapula. To the best of our knowledge this has not yet been described in the literature.

METHOD AND MATERIALS
The study was divided into 2 parts: A. Maturation of the coracoid process and bipolar growth plate. Retrospective review of 182 consecutive shoulder MRIs in 160 children without clinical or MRI evidence of coracoid pathology (107 boys, 53 girls, ages 0 to <5, n=36, 5 to <10, n=25, 10 to <15, n=67, and 15 to 18, n=54). The studies were reviewed with special attention to the development and fusion of the coracoid to the scapula, via the bipolar growth plate. B. Growth plate injuries. Retrospective review of shoulder MRIs with coracoid growth plate disturbance (7 boys, 1 girl, mean age 15).

RESULTS
A. Maturation of the coracoid process and bipolar growth plate. At 0 to < 5 years the cartilaginous coracoid precursor conformed to the shape of a mature coracoid process, with a small oval primary ossification center within it. The bony margins at the coracoid-scalapular interface transformed from smooth to irregular with advancing age. At 5 to < 10 years of age, a more distinct, undulating, bipolar growth plate developed. Complete closure of the bipolar plate was observed as early as 11 years of age and was noted in 41% of patients by age 14 and in 86% of 15 to 18 year olds. B. Growth plate injuries. The 8 patients with growth plate stress injuries included 2 patients with neuromuscular disorders and 6 patients with sports related symptoms. The growth plate demonstrated widening, irregularity and increased signal, with surrounding soft tissue and opposing bony marrow edema and hypertrophy.

CONCLUSION
MR imaging of normal maturation as well as stress injury of the base of the coracoid is crucial for accurate imaging diagnosis. Injury to the base of the coracoid, while uncommon, should be considered when assessing adolescents with shoulder symptomatology.

CLINICAL RELEVANCE/APPLICATION
Radiologists should be aware of the normal MRI appearance of coracoid maturation and coracoid stress injury to differentiate between normal development and pathology.

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/
PURPOSE

Our previous study has clarified injury of the medial collateral ligament (MCL), which does not frequently occur in youth baseball players, showed unexpectedly high at 41.9% in MRI elbow screening for healthy youth baseball players. The purpose of this study was to clarify the clinical interpretation of 'asymptomatic MCL injury of the elbow in youth baseball players observed on MRI' by comparing the results of standard clinical orthopedic examinations including palpation and US.

METHOD AND MATERIALS

62 players from 9 to 13 years were recruited. MRI was performed using a 0.2 T open-type MRI. MCL injury was diagnosed by criterion 1-6. The laterality of the joint space opening by valgus stress (laterality of cleft between articulations) was calculated by US, which represented MCL function. MCL tenderness, Moving valgus test, and Milking test were also performed as physical examinations. The laterality of the joint space opening was compared between subjects with MCL injury on MRI and subjects without MCL injury by using t-test. MRI findings and physical findings were analyzed with the χ2 and Fisher's exact test.

RESULTS

34 subjects (53.1%) were diagnosed as MCL injury on MRI. The mean laterality of the cleft between articulations was 0.29 mm in the subjects with MCL injury and 0.08 mm in the subjects without MCL injury on MRI without statistical differences (P=0.16). As for the coefficient between MRI findings and physical findings, Milking test and Criterion 1 (ϕcoefficient=0.27, P=0.048) and 4 (ϕcoefficient= 0.39, P=0.004) showed a weak correlation.

CONCLUSION

'Adaptation' refers to normal MCL thickening on MRI in a baseball player after epiphyseal closing. We hypothesized asymptomatic MCL injury in youth baseball players on MRI might represent the transition period to adaptation because ligament function was normal. However, some subjects showed weak correlations between positive physical findings and positive MCL injury on MRI. These might become a 'symptomatic' MCL injury in the near future. We conclude 'asymptomatic MCL injury in youth baseball players on MRI' includes the group of changing to adaptation, and the group of changing to symptomatic MCL injury (pre-injury) group (Fig).

CLINICAL RELEVANCE/APPLICATION

'asymptomatic MCL injury of the elbow in youth baseball players on MRI' is not always need to be treated but careful observation is needed.
trigger fingers is not clear. But based on result from test, we presumed that the thickening of A1 pulley was causative of pediatric trigger fingers in distal type. In proximal type, the disproportionate growth of space including flexor tendon, volar plate and A1 pulley was postulated as the cause.

CLINICAL RELEVANCE/APPLICATION
Ultrasound may be instrumental in the diagnosis and classification of the pediatric trigger fingers and is recommended when the cause of contracture of fingers in pediatrics is uncertain.

RC213-07  Imaging of Tarsal Coalition
Monday, Nov. 28 9:40AM - 10:00AM Room: N230B

Participants
Sarah D. Bixby, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Demonstration of the various types of tarsal coalition in children. 2) Discussion of the anatomy of the subtalar joint with respect to the location of various forms of subtalar coalition. 3) Description and demonstration of a variant of subtalar coalition, the posteromedial subtalar coalition, and discussion around its importance.

ABSTRACT

participants
Jonathan D. Samet, MD, Chicago, IL, (jsamet@luriechildrens.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify imaging features of osteochondritis dissecans (OCD), with a focus on MRI. 2) Recognize the spectrum of findings between stable and unstable lesions. 3) Identify the varying postoperative appearances after surgical intervention.

RC213-09  Fishtail Deformity of the Distal Humerus; Be Aware of the Associated Osteochondritis Dissicans of the Capitellum
Monday, Nov. 28 10:40AM - 10:50AM Room: N230B

Participants
Matthew R. Wanner, MD, Carmel, IN (Presenter) Nothing to Disclose
Boaz Karmazyn, MD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the association of osteochondritis dissicans of the capitellum in patients with fishtail deformity of the distal humerus (FTD).

METHOD AND MATERIALS
Using the radiology information system, we identified all patients (<18 years) with FTD (2002-2016). Imaging were reviewed for presence of OCD of the capitellum (OCD). Medical charts were reviewed for type of initial injury, time until presentation with FTD, and presenting symptoms.

RESULTS
We identified 7 cases of FTD (3 females). Age at diagnosis ranged from 9.7-14.4 years (mean 12.5 years). 5 patients had a known prior fracture, all supracondylar humerus fractures; type-3 (n=3) and type-1 (n=1). They presented on average 8 years (5.2-10.9 years) after the fracture. Symptoms at diagnosis included either limited range of motion (n=2), pain (n=3), or both pain and limited range of motion (n=2). Five (71%, 5/7) of the patients were found to have OCD. Only 2 (40%, 2/5) cases were diagnosed with radiographs, 3 were diagnosed with MRI and 1 with CT. Two patients had surgery to treat the OCD; drilling (n=1) and osteoplasty, microfracture, and removal of loose body (n=1).

CONCLUSION
OCD of the capitellum is often present in patients with FTD, but may be occult on radiographs.

CLINICAL RELEVANCE/APPLICATION
Our series is the first to show a high prevalence of OCD of the capitellum in patients with fishtail deformity, suggesting MRI should be considered even in the absence of OCD on radiographs.

RC213-10  MRI Findings in Non-traumatic Causes of Pediatric Knee Pain
Monday, Nov. 28 10:50AM - 11:00AM Room: N230B

Participants
Sonja Kinner, MD, Madison, WI (Presenter) Nothing to Disclose
Richard Kijowski, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine the frequency and spectrum of knee joint pathology on MRI in pediatric patients with knee pain who have no history of acute trauma.
A retrospective review of imaging archive and medical records systems was used to identify 150 consecutive patients between 6 and 18 years with knee pain who underwent a MRI study and had no history of acute trauma, arthritis, or neoplasm. All studies were retrospectively reviewed separately by a pediatric musculoskeletal radiologist and a musculoskeletal radiologist with any discrepancies settled through a consensus read. The frequency and spectrum of knee joint pathology was determined. T-tests were used to compare the age, body mass index (BMI) and referring physician with and without each type of knee joint pathology.

RESULTS
Knee joint pathology was present in only 69 of 150 patients (46%). Patients with no pathology were referred by an orthopedic specialist in 52% and primary care provider in 57%. The spectrum of pathology included effusion in 25, superior lateral Hoffa's fat pad edema in 18, bone marrow edema lesion in 10, cartilage lesion in 10, Osgood-Schlatter disease in 8, osteochondritis dissecans (OCD) lesion in 7, patellar tendinopathy in 7, Baker's cyst in 7, discoid meniscus in 5, meniscal tear in 5, and edematous bipartite patella in 2 patients. There was no significant difference for age and BMI with and without each type of knee joint pathology. Cartilage lesion, OCD lesion, and edematous bipartite patella were more likely to be referred from an orthopedic specialist. Otherwise, there is no difference in the positive knee pathology rates between those referred by orthopedic specialists and primary care providers (48% verses 43%, respectively). Seven patients (10%) underwent subsequent surgical intervention (3 with OCD lesions and 4 with meniscal tears).

CONCLUSION
Although almost half of the pediatric patients with knee pain and no history of acute trauma showed knee joint pathology on MRI, only 10% of them required subsequent surgical intervention. Our results raise questions regarding the need for immediate use of MRI for assessing knee pain in those patients.

CLINICAL RELEVANCE/APPLICATION
MRI in children with non-traumatic knee pain shows pathologies in less than half of the patients and only 10% of them require surgical intervention. MRI therefore might be overused for this indication.

RC213-11 Unexplained Fractures in Infants and Young Children: (Ir)relevance of Serum Vitamin D

Participants
Elaine Pang, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Sujatha Gopal, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Alan Spigg, MBChB, FRCP, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Amaka C. Offiah, MBBS, PhD, Sheffield, United Kingdom (Presenter) Speaker, Alexion Pharmaceuticals, Inc; Speaker, BioMarin Pharmaceutical Inc; Speaker, Infomed Research and Training Ltd; Travel support, Alexion Pharmaceuticals, Inc; Travel support, BioMarin Pharmaceutical Inc; Travel support, Infomed Research and Training Ltd; Director, OCIN Ltd

PURPOSE
To test the hypothesis that low serum total 25-hydroxyvitamin D (25OHD) predisposes children aged ≤2 years to fractures, even when there is no overt rickets.

METHOD AND MATERIALS
A retrospective single centre study. The hospital database was interrogated for children ≤2 years who had 25OHD measured between 01/01/10 and 12/31/14 AND at least 1 skeletal radiograph within 2 weeks of this. Blinded to 25OHD, 2 observers independently scored the anonymised full skeletal surveys (SS) and individual radiographs (XR) for fracture (yes/no), bone density (reduced/normal) and rickets (Thacher score 0/≥1). Discrepancies were arbitrated by a third observer in a final consensus read. Analyses (SPSS Version 22.0 for Mac, p ≤ 0.05) included descriptive statistics (prevalence of clinical and radiographic parameters), Cohen's kappa (interobserver reliability for radiographic parameters) and binomial logistic regression (likelihood of fracture based on 25OHD, bone density or Thacher score). Further analyses (calcium/phosphate/ethnicity/breast fed) are ongoing. Research and Development approval was granted; Ethics Committee approval was waived.

RESULTS
388 children, mean age 9 months (0-24), 167 SS and 239 XR were included. Mean 25OHD was 67nmol/L (<6-778nmol/L); 77 children (20%) were 25OHD deficient (<25nmol/L); 78 (20%) insufficient (25.1-50nmol/L); 69 (18%) had at least one fracture; 39 (10%) reduced bone density; 22 (6%) Thacher ≥1. Interobserver kappa was very high for fracture (0.915) and Thacher score (0.842) and good for bone density (0.706). Logistic regression (Table) showed that radiographic bone density was the only statistically significant variable predictive of presence of fracture, with an odds ratio of 4.61 (95% CI 2.05-10.38). The odds ratio for 25OHD level was 1.02 (0.99-1.06).

CONCLUSION
Observer reliability for diagnosing reduced bone density and rickets from radiographs ranges from good to very high. This study provides objective evidence to support mainstream thinking that in the absence of radiographic evidence of reduced bone density and/or rickets, a low 25OHD should not be interpreted as the cause of unexplained fractures in a child below 2 years of age.

CLINICAL RELEVANCE/APPLICATION
In children aged ≤2 years with unexplained fractures, whose radiographs reveal normal bone density and/or a Thacher score of zero, serum 25OHD level is irrelevant to the etiology of the fractures.

RC213-12 The Assessment of IDEAL-IQ Technique in Quantifying the Fatty Infiltration of Leg Muscles in Duchenne Muscular Dystrophy

Participants
Jing Du, MD, Beijing, China (Presenter) Nothing to Disclose
PURPOSE
To assess the thigh muscle fat fraction level (FF) using IDEAL-IQ technique in Duchenne Muscular Dystrophy, and to correlate the FF with multiple clinical data.

METHOD AND MATERIALS
One hundred and seventy three boys (ranged from 2 to 13 years old, medium 6 years) with genetically confirmed DMD were recruited. Imaging was performed on a 3.0-T MR scanner. A quantitative water-fat separation method (IDEAL-IQ) were used to image leg muscles. The Kappa index (k) was calculated to test the degree of agreement between the two radiologists of the measurement. Agreement was considered insignificant if k< 0.20, weak if between 0.21 and 0.40, moderate if between 0.41 and 0.60, strong if between 0.61 and 0.80 and very strong if ≥0.80. P ≤ 0.05 was considered significant.

RESULTS
The gluteus maximus was the most severely infiltrated muscle (the involvement frequency 100%, mean FF 28.6%±20.6%), followed by the adductor longus and gracilis, with the involvement frequency 10%-15%, mean FF less than 6.5%. FF value exhibited positive correlation with muscle force (r=0.76, P<0.05). The FF value showed a significant positive correlation with the Brooke score (r=0.80, P<0.05). Agreement between FF value and CK values (r=-0.33, P<0.05) was strong if between 0.61 and 0.80 and very strong if ≥0.80. There was no significant differences of muscle fatty infiltration level among the three gene mutation forms.

CONCLUSION
IDEAL-IQ technique could be used to assess thigh muscle fatty infiltration level in DMD patients. The muscle fatty infiltration level evaluated by MRI was correlated with the clinical data.

CLINICAL RELEVANCE/APPLICATION
The application of IDEAL-IQ technique in DMD patients.

PURPOSE
Use of Adding T2 Mapping Sequence to a Routine MR Imaging Protocol to Evaluate the Articular Cartilage Changes of the Knee and Ankle Joint with Hemophilia in Children

Participants
Ningning Zhang, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yanqi Lv, Beijing, China (Abstract Co-Author) Nothing to Disclose
Di Hu, Beijing, China (Abstract Co-Author) Nothing to Disclose
Huoying Kang, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yue Li, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
RuiHui Wu, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yun Peng, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Hua Cheng, MD, Beijing, China (Presenter) Nothing to Disclose

METHOD AND MATERIALS
The cartilage of T2 relaxation time of distal femur cartilage, proximal tibia, distal tibia talus surface, and the average T2 relaxation time of whole layer cartilage and the normal reference, please see fig.1. The degree of correlation in the measurement of the two radiologists was very strong (k=0.84, P<0.05). T2 relaxation time of both knee distal femur and proximal tibia articular cartilage were higher than those of healthy children (4). There were four morphologically normal joint cartilage in the routine MR protocol where their T2-mapping showed visible unevenness, out of these two cases were ankle (fig. 2) and the other two were knees.
Non-Invasive Assessment of Synovitis in Juvenile Idiopathic Arthritis: DWI is Powerful as Potential Biomarker

PURPOSE
To compare two imaging biomarkers, the already established dynamic-contrast-enhanced MRI (DCE) and the new non-invasive diffusion-weighted imaging (DWI), in quantitatively assessing synovial inflammation in patients with juvenile idiopathic arthritis (JIA).

METHOD AND MATERIALS
35 JIA patients underwent MRI of the knee on a 1.0T scanner. In addition to standard sequences an axial T1W DCE and axial T2W SE EPI DWI (b-values 0, 50, 600) were acquired. DWI was post-processed into apparent diffusion coefficient (ADC)50-600 maps to eliminate signal intensity from vascular flow. To quantify signal from the synovium on DCE and DWI, regions of interest (ROI) were manually drawn in synovium on the DCE images and secondly on the ADC map using an in-house developed Matlab program (Dynamo). Collected DCE perfusion parameters include maximum enhancement (ME), slope of enhancement (slope), time-to-peak (TTP) and % of time-intensity curves (TIC) 2-5. A subset of patients (n=5) was measured twice to check consistency of ROI drawing. Patients were subdivided based on the validated JIA MRI score (JAMRIS), a score of 0 for synovial hypertrophy corresponds to inactive disease (n=16), a score ≥1 to active disease (n=19). Mann-Whitney U was used for testing DCE and DWI parameters between patients with active and inactive disease, the intraclass correlation coefficient (ICC) was used to assess reliability of ROI drawing and Spearman’s rank for correlation between DCE and DWI parameters.

RESULTS
High correlations for all parameters (ICCs 0.89-0.99, p<0.05) were found when assessing the twofold ROI placements. Correlation between ME and ADC was good (r 0.62, p=0.000), other correlations were not significant. ME, slope, TTP, % TIC 2-5 (all p<0.05) as well as ADC were significantly different in the active vs. the inactive patients with median ADC-active 1.49x10-3 mm^2/sec, median ADC-inactive 1.26 x10-3 mm^2/sec, p=0.003.

CONCLUSION
Similar to DCE parameters, non-invasive DWI-derived ADC can differentiate active JIA from inactive JIA in the knee using a ROI drawing method that proved to be uniform. Diffusion in inflamed synovium is increased compared to non-inflamed synovium.

Pediatric Temporomandibular Joint Imaging

PURPOSE
To compare two imaging biomarkers, the already established dynamic-contrast-enhanced MRI (DCE) and the new non-invasive diffusion-weighted imaging (DWI), in quantitatively assessing synovial inflammation in patients with juvenile idiopathic arthritis (JIA).

METHOD AND MATERIALS
35 JIA patients underwent MRI of the knee on a 1.0T scanner. In addition to standard sequences an axial T1W DCE and axial T2W SE EPI DWI (b-values 0, 50, 600) were acquired. DWI was post-processed into apparent diffusion coefficient (ADC)50-600 maps to eliminate signal intensity from vascular flow. To quantify signal from the synovium on DCE and DWI, regions of interest (ROI) were manually drawn in synovium on the DCE images and secondly on the ADC map using an in-house developed Matlab program (Dynamo). Collected DCE perfusion parameters include maximum enhancement (ME), slope of enhancement (slope), time-to-peak (TTP) and % of time-intensity curves (TIC) 2-5. A subset of patients (n=5) was measured twice to check consistency of ROI drawing. Patients were subdivided based on the validated JIA MRI score (JAMRIS), a score of 0 for synovial hypertrophy corresponds to inactive disease (n=16), a score ≥1 to active disease (n=19). Mann-Whitney U was used for testing DCE and DWI parameters between patients with active and inactive disease, the intraclass correlation coefficient (ICC) was used to assess reliability of ROI drawing and Spearman’s rank for correlation between DCE and DWI parameters.

RESULTS
High correlations for all parameters (ICCs 0.89-0.99, p<0.05) were found when assessing the twofold ROI placements. Correlation between ME and ADC was good (r 0.62, p=0.000), other correlations were not significant. ME, slope, TTP, % TIC 2-5 (all p<0.05) as well as ADC were significantly different in the active vs. the inactive patients with median ADC-active 1.49x10-3 mm^2/sec, median ADC-inactive 1.26 x10-3 mm^2/sec, p=0.003.

CONCLUSION
Similar to DCE parameters, non-invasive DWI-derived ADC can differentiate active JIA from inactive JIA in the knee using a ROI drawing method that proved to be uniform. Diffusion in inflamed synovium is increased compared to non-inflamed synovium.
Hands-on Musculoskeletal Ultrasound: A Forum for Question and Answer (Hands-on)

Monday, Nov. 28 8:30AM - 10:00AM Room: E258

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

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Presenter) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Catherine J. Brandon, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Alberto S. Tagliafico, MD, Genova, Italy (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 2016. 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. If you plan to attend this session and you want your questions answered in November, please contact us soon at marnix@rad.hfh.edu

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 A. Dipietro, MD - 2016 Honored Educator
**Magnetic Resonance guided Focused Ultrasound (MRgFUS) for totally Non-Invasive Treatment of Non-vertebral Osteoid Osteoma: A Prospective Two-Center Study**

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

**METHOD AND MATERIALS**
Patients were eligible if they had clinical and imaging diagnosis of Osteoid Osteoma. Lesions located in vertebral body were excluded; recurrences after RFA or surgery were included. Patients received focal therapy using MRgFUS (InSightec), delivered toward the nidus. Primary endpoints were pain relief assessed using questionnaires on Visual Analog Pain Score (VAS) and daily intake of Non-steroidal drugs (NSAIDs); secondary endpoints were need for further intervention and bone changes analyzed at imaging (CT and dynamic CE-MRI; Gd-BOPTA, Bracco). Patient's follow-up, including clinical and imaging examinations, was established at 1 and 12 months

**RESULTS**
36 patients (female 8; male, 28; mean age 26) were recruited for MRgFUS treatment; all patients completed the procedure without adverse events immediately after treatment or at follow-up. A mean number of 6 ± 1.5 sonications with mean energy of 991 ± 452 J was necessary to complete the treatment. Three patients underwent treatment as rescue (2 post-RFA, 1 post surgery). Complete clinical response was found in 32/36 (88.8%) patients (pain score=0 and NSAIDs discontinuation). There was a statistically significant difference (p=0.001) between baseline (7 ± 2) and follow-up values (0 ± 2) for pain severity, according to VAS. Two patients (5.1%) reported pain recurrence requiring both RFA and other two experienced pain decrease >2 points in the scale but did not reach 0, being classified as partial responders without requiring further interventions. Imaging evaluation with CE-MRI demonstrated marked reduction of nidus perfusion in all complete responders

**CONCLUSION**
MRgFUS can be effectively adopted for the treatment of Osteoid Osteoma. This application is totally non-invasive with robust pain relief

**CLINICAL RELEVANCE/APPLICATION**
MRgFUS can be performed safely with high rate of success for the noninvasive treatment of Osteoid Osteoma

**Painful Bone Metastases Palliation through MR-Guided Focused Ultrasound: Clinical Response Evaluation**

**PURPOSE**
To evaluate MRgFUS treatment efficacy in patients with painful bone metastases non responding to pain-killer drugs and radiation therapy.

**METHOD AND MATERIALS**
Our study included 44 patients (14 female and 30 males; mean age 61.4 ± 9.5) suffering from metastatic bone disease. All patients
were considered non responders to conventional therapies (radiation, analgesic drugs) and were preliminary analyzed by contrast-enhanced MR imaging and pain scale assessment (Quality of Life Questionnaire-BM22 and VAS scale). We treated 52 non-vertebral skeletal metastases with MRgFUS (ExAblate 2100, InSightec). Follow-up evaluation comprehended MR scan and pain scale scoring at 3 and 6 months after treatment.

RESULTS
MRgFUS ablation was performed without adverse events. 26 out of 44 patients (60%) experienced a complete clinical response and suspended any other therapy. 13/44 patients (31%) reported an incomplete response (more than 2 points decrease in VAS pain scale). 5/44 patients (9%) have been classified as non-responders (less than 2 points decrease in VAS pain scale). Statistically significant differences between baseline, 3-month and 6-month follow-up have been demonstrated, in terms of VAS scale, analgesic drugs intake and pain interference on quality of life (QLQ- BM22).

CONCLUSION
MRgFUS treatment of bone metastases is effective and safe in pain palliation of selected patients.

CLINICAL RELEVANCE/APPLICATION
MRgFUS could be routinely introduced in treatment options for painful bone metastases non responding to conventional treatment.

SSC09-03  Radiological Percutaneous Osteosynthesis and Cementoplasty for Osteolytic Metastases

Participants
Erti Mavrovi, Lyon, France (Presenter) Nothing to Disclose
Anne-Charlotte Kalenderian, Lyon, France (Abstract Co-Author) Nothing to Disclose
Charles Mastier, Lyon, France (Abstract Co-Author) Nothing to Disclose
Hedi Beli, Vienne, France (Abstract Co-Author) Nothing to Disclose
Quelker Vaz, Lyon, France (Abstract Co-Author) Nothing to Disclose
Marie T. Cuinet, MD, Lyon, France (Abstract Co-Author) Nothing to Disclose
Philippe Thiesse, MD, Lyon, France (Abstract Co-Author) Nothing to Disclose
Frank Pilleul, MD, Lyon, France (Abstract Co-Author) Nothing to Disclose
Bertrand Richourd, Lyon, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
Radiological percutaneous osteosynthesis and cementoplasty (RPOC) is a recent technique for interventional radiologists. It is a minimally invasive procedure and could be an alternative of surgery in patients with metastatic disease. We report our experience in the field of oncology.

METHOD AND MATERIALS
We retrospectively reviewed all cases of RPOC performed in our hospital in patients suffering from osteolytic metastases with or to prevent pathological fracture. An impending pathological fracture was defined by a Mirels' score > 8.

After institutional review board the patients were not candidates for surgery due to poor performans status, refusal or on-going chemotherapy. RPOC was performed with cannulated screws under computed tomography and scopic guidance with a CT-Navigation device. We retrospectively analyzed occurrence of post-procedural fractures, reduction in pain, technical feasibility, duration in the operating room, early complications and duration of hospitalization.

RESULTS
Between September 2013 and November 2015 RPOC was performed in 30 patients (10 women, 20 men, mean age of 59 y ± 11). The technical success was 96.7% with screwing a failed iliopubic branch too fragile. The average duration of the procedure was 92 minutes ± 19. All patients got up and walked on the day after the surgery. The average duration of hospital stay was 4 days ± 3 (range, 2-10). Twenty patients had RPOC for impending malignant pathological fracture, 14 of the proximal femur and 6 of the acetabulum roof. The average Mirels' score was 9.8 ± 1.1 (range, 8-12). For the proximal femur, no fracture occurred, with a median follow-up of 242 days (range, 11-600). For the acetabulum roof, 2 pathological fractures occurred (fracture rate=33.3%, mean follow-up of 245 days). Ten patients had RPOC for 10 painful pathological fracture. For symptomatic patients (n = 17), visual analog scale (VAS) decreased from 6.8 ± 1.2 (range, 5-9) before treatment, to 2.3 ± 1.1 (range, 1-4) one month later.

CONCLUSION
Radiological Percutaneous Osteosynthesis and Cementoplasty for osteolytic metastasis is a safe and feasible technique. For fragile patients that are not candidates for surgical stabilization, RPOC can be a good alternative in pain relief of pathologic fractures or consolidation of lytic metastasis with a high fracture risk.

CLINICAL RELEVANCE/APPLICATION
Alternative at surgical stabilization for fragile metastatic patients.

SSC09-04  Safety and Results of Image-Guided Vertebroplasty with Elastomeric Polymer Material (Elastoplasty)

Participants
Giovanni Mauri, MD, Milan, Italy (Presenter) Consultant, Esaote SpA
Gianluca M. Varano, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Paolo Della Vigna, MD, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Guido Bonomo, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Franco Orsi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Giovanni Carlo Anselmetti, MD, Torino, Italy (Abstract Co-Author) Research Consultant, Medtronic plc

PURPOSE
To use an elastomeric polymer material rather than traditional polymethymethacrylate ("PMMA") or acrylic bone cement in vertebroplasty could theoretically lower the number of secondary fractures. Primary endpoint of the present study was to assess safety of image-guided vertebroplasty using a novel silicone based elastomeric polymer material (elastoplasty). Secondary endpoint was the effectiveness in pain relief.

**METHOD AND MATERIALS**

19 patients (13 females, mean age 72±10 y) underwent elastoplasty between 2010 and 2016. 14 patients had osteoporotic fractures, 2 patients traumatic fractures, 1 patient a painful myeloma localization, and 1 patient a painful vertebral angioma. 15 patients were using a brace and all were consuming drugs for pain relief. A total of 33 vertebrae were treated (range L1-T6).

Patients were treated under local anesthesia and fluoroscopic guidance, using transpedicular approach and 2-6 ml of silicone based elastomeric polymer material (VK100) was injected by an interventional radiologist with more than 20 years’ experience in vertebroplasty. Chest x-ray was performed after the procedure in order to detect pulmonary embolism. Immediate and late complications, if any, were recorded, and VAS and Oswestry before and after the procedure evaluated.

**RESULTS**

It was always possible to complete the procedure. In 6/19 (31.5%) asymptomatic leakage of the material was observed. Minimal asymptomatic pulmonary embolism was seen in 4/19 (21%) patients, with no alteration of the saturation parameters. After two days no evidence of pulmonary embolism existed. In 18/19 (94%) patients had a recovery from pain symptoms. One patient with painful angioma did not experience any change in symptoms. One patient no longer required a brace after the procedure (p<0.001) and 16/19 (84%) completely stopped using any drugs for pain relief after treatment (p<0.001). At a mean follow-up of 2.1±2.4 years, no new treatment for symptomatic vertebral fractures were needed.

**CONCLUSION**

Image-guided elastoplasty is a safe and effective procedure when performed by experienced operator.

**CLINICAL RELEVANCE/APPLICATION**

elastoplasty is a novel procedure that can be safely performed by experienced operators, and holds the potential of lowering the number of secondary fractures.

**SSC09-06**  
**Nomogram for Predicting Intradiscal Cement Leakage Following Percutaneous Vertebroplasty in Patients with Osteoporosis Vertebral Compression Fractures**

Monday, Nov. 28 11:20AM - 11:30AM Room: E450A

Participants  
Binyan Zhong, MD, PhD, Nanjing, China (Presenter) Nothing to Disclose
Gao-Jun Teng, MD, Nanjing, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

We aim to establish an effective and novel nomogram for intradiscal cement leakage (ICL) following percutaneous vertebroplasty (PVP) in patients with osteoporosis vertebral compression fractures (OVCFs).

**METHOD AND MATERIALS**

Patients with OVCFs who underwent their first PVP in our department between January 2007 and December 2013 were included in this study. Univariate and multivariate analysis were used to predict the independent risk factors. The Nomogram was then created based on the identified independent risk factors.

**RESULTS**

A total of 241 patients and 330 vertebrae were included. The mean age of the patients was 73.5 (SD 7.9) years old, and the mean number of treated vertebrae was 1.4 per person. ICL was observed in 93 (28.2%) of the treated vertebrae. Greater fracture severity (P=0.016), cortical disruption of the endplate (P<0.0001), absence of Kummell's disease (P=0.010), and higher CT values (P=0.050) are the independent risk factors for ICL.

**CONCLUSION**

Greater fracture severity, cortical disruption of the endplate, absence of Kummell's disease, and higher CT values are the independent risk factors for ICL. The novel nomogram gives accurate prediction of ICL.

**CLINICAL RELEVANCE/APPLICATION**

This predictive nomogram can guide physicians do something to prevent ICL.

**SSC09-07 CT-guided Percutaneous Pedicle Screw Fixation Followed by Cementoplasty in the Treatment of Metastatic Spinal Disease**

**PURPOSE**

evaluate the feasibility and effectiveness of CT-guided percutaneous screw fixation plus cementoplasty (PSFPC) in patients with painful vertebral metastases with fractures or to prevent pathological fracture.

**METHOD AND MATERIALS**

Twenty patients (7 men and 13 women, median age 52 years) with 24 vertebral metastases (7 NSCLC, 7 multiple myeloma, 6 breast carcinoma) underwent CT–guided PSFPC. The procedure was performed in a single vertebra in 16 patients and in two vertebrae in 4 patients. The vertebral approach was unilateral with a single screw in thirteen patients and bilateral with two screws in the remaining 7. We analyzed the feasibility and complications of the procedure, the decrease in pain using a visual analogue scale (VAS) and the functional outcome assessed according to the evolution of their walking ability.

**RESULTS**

There were no complications related to infections or incorrect positioning of the screws or leakage of cement. VAS score decreased from 7.4 (range, 4- 9) to 1.2 (range, 0-3). All patients were able to walk within 6 hours after the procedure and have improved their walking capacity at six months. No new bone fracture occurred during a median follow up of 10 months.

**CONCLUSION**

our results suggest that PSFPC is a safe and effective procedure which allows us to stabilize the fracture and prevent pathological fractures with a significant pain relief and good recovery of walking ability. PSFPC seems to be a promising alternative for patients who are not candidates for surgery. Further studies are required to confirm this preliminary experience.

**CLINICAL RELEVANCE/APPLICATION**

These results may introduce a new method of palliative treatment in patients with painful vertebral metastatic lesion with fracture or at high risk of fracture.

**SSC09-08 Percutaneous Image-Guided Spinal Biopsy: Factors Affecting the Higher Diagnostic Yield**

**PURPOSE**

The objectives of this study were to determine the accuracy of percutaneous image-guided spinal biopsy of osseous spinal lesions in patients with known or suspected underlying malignancy in reference to the imaging appearance of the biopsied lesion and to analyze factors affecting the higher biopsy yield.

**METHOD AND MATERIALS**

We retrospectively reviewed 247 consecutive percutaneous spinal biopsies. Size (< 2 cm and ≥ 2 cm), location (C-, T-, L-spine, and sacrum), and CT density (osteoblastic, osteolytic, mixed, and isodense) of the lesion, guiding modality (CT and fluoroscopy),
years of biopsy attending experience (< 2 years and ≥ 2 years), number of approach (one and ≥ 2), pathologic report of the biopsy, and final diagnosis of the lesion were recorded. A biopsy was considered as diagnostic if it provided a confident pathologic result or non-diagnostic if the pathology could not suggest a specific diagnosis. All variables were compared using Pearson’s chi square test or Fisher’s exact test.

RESULTS
In all, 197 of 247 (79.8%) biopsies were diagnostic. On multivariate analysis, size, CT density, and final diagnosis of the lesion were statistically significant factors affecting biopsy yield. Biopsy in larger lesions (≥ 2 cm) showed significantly higher diagnostic yield than smaller lesion (p = 0.006). The osteolytic lesions had highest diagnostic rate (87.6%), followed by mixed (84.4%), osteoblastic (66.7%) and isodense lesions (61.1%). There was statistically significant difference in the diagnostic biopsy rates of osteolytic versus osteoblastic lesions (p=0.004) and of osteolytic versus isodense lesions (p=0.031). Metastasis had highest diagnostic rate (97.2%), followed by primary malignancy (84.2%) and benign lesion (39.4%) with statistical significance.

CONCLUSION
In the percutaneous image-guided biopsy for the spinal lesion, size, CT density, and final diagnosis of the lesion can affect the higher biopsy yield. Osteolytic lesions have higher diagnostic biopsy rate than osteoblastic or isodense lesions. Metastatic lesions have highest diagnostic biopsy rate followed by primary malignant and benign lesions.

CLINICAL RELEVANCE/APPLICATION
Percutaneous biopsies for osteolytic or mixed spinal lesions have a higher diagnostic yield than for osteoblastic or isodense lesions.

SSC09-09 Short and Long Term Effects of In Vivo Periarticular Osseous Ablation on Porcine Articular Cartilage: Comparison between Cryoablation and Radiofrequency Ablation

Monday, Nov. 28 11:50AM - 12:00PM Room: E450A

Awards
Student Travel Stipend Award
Participants
Ji Y. Buethe, MD, Cleveland, OH (Presenter) Research Grant, Galil Medical Ltd
Craig Lance, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
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Mark R. Robbin, MD, Cleveland Hts, OH (Abstract Co-Author) Nothing to Disclose

PURPOSE
We aim to compare the short- and long-term effects of cryoablation (Cryo) versus radiofrequency ablation (RFA) on nontarget articular cartilage tissue during CT-guided periarticular bone ablation in an in vivo porcine model.

METHOD AND MATERIALS
Following Institutional Animal Care and Use Committee approval, 3 juvenile female miniature pigs underwent a 2-arm study using the animals as their own control. Pigs #1 and #2 underwent CT-guided periarticular bone ablations (pig #1-Cryo; pig #2-RFA) at 4 different sites each, and all limbs (including 1 control site) were removed from both pigs immediately following the procedures. Pig #3 underwent periarticular bone Cryo or RFA at 3 different sites each, and all limbs (including 1 control site) were removed 7 weeks following the procedure. For all ablations, an 11-gauge coaxial introducer was percutaneously advanced into the target epiphyseal site followed by placement of single RFA or Cryo probe 1cm from the articular surface under general anesthesia. RFA was performed for a total of 6 minutes at a target temperature of 90 degrees Celsius using 17G cooled-tip electrodes. Cryo was performed using 17G probes for two 10-5-minute freeze-thaw cycles. All bone and articular cartilage specimens were examined histologically with H&E staining.

RESULTS
In vivo Cryo and RFA both resulted in acute osteonecrosis at the ablation sites without associated histologic articular cartilage disruption immediately following the procedure. Cryo and RFA resulted in focal osteonecrosis and inflammatory reaction with bone remodeling at the ablation sites without associated histological cartilage disruption 7 weeks following the percutaneous ablation therapy.

CONCLUSION
In vivo Cryo and RFA of periarticular bone in a porcine model did not result in short- or long-term histological articular cartilage disruption. These findings suggest that both Cryo and RFA may not cause significant damage to the adjacent articular cartilage tissue during percutaneous periarticular osseous ablation therapies.

CLINICAL RELEVANCE/APPLICATION
Nontarget articular cartilage disruption is a potential risk associated with periarticular thermal bone ablation, and there is paucity of data on the long-term effects.
TEACHING POINTS

1. Review the anatomy of ligaments of the ankle and midfoot in cadavers, with imaging correlation. 2. Illustrate the ligaments as seen on US and MRI, and discuss positioning tips for US.

TABLE OF CONTENTS/OUTLINE

- On MRI and in cadaveric specimens, all ligaments were well depicted. On US, all ligaments except for the Lisfranc ligament, were seen. At the anterolateral ankle, two bands of the anterior talofibular ligament were seen. The broad anterior tibiofibular ligament was depicted. Inferior to this ligament, Bassett’s ligament is seen. The lateral talocalcaneal ligament was seen in 1 specimen.
- Posterolaterally, the posterior tibiofibular ligament, inferior transverse ligament, intermalleolar ligament and posterior talofibular ligament were seen. Laterally the calcaneofibular ligament could be seen in an oblique axial plane.
- Medially, the components of the deltoid ligament were seen: tibiotalar, tibiocalcaneal, tibiospring, and tibionavicular. The spring ligament and gliding zone were also observed.
- At the Chopart joint, the dorsal talonavicular, bifurcate (2 components), lateral calcaneocuboidal, and long plantar ligaments were seen.
- At the Lisfranc joint a dorsal, proper, and plantar ligament could be seen on MRI. The tarsometatarsal ligaments and intermetatarsal ligament were well seen on US and MRI.
**MK300-SD-MOA1**

**Prevalence of Vertebral Compression Fractures at Abdominal CT According to Trabecular Attenuation**

Station #1

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

**Sub-Events**

**PURPOSE**
Abdominal CT scans contain robust bone data that are often underutilized, but opportunistic osteoporosis screening is now gaining traction. The purpose of this study was to correlate L1 trabecular HU measurements with prevalent vertebral body fractures in older adults undergoing abdominal CT for other indications.

**METHOD AND MATERIALS**
ROI mean HU measurement of the anterior trabecular space of the L1 vertebral body was retrospectively performed on the axial CT images in 214 consecutive adults over the age of 65 years (Mean age 74.3 ± 6.2 years; 93 men, 121 women), regardless of study indication. Sagittal CT scout view and sagittal reconstructions were analyzed for prevalent moderate (grade 2) or severe (grade 3) thoracolumbar vertebral compression fractures, according to the Genant semi-quantitative assessment method. All potential fractures were verified by a second experienced radiologist. Diagnostic performance of L1 HU alone for predicting prevalent vertebral fractures was performed, including ROC analysis.

**RESULTS**
A total of 37 (17%) individuals (mean age, 76.5 years; 19 men, 18 women) had at least one moderate-severe vertebral fracture, and 13 patients had multiple fractures. Mean L1 attenuation was 74.0 HU among patients with a prevalent fracture, compared with 123.5 HU among patients without a fracture (p<0.001). Fracture prevalence increased to 49% (32/66) at or below L1 attenuation of 90 HU. Sensitivity and specificity for fracture was 70% and 87% at a threshold of 80 HU, 86% and 81% at a 90 HU threshold, and 92% and 69% at a 100 HU threshold, respectively. The corresponding area under the ROC curve (ROC AUC) was 0.893.

**CONCLUSION**
L1 vertebral trabecular attenuation is highly predictive of prevalent vertebral fractures. When L1 attenuation measures 90-100 HU or less on the axial images at routine abdominal CT, the sagittal reconstruction should be scrutinized for vertebral compression fractures.

**CLINICAL RELEVANCE/APPLICATION**
Early incidental/opportunistic detection of osteoporosis via abdominal CT is easy to incorporate into routine practice and provides added value to our practice.

**Honored Educators**
Perry J. Pickhardt, MD - 2014 Honored Educator

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**MK301-SD-MOA2**

**Feasibility of Volumetric ADC Mapping to Tumor Habitats Derived from Dynamic Contrast Enhanced MRI in Soft Tissue Sarcomas**

Station #2

**Participants**
Jared S. Mahan, MD, Miami, FL (Presenter) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Yu-Cherng C. Chang, Miami, FL (Abstract Co-Author) Nothing to Disclose
Raphael Yechieli, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Radka S. Stoyanova, MS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To determine feasibility of semi-automated volumetric delineation of soft tissue sarcoma habitats from Dynamic Contrast Enhanced (DCE) MRI data, and compare volumetric ADC measurements among those habitats.
METHOD AND MATERIALS

Eight patients with soft tissue sarcomas underwent MRI with DWI (b-values 50 and 600 s/mm²) and DCE with 10 sec temporal resolution. Tumors were manually segmented in 3D using T1 post-contrast. Tumor habitats were delineated using previously developed technique that automatically identifies three unique temporal patterns from DCE-MRI datasets corresponding to well-perfused, hypoxic, and necrotic tumor environments. ADC maps were co-registered with T1 MRI and ADC mean values were derived for each habitat. ADC were compared across tumor environments.

RESULTS

The DCE-MRI dataset allowed identification of three habitats 7 patients, and 2 habitats in one patient with a small residual subcutaneous tumor. Mean tumor volume was 151 cc. Mean ADC of hypoxic, well-perfused, and necrotic tumor compartments were 1.25, 1.33, and 1.33 x 10⁻³ mm²/sec, respectively; although there was a slight increase in ADC values in the necrotic habitat, this small 0.08 x 10⁻³ mm²/sec within-subject difference between well-perfused and necrotic compartments was not statistically significant (p = 0.27, paired t-test). The volumetric % necrosis correlated with % histologic necrosis in 5 patients where available (r = 0.91). Ktrans values in hypoxic, well-perfused, and necrotic tumor compartments were 0.16, 0.097, and 0.049 min⁻¹, respectively; there was little correlation with tumor habitat mean ADC (Pearson r range -0.0.19 to 0.047).

CONCLUSION

Volumetric mean ADC values showed little correlation with automatically delineated tumor habitats in soft tissue sarcoma regardless of treatment response; the non-overlapping nature of these results suggests they may serve complementary roles in assessing tumor viability in different sarcoma microenvironments.

CLINICAL RELEVANCE/APPLICATION

Combining volumetric ADC data and DCE sequences with automated identification of tumor habitats is feasible in soft tissue sarcoma and could improve quantitative multiparametric tumor response assessment.

MK302-SD-MOA3

Accelerated Onset of Knee Osteoarthritis - Role of MRI-Defined Risk Factors One Year Prior Osteoarthritis Incidence

Participants

Frank W. Roemer, MD, Boston, MA (Presenter) Chief Medical Officer, Boston Imaging Core Lab LLC; Research Director, Boston Imaging Core Lab LLC; Shareholder, Boston Imaging Core Lab LLC; ;
Kent C. Kwoh, MD, Pittsburgh, PA (Abstract Co-Author) Advisory Panel, Pfizer Inc Data Safety Monitoring Board, Novartis AG
Erin Ashbeck, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Charles Ratlaff, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael Hannon, Oakland, PA (Abstract Co-Author) 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

PURPOSE

To identify structural features on MRI that distinguish knees with accelerated incident radiographic osteoarthritis ROA) from those with slow development of OA.

METHOD AND MATERIALS

Participants were drawn from the Osteoarthritis Initiative (OAI) study. Incident cases of ROA were identified, defined as Kellgren and Lawrence (KL) grade ≥2, through 48 months of follow-up. Structural features in the two years prior to incident ROA were assessed using the semi-quantitative MOAKS instrument. Two radiographic definitions of the development of accelerated incident OA over two annual OAI visits were considered as outcomes in the analyses, i.e. accelerated KL grade (i.e., from KL 0 or 1 to ≥3) and accelerated OARSI medial joint space narrowing (i.e., OARSI JSN; 0 to ≥2 or 1 to 3). The association between structural damage one year prior to incident ROA and accelerated incident ROA compared to those with slow development of incident ROA (i.e., from KL 0 or 1 to 2 or OARSI JSN from 0 to 1 or 1 to 2) was estimated using logistic regression with generalized estimating equations with knees showing slow incident ROA as the referent group.

RESULTS

Altogether 328 knees were included for the KL grade definition and 329 knees for the JSN definition. 20.4% and 9.1% showed accelerated incident ROA according to the different definitions. One year prior to incident ROA, only presence of effusion-synovitis was associated with increased odds of accelerated early OA based on KL Grade OR=1.97, 95%CI(1.10, 3.11), p=0.0223. None of the other analyzed structural risk factors was more commonly associated with accelerated incident ROA compared to those knees that with slow development of incident ROA.

CONCLUSION

Presence of effusion-synovitis one year prior incident ROA is associated with accelerated incident ROA based on the K-L grade definition supporting a role of joint inflammation in accelerated disease onset. The fact that presence of none of the other structural parameters could distinguish knees with accelerated from those with slow incidence of ROA suggests that factors may play a role in radiographically defined accelerated disease onset.

CLINICAL RELEVANCE/APPLICATION

A subgroup of patients with early knee OA shows accelerated disease onset with inflammation being a strong risk factor for this phenotype. Further work is needed to understand whether targeting inflammation early in the disease course may prevent knees from an accelerated disease course.

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 activities.
For a 65 years old male patient, early MRI of occult hip fracture followed by early-uncomplicated surgical repair had higher QALYs.

RESULTS

Variables, and probabilities of surgical complications were evaluated with sensitivity analysis from published sources. The cost and health outcomes were discounted at 3% to account for future cost increase. A number of incremental cost-effectiveness ratio (ICER). Gross and micro-cost data for procedure, medical and surgical costs, were obtained.

Carlo decision model was developed to calculate the lifetime costs and effectiveness, quality-adjusted life-years (QALYs) and symptomatic patients with occult hip fractures who had negative hip radiographs. The 2 adverse outcomes considered are: early death and late death.

A healthcare analytic model was created to compare the lifetime cost and lifetime health outcome of early hip MRI versus no MRI in the treatment of occult hip fractures without and with surgical intervention. We found a high correlation between DW neurography and surgery (r=0.79) and a low correlation between conventional MRI and surgery (r=0.41). The interobserver correlation was higher for MRI with DW neurography (r=0.94) than for conventional MRI (r=0.73). The sensitivities, accuracies and positive predictive values obtained were above 90% for MRI, with no statistically significant difference (p>0.05). The specificities were generally higher for DW neurography (p<0.05). MRI demonstrated high sensitivity in the diagnosis of avulsion / rupture (94.1%) and low sensitivity in the diagnosis of lesion-in-continuity (42.8%). MRI accuracy (93.9%) was significantly higher than clinical examination (76.5%) in diagnosis of brachial plexus traumatic lesions (p<0.05).

CONCLUSION

MRI presents high accuracy and low specificities in the diagnosis of traumatic brachial plexus injuries. DW neurography provides a higher correlation with surgical results and higher interobserver correlations compared to conventional MRI. Also, MRI is useful in the diagnosis of avulsion and rupture, however it needs improvement for the diagnosis of lesion-in-continuity. MRI accuracy is significantly higher than clinical examination in diagnosis of the traumatic brachial plexus injuries.

CLINICAL RELEVANCE/APPLICATION

MRI with the use of DW neurography is an accurate tool and may provide topographic diagnosis for the surgeon. However, MRI still needs improvement in the diagnosis of partial nerve lesions (lesions-in-continuity).

Early MRI of Occult Hip Fracture in Symptomatic Patients with Normal Hip Radiographs: A Cost-Effectiveness Study from a Health-Services Perspective

PURPOSE

Hip fractures are common cause of morbidity and mortality in elderly patients, and is expected to double or triple due to an aging population. Approximately 5% of patients will have normal hip radiographs despite having an occult fracture. MRI can detect up to 90% of those occult fractures; however, it needs to be performed shortly after the trauma for optimal survival benefit. Our study compares lifetime health outcomes, healthcare costs, and incremental cost-effectiveness of occult hip fractures without and with early MRI.

METHOD AND MATERIALS

A healthcare analytic model was created to compare the lifetime cost and lifetime health outcome of early hip MRI versus no MRI in symptomatic patients with occult hip fractures who had negative hip radiographs. The 2 adverse outcomes considered are: early morbidity and mortality in delayed or no surgical intervention and complications of surgery despite early detection. A Markov Monte Carlo decision model was developed to calculate the lifetime costs and effectiveness, quality-adjusted life-years (QALYs) and incremental cost-effectiveness ratio (ICER). Gross and micro-cost data for procedure, medical and surgical costs, were obtained from published sources. The cost and health outcomes were discounted at 3% to account for future cost increase. A number of variables, and probabilities of surgical complications were evaluated with sensitivity analysis.

RESULTS

For a 65 years old male patient, early MRI of occult hip fracture followed by early-uncomplicated surgical repair had higher QALYs.
and lower immediate costs (14.41 QALYs, $57.992) compared to patients who did not receive early MRI and subsequently had a complicated clinical course (12.88 QALYs, $71.600). The ICER was -$8,195 per QALY. As the probability of surgical complications increased, both groups would have similar costs and outcomes. Also, the sensitivity of MRI for the detection of occult fracture influenced the results, while MRI cost had less influence.

**CONCLUSION**

Early hip MRI in patients with occult hip fractures can be a cost-effective method to identify patients who are most likely to benefit from early surgery.

**CLINICAL RELEVANCE/APPLICATION**

Hip fractures are an increasing public health burden in an aging population. Failure to identify occult hip fractures can lead to significant morbidity and mortality for elderly patients. Timely performance of MRI can carry survival benefits as well as health services savings.

**MK305-SD-MOA6**

**Sciatic Nerve Anatomical Variants and Piriformis Syndrome: Is It Painful to Be Different**

**Participants**

Adam C. Luce, MD, MS, Stanford, CA (Presenter) Nothing to Disclose
Praveen Anchala, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Christopher F. Beaulieu, MD, PhD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Amelie M. Lutz, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the purported relationship between sciatic nerve variant anatomy and piriformis syndrome and radiculopathy, previously related in the literature through surgical case series and cadaver studies, using anatomical data from hip MRI correlated with clinical data from chart review.

**METHOD AND MATERIALS**

Over 18 months at an academic medical center, 343 hip MRIs were completed for all indications. MRI studies were excluded if they were repeat studies or if the protocol was insufficient to determine anatomical variants. Images were reviewed by MSK radiologists to evaluate for sciatic nerve variants, and patients were categorized into Beaton and Anson anatomical types. Retrospective chart review determined the prevalence of ICD9 diagnoses related to radiculopathy and pain syndromes, as well as explicit diagnosis of piriformis syndrome or buttock pain, which do not have dedicated ICD9 codes. Student’s t test was completed for each diagnosis, comparing the prevalence of the diagnosis in the variant anatomy and normal groups.

**RESULTS**

263 MR studies were included in the analysis. Sciatic nerve variants were present in 50 hips (19.0%). Piriformis syndrome had a similar prevalence in variant and normal hips (8.0% vs 7.5%, respectively) and there was no significant difference in prevalence (p=0.55). Similarly, there was no significant difference in the prevalence of buttock pain (38.0% vs 31.5%, p=0.81). Additionally, using a 5% significance level, there was no significant difference between the groups for the investigated ICD9 diagnoses (lesion of the sciatic nerve; sciatia; disorder of sacrum; thoracic or lumbosacral neuritis or radiculitis; neuralgia, neuritis, and radiculitis unspecified).

**CONCLUSION**

No significant differences in prevalence of piriformis syndrome, buttock pain, and the various investigated pain syndromes existed between the patients with anatomical variants of the sciatic nerve and those with normal anatomy. This first radiologic study into the relationship between sciatic nerve variant anatomy and pain syndromes calls into question this purported relationship.

**CLINICAL RELEVANCE/APPLICATION**

This first radiologic study into the relationship between sciatic nerve variant anatomy and pain syndromes calls into question this purported relationship.

**MK306-SD-MOA7**

**Image-guided Percutaneous Biopsy of Rib Lesions: A Retrospective Review of Efficacy and Safety in 166 Patients**

**Participants**

Casey Medina, BA, Houston, TX (Presenter) Nothing to Disclose
Samuel Kusin, Houston, TX (Abstract Co-Author) Nothing to Disclose
Michael J. Wallace, MD, Houston, TX (Abstract Co-Author) Speaker, Siemens AG Research support, Siemens AG
Sharjeel Sabir, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To assess the efficacy and safety of percutaneous image-guided biopsy of rib lesions.

**METHOD AND MATERIALS**

A retrospective review of all percutaneous image-guided rib biopsies performed between 8/2009 and 9/2014 was undertaken. Biopsy was performed with coaxial technique. 13-20 gauge core needles and 22 gauge FNA needles were used. Imaging guidance was with CT, US, or MRI. Procedures were performed with moderate sedation or general anesthesia, dependent on patient’s clinical status. Patient demographic, lesion imaging, and procedural technique variables were collected. Complications associated with the procedures were noted. The pathology reports were reviewed and the results were categorized as malignant, benign, or non-diagnostic. For any patient with a benign diagnosis, follow up imaging or clinic notes were reviewed to confirm benignity of the lesion. In addition, the pathology reports of all patients that had surgical resection were reviewed.

**RESULTS**
166 patients underwent 172 procedures. 74 (45%) were women with an average age of 59 years (range 13-84). Nearly all of the lesions were metastases most commonly from lung 24%, breast 20%, and prostate 14%. Of the biopsied lesions, 43% were FDG and 43% were MDP avid on nuclear imaging performed within 6 months prior to biopsy. The lesions biopsied were lytic rib 62%, sclerotic rib 21%, or soft tissue extending from rib 17%. The average long axis size of lesions targeted was 2.7 cm +/-1.8. The procedures were performed under CT 93%, US 5.8%, and MRI 1.2% guidance. 99% of procedures were technically successful. 139 (81%) procedures had core biopsy of which 94% were diagnostic and 150 (87%) procedures had FNA of which 89% were diagnostic. 2 (1%) complications occurred: 1 pneumothorax needing chest tube, 1 hematoma requiring pressure. 6 patients had repeat procedures: 2 for treatment assessment, 2 showed new malignancy, 1 true negative, and 1 false negative. 5 patients had post-biopsy surgical resection of the rib lesion: 3 cases were concordant and 2 cases were discordant with biopsy. The sensitivity of rib biopsy was 95%, specificity was 100%, positive predictive value was 100%, negative predictive value was 93%.

CONCLUSION

Image-guided percutaneous rib biopsy is both effective and safe in the diagnosis of rib lesions.

CLINICAL RELEVANCE/APPLICATION

We show rib biopsies to be highly sensitive and specific as well as safe in a larger cohort of patients than previously reported.

MK111-ED-MOAB Necrotizing Fasciitis: A Review of Pathophysiology, Early and Late Radiographic and Cross-sectional Imaging Features, and Clinical Management

Station #8

Participants
Andrew M. Petraszko, MD, Detroit, MI (Presenter) Nothing to Disclose
Matthew C. Rheinboldt, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this review is to: review the pathophysiology underlying types I and II necrotizing fasciitis, potential comorbidities, the three stages of clinical presentation and strategies for management describe the radiographic, sonographic, CT and MR imaging findings of necrotizing fasciitis with an emphasis on detecting potential early findings on cross-sectional imaging prior to the formation of frank soft tissue emphysema discuss potential clinical and imaging differential diagnostic considerations

TABLE OF CONTENTS/OUTLINE

Introduction: Pathophysiology, Clinical staging and potential comorbidities Type I necrotizing fasciitis Fournier's gangrene Type II necrotizing fasciitis radiographic features cross-sectional features early signs: deep fascial exudative thickening, hyperemia and non-enhancement, compartmental involvement soft tissue emphysema differential diagnosis considerations cellulitis, paraneoplastic and eosinophilic fasciitis, dermatomyositis, lupus myofasciitis, compartment syndrome and myonecrosis, clinical management summary

MK208-ED-MOAI0 Dynamic Ultrasound in the Shoulder Impingement: Easy and Useful

Station #10

Participants
Montserrat C. del Amo, Barcelona, Spain (Presenter) Nothing to Disclose
Jaume Pomes, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Xavier Tomás-Batlle, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Ana Isabel García, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Isaac Pomes, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jose Bonilla, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To show the importance to adding a dynamic study in the routine ultrasound exam of the shoulder. To describe and expose the dynamic maneuvers for evaluating impingement with images and videos of ultrasound findings

TABLE OF CONTENTS/OUTLINE

Impingement syndrome is produced by dynamic changes or compression. The supraspinatus tendon and subacromial bursa are "impinged" between: humeral head, acromion and coracoacromial ligament (CAL). MRI and basal US cannot easily prove conflict in the subacromial space. After routine US using high frequency linear-array transducers, dynamic assessment of the shoulder will be performed. In the dynamic study, the arm should be positioned at 60-degree forward flexion, 60-degree abduction and with internal rotation of the shoulder. The ultrasound probe is positioned in the coronal plane along the long axis of the supraspinatus tendon, between the acromion and the greater tuberosity. The motion of the bursa, supraspinatus tendon, humeral head and CAL is seen well and furthermore allows us better diagnosis of lesions in the supraspinatus tendon. Also, with the arm lifted 45 degrees, we can show changes in the subacromial space. Dynamic US shows these structures in motion, check their involvement in the impingement and the consequences in the tendon and bursa.

MK230-ED-MOAI1 Capsuloligamentous Plane of the Knee: Illustrative Review of Anatomy and Component Injuries with Biomechanical Approach of the Knee Trauma

Station #11

Participants
Yun Hee Cho, MD, Seongnam, Korea, Republic Of (Presenter) Nothing to Disclose
Yusuhn Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) 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
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

The complex anatomy of the knee is due largely to the controversies about anatomical description of capsules and ligaments of the knee. The injured capsuloligamentous components reflect the mechanism of injury. Understanding of the capsuloligamentous plane of the knee will enhance the detection and extent evaluation of the knee injury. The goal of this exhibit is to present in detail the complex anatomy and imaging findings of the capsuloligamentous plane and associated traumatic abnormality.

TABLE OF CONTENTS/OUTLINE

1. Introduction.
   a. Illustrative review of anatomy with schematic drawings and MR imaging.
   b. Review of the controversies about anatomical description of capsules and ligaments of the knee.
   a. Review of imaging findings about the capsuloligamentous injuries of the knee.
   b. Associated lesions including bone and cartilage injury.
4. References.
Lunch & Learn: Transitioning to DR, Clinical and Financial Benefits Beyond Preventing Reimbursement Penalties: Supported by Fujifilm (invite-only)

Monday, Nov. 28 12:30PM - 1:30PM Room: S403B

Participants

PARTICIPANTS

Jerry Thomas, MS, FAAPM, DABR, CHP, DABSNM Wichita, KS
William Tobin BS, Tyler, TX

PROGRAM INFORMATION

This course does not offer CME credit.
Articular cartilage is a complex tissue with unique properties that are essential for normal joint function. Many processes result in chondrosis or cartilage injury, ranging from acute trauma to degenerative injury, and these injuries result in significant morbidity. Conventional MRI can reveal the severity of chondrosis which is graded using the modified Outerbridge system. Newer 3D techniques are improving resolution, and quantitative sequences allow collagen and proteoglycan assessment. Multiple surgical options are available to attempt to reduce symptoms, promote cartilage healing and delay the onset of osteoarthritis. These include marrow stimulation (microfracture), autologous chondrocyte implantation (ACI), osteochondral grafting (OATS and allografts) and cell-based repair. This exhibit will review cartilage microarchitecture, imaging techniques, chondrosis grading, and cartilage repair surgeries, with arthroscopic correlation of MRI features.
Musculoskeletal Monday Poster Discussions

Monday, Nov. 28 12:45PM - 1:15PM Room: MK Community, Learning Center

MK

AMA PRA Category 1 Credit™: .50

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

Sub-Events

MK308-SD-MOB2

Mucoid Degeneration of the Anterior Cruciate Ligament Preceding Progression of Medial Joint Space Narrowing: A FNIH Biomarkers Consortium Study

Station #2

Participants
Robert M. Kwee, Heerlen, Netherlands (Presenter) Nothing to Disclose
Nima Hafezi Nejad, MD, MPH, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Bashir Zikria, Baltimore, MD (Abstract Co-Author) 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
Shadpour Demehri, MD, Baltimore, MD (Abstract Co-Author) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;

PURPOSE
To investigate whether ACL mucoid degeneration at 3T magnetic resonance (MR) imaging is associated with 2-year progression of radiographic medial tibiofemoral compartment (MTFC) joint space narrowing (JSN).

METHOD AND MATERIALS
The study was IRB-approved and HIPAA-compliant. One index knee of six hundred subjects (41% males; median age 61 years, range 45-79) from the Osteoarthritis Biomarkers Consortium FNIH Project were included. The ACL was evaluated at 3T MR imaging at baseline. Minimum joint space width (minJSW) in the MTFC was assessed at knee radiographs at baseline and after 2 years. JSN progression was defined as decrease in minJSW >0.7 mm. Multivariable logistic regression analysis identified the association of ACL mucoid degeneration with JSN progression. Covariate adjustments were performed for age, gender, BMI, baseline WOMAC pain score, and MTFC minJSW (adjusted OR). Stratified data identified whether baseline Kellgren-Lawrence (KL) and Osteoarthritis Research Society International (OARSI) grade are interacting with ACL mucoid degeneration in association with JSN progression.

RESULTS
Subjects with ACL mucoid degeneration more often showed JSN progression compared to subjects with a normal ACL (64% vs. 47%, P<0.01). In multivariable logistic regression, ACL mucoid degeneration was associated with JSN progression (adjusted OR=1.68, 95% confidence interval= 1.02-1.77, P=0.04). Subjects with baseline KL grade 1 and 2 and OARSI grade 0 were more likely to demonstrate JSN progression compared to subjects with baseline KL grade 3 (P=0.03) and higher OARSI grades (P<0.01), respectively.

CONCLUSION
ACL mucoid degeneration is associated with 2-year progression of MTFC JSN. It is more likely to be a risk factor for JSN progression among subjects with milder features of radiographic OA at baseline.

CLINICAL RELEVANCE/APPLICATION
Given the association between ACL mucoid degeneration and progression of MTFC JSN, strategies should be developed in order to prevent and slow down MTFC OA in subjects with ACL mucoid degeneration at MR imaging.

Honor...
Participants

MOB5

MK311-SD-
decisions.

Imaging interpreter must be aware of possible association between AALTF and tarsal coalition to aid appropriate clinical and surgical persistent symptoms if only the coalition is treated.

special attention should be made to evaluate for other associated pathologies. Failure to recognize an AALTF may result in

AALTF is common and significantly associated with tarsal coalitions, specifically EATCC and MFTCC. When a coalition is identified, 

CONCLUSION

tarsi edema on MRI (45 of 59, P< 0.05).

association was found with CNC, PFTCC or other rare coalitions. AALTF was also found to be significantly associated with sinus edema on MRI (45 of 59, P< 0.05).

METHOD AND MATERIALS

Fifteen knee MR studies consisted of sagittal conventional Cube and CS Cube sequences were reviewed retrospectively. Imaging parameters of 3D FSE Cube were TR/TE=1300/30 ms; echo train length (ETL)=48; matrix=320x320; field-of-view (FOV)=160x160mm; slice thickness=0.5mm. Sagittal MRI scans using CS with an acceleration factor of 1.5 were repeated with identical MR parameters. Overall image quality was assessed by calculating correlation coefficient, root-mean-square error (RMSE), and structural similarity index (SSIM). Regional image quality was evaluated with signal-to-noise ratio (SNR) of cartilage to background noise and contrast-to-noise ratio (CNR) of synovial fluid-cartilage, cartilage-bone, and meniscus-infrapatellar fat. Diagnostic agreements between the two sequences were assessed by evaluating images for lesions of anterior horn, body, and posterior horn of medial/lateral menisci with a three-point scale (0, normal; 1, degeneration; 2, tear). The Wilcoxon signed-rank test and intra-class correlation coefficient (ICC) were used for statistical analysis.

RESULTS

Fifteen patients (M:F=5:10, mean age 56.8) were enrolled. Scan time was reduced (7min 48sec vs. 5min 12sec) with CS acceleration factor 1.5. Mean correlation coefficient between CS Cube and conventional Cube were 0.88 (P<0.05) while averages of RMSE and SSIM were calculated as 132.15 and 0.99, respectively. SNR was significantly higher in conventional Cube MRI compared to CS Cube MRI (124.6 vs 73.5; P=0.001). CNRs were higher in conventional Cube MRI compared to CS Cube MRI (219.5 vs 131.9, 70.1 vs 41.6, 44.5 vs 37.2; P=0.001, P=0.003, P=0.005, respectively). Diagnostic agreements for evaluating meniscal lesions were excellent with inter-method agreement (ICC=0.994) and inter-observer agreement (ICC=0.981).

CONCLUSION

Compressed sensing Cube knee MRI sequence demonstrates acceptable image quality while reducing scan time. The CS Cube could replace conventional Cube in knee MR imaging with optimized acceleration factor.

CLINICAL RELEVANCE/APPLICATION

Knee MRI acquisition can be accelerated with the use of compressed sensing technique while maintaining image quality and diagnostic acceptability.

MK303-SD- MGB4  Accessory Anterolateral Talar Facet Associated with Tarsal Coalition: Prevalence and Cross-sectional Characterization

Participants

Eman Alqahtani, MD, MPH, La Jolla, CA (Presenter) Nothing to Disclose
Evelyne Fliszar, MD, Mount Royal, QC (Abstract Co-Author) Nothing to Disclose
Donald L. Resnick, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

The accessory anterolateral talar facet (AALTF) is a developmental entity recently described as a potential cause for rigid painful flat foot. We hypothesize that there is an association between AALTF and other flat foot etiologies such as tarsal coalitions.

METHOD AND MATERIALS

We investigated the presence of AALTF on all CT and MRI of patients with possible tarsal coalition or sinus tarsi syndrome (01/01/2010-12/31/2016). Exclusion criteria included acute ankle trauma, recent ankle surgery, motion or metal artifacts. We evaluated the AALTF length and height, and the lateral talocalcaneal structures and sinus tarsi for edema and osseous changes. The presence of tarsal coalitions such as calcaneonavicular (CNC), intra- articular middle facet talocalcaneal (MFTCC), posterior facet talocalcaneal (PFTCC), extra-articular middle facet talocalcaneal (EATCC) and other rare coalitions were also evaluated.

RESULTS

187 patients were included in this study (age range 14-91 years; mean ± SD age; 50 ± 17 years), 47.1% males and 52.9% females. Overall AALTF prevalence was 31.55% (59/187), 41.91% in men, and 23.23% in women. AALTF average length was 4.5±1.1mm, and average height was 8.9±4.3mm. AALTF was found to be significantly associated with lateral talocalcaneal osseous changes such as cortical thickening and cystic changes (34/59 and 24/59 respectively, P<0.01). At least one type of collation was identified in 37.43% of study population (70/187). The most common type was CNC (52.86%) followed by EATCC (35.71%). Intra-articular MFTCC (12.86%) was found to be more common than PFTCC (5.71%). Other rare coalitions were present in less than 3%. There was a significant association between AALTF and the presence of EATCC (19/59, P < 0.01) and MFTCC (7/59, P < 0.05). No association was found with CNC, PFTCC or other rare coalitions. AALTF was also found to be significantly associated with sinus tarsi edema on MRI (45 of 59, P < 0.05).

CONCLUSION

AALTF is common and significantly associated with tarsal coalitions, specifically EATCC and MFTCC. When a coalition is identified, special attention should be made to evaluate for other associated pathologies. Failure to recognize an AALTF may result in persistent symptoms if only the coalition is treated.

CLINICAL RELEVANCE/APPLICATION

Imaging interpreter must be aware of possible association between AALTF and tarsal coalition to aid appropriate clinical and surgical decisions.

MK311-SD- MGB5 Sagittal Balance Evaluation of Total Ankle Arthroplasty Implants: SEMAC MRI versus Radiography

Participants

Fifteen patients (M:F=5:10, mean age 56.8) were enrolled. Scan time was reduced (7min 48sec vs. 5min 12sec) with CS acceleration factor 1.5. Mean correlation coefficient between CS Cube and conventional Cube were 0.88 (P<0.05) while averages of RMSE and SSIM were calculated as 132.15 and 0.99, respectively. SNR was significantly higher in conventional Cube MRI compared to CS Cube MRI (124.6 vs 73.5; P=0.001). CNRs were higher in conventional Cube MRI compared to CS Cube MRI (219.5 vs 131.9, 70.1 vs 41.6, 44.5 vs 37.2; P=0.001, P=0.003, P=0.005, respectively). Diagnostic agreements for evaluating meniscal lesions were excellent with inter-method agreement (ICC=0.994) and inter-observer agreement (ICC=0.981).
Subchondroplasty: Pre-operative MR Imaging Findings and Outcomes

Participants
Ashima Lall, MD, Newtown Square, PA (Abstract Co-Author) Nothing to Disclose
Peter R. Wahba, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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
Peter Sharkey, MD, Philadelphia, PA (Abstract Co-Author) Royalties, Corentec Co, Ltd; Royalties, StelKast; Royalties, Zimmer Biomet Holdings, Inc; Speaker, ConvaTec Inc; Speaker, Corentec Co, Ltd; Speaker, Zimmer Biomet Holdings, Inc; Consultant, Corentec Co, Ltd; Consultant, Zimmer Biomet Holdings, Inc; Stockholder, CrossCurrent, Inc; Stockholder, Force PT; Stockholder, Universal Research Solutions, LLC; Stockholder, Physician Recommended Nutriceuticals
Steven C. Cohen, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Smith & Nephew plc; Consultant, Zimmer Biomet Holdings, Inc

PURPOSE
Subchondroplasty (SCP) is an emerging minimally invasive orthopedic procedure for patients with osteoarthritis of the knee in which a calcium phosphate bone substitute is injected into the subchondral bone; it is intended as an alternative pain-reducing treatment between conservative therapy and joint replacement. We sought to investigate pre-operative MR imaging features resulting in improved outcomes.

METHOD AND MATERIALS
Pre-operative MRI exams of 35 knees in 34 patients (age range 42-81, average 60; 19 males, 15 females) who subsequently underwent SCP were reviewed. Clinical charts and surgical notes were reviewed for location of SCP as well as knee pain (scale 0-10) before and after the procedure. MR exams were reviewed for extent of cartilage damage in compartment undergoing SCP; extent of subchondral edema as a percentage of articular surface in the compartment; presence of subchondral fracture; and intensity of bone marrow edema, as a percentage signal relative to joint fluid. Comparison was made between pain scores and pre-
operative imaging findings.

RESULTS
Of 35 knees, 33 (94%) had improvement in pain. Numerical scores for pain were available for 20 knees, with an overall change from an average pain score of 6.8 to 2.7. Most common sites for SCP were the medial femoral condyle (N=9) and medial tibial plateau (N=11). Multiple sites were injected in 5 knees. Subchondral fracture was present in 9 of the 20 knees with numerical pain scores, without difference in outcome compared to non-fractures (6.7 to 3.0 vs 6.8 to 2.4). There was also no difference in pain improvement related to extent of chondrosis, nor extent / intensity of bone marrow edema. Data collection is ongoing.

CONCLUSION
A decrease in pain related to knee osteoarthritis is seen in patients undergoing subchondroplasty. As yet, there is no evidence of an MR imaging predictor for improved outcomes.

CLINICAL RELEVANCE/APPLICATION
Pre-procedure MR imaging is essential for planning of the subchondroplasty procedure. Calcium phosphate injection is targeted in areas of bone marrow edema. However, no apparent MR imaging sub-features have been identified to stratify patients into those who might have improved outcomes.

PURPOSE
To evaluate tin-filtered 150-kVp high tube voltage low tube current computed tomography of the lumbar spine in comparison to standard unenhanced dual-energy CT with regards to objective and subjective image quality and radiation dose exposure.

METHOD AND MATERIALS
100 patients were included in this IRB-approved retrospective study with a waiver for written consent. Patients underwent low dose (LD; 150 kVp with tin filter, 60 mAs) or standard dose (SD; dual-energy 140/80-kVp, 260/620 mAs) unenhanced lumbar spine CT on a 3rd-generation 192-slice dual-source CT. Attenuation and noise in various anatomic landmarks (bone, fat, muscle) was measured and Signal-to-noise ratio (SNR) was calculated. Subjective image quality was rated by three independent reviewers (5-9 years of experience in CT diagnostic) using 5-point grading scales with regards to image sharpness of trabecular and cortical bone structure, visualization of intervertebral joints, delineation of neuroforamina and intervertebral discs in both axial and sagittal reconstructions. Radiation dose was assessed as CTDIvol. Interobserver agreement was calculated using intraclass correlation coefficient (ICC).

RESULTS
Radiation exposure was reduced by 85% in LD compared to SD settings (CTDIvol, 2.12 ± 0.56 vs. 14.25 ± 5.64 mGy). SNR was significantly lower in LD (1.1 ± 0.2 vs. 3.4 ± 0.6; p<0.05). Subjective ratings of bone structures were good to excellent with no case of non-diagnostic for both protocols. Sharpness of trabecular and cortical bone structures were rated significantly better for SD compared to LD (LD: 4.20/3.31; SD: 4.74/ 4.42; both p<0.05) with substantial interrater agreement (ICC > 0.72). Delineation of intervertebral joints (LD: 4.83; SD: 4.91) and neuroforamina (LD: 4.98; SD: 5.0) were rated excellent for both protocols without significant differences (both p>0.05). Visualization of vertebral discs were rated sufficient in both image series with no significant difference (LD: 3.61; SD: 3.79; p = 0.17). Global interrater reliability was almost perfect (ICC: 0.839).

CONCLUSION
Low dose tin-filter high-kVp CT of the lumbar spine provides good to excellent visualization of bone structures, while radiation exposure is reduced by 85 % compared to SD with radiation doses close to conventional two-plain x-ray examinations.

TEACHING POINTS
The purpose of this exhibit is to:1. Review the anatomical landmarks of the inominate bone and their correlate on plain film and CT.2. To provide a simplified, systematic approach to classifying traumatic acetabular fractures. 3. Describe additional features not included in the Letournel classification scheme that the surgeons want to know.
**TEACHING POINTS**

After reviewing this exhibit, the learner will be able to:
1. Draw the lines and measure the angles of hip and proximal femur.
2. Understand the meaning of the lines and angles of hip and proximal femur.
3. Correlate the abnormal angles and lines with the diseases of hip and proximal femur.

**TABLE OF CONTENTS/OUTLINE**

1. Lines and angles of the hip and proximal femur are frequently used to diagnose developmental dysplasia of the hip, pincer and cam types of femoroacetabular impingement, acetabular and proximal femur fractures, failed total hip arthroplasty, acetabular protrusion, and coxa profunda.
2. Iliopubic line, ilioischial line, Hilgenreiner line, Perkin line, Shenton line, anterior, posterior, and medial acetabular wall lines, acetabular angle, acetabular abduction angle, Tonnis angle, lateral and anterior center-edge angles, acetabular version angle, alpha and beta angles of Graf, alpha, beta, and gamma angles, two different delta angles, neck-shaft angle (angle of inclination), femoral calcar line, and femoral anteversion angle will be discussed.
3. Plain radiography, CT, or MRI can be used to draw the lines and measure the angles. Ultrasonography can be used in neonates with developmental dysplasia of the hip.

**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

**TEACHING POINTS**

Review the main MR imaging findings in neuromuscular diseases. Highlight specific patterns of distribution in muscular involvement that help making the diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Radiologists are not much familiar with neuromuscular diseases, probably because most of them are diagnosed clinically and also because of the prior relative lack of usage of diagnostic imaging in this field. However, during the two past decades, MR imaging has gained critical importance in diagnosing these entities, specially in regard to inherited and inflammatory neuromuscular diseases. Its value lies on adding relevant information about the pattern of muscular involvement and assessing its degree. Besides, although muscle biopsy is still the gold standard for establishing a definitive diagnosis, MR imaging helps in narrowing the range of differential diagnosis and supporting a clinical hypothesis, once we get to know the key features of neuromuscular imaging. Therefore, the main goal of this pictorial review is to provide a general overview of the most common neuromuscular diseases and myopathies that might help the radiologist reaching a diagnosis.
Bienvenida / Welcome

La Imagen Medica Personalizada y Precisa / Precise and Personalized Medical Imaging

Esclerosis Múltiple : Seguimiento Cuantitativo / Multiple Sclerosis: Quantitative Follow Up

LEARNING OBJECTIVES

ABSTRACT

Esclerosis Múltiple: Seguimiento Cuantitativo / Multiple Sclerosis: Quantitative Follow Up

Participants
Leonardo Vedolin, MD, PhD, Sao Paulo, Brazil, (leonardovedolin@hotmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To describe basic background about quantitative MRI techniques applied to multiple sclerosis. 2) To discuss how quantitative MRI techniques contribute to monitoring of MS progression.

ABSTRACT

Multiple sclerosis (MS) is a chronic demyelinating and neurodegenerative disease that affects the central nervous system (CNS). Brain and spine MRI are most important paraclinical tool for the diagnosis of MS as conventional MRI techniques, such as T2/FLAIR weighted and gadolinium-enhanced T1-weighted sequences are highly sensitive for detecting focal active white matter lesions. However, these techniques are not specific enough to detect diffuse injuries in both grey and white matter. Pathological and imaging data indicated that lesion pattern and timely detection of tissue damage could help identify patients with an increased risk...
of developing severe disability and cognitive impairment. In this context, advanced quantitative MR tools have been used to access brain and spinal cord lesions in MS. Proton magnetic resonance spectroscopy (MRS) has been used in patients with CIS to identify tissue damage apart from the visible T2 lesions. Diffusion tensor imaging and magnetization transfer imaging have also revealed differences in normal-appearing brain tissue between patients with CIS and controls. Additionally, double inversion recovery (DIR) sequence, quantitative susceptibility mapping and phase sensitive inversion recovery (PSIR) are promising technique to monitor cortical damage and disease progression in patients with MS. The purpose of this lecture are (1) to describe basic background regarding quantitative MRI techniques applied to multiple sclerosis and (2) to discuss how quantitative MRI techniques contribute to monitoring of MS progression.

URL

SPSP21D  Preguntas/Q & A

Participants

SPSP21E  Resonancia Magnética en las Cardiopatías/Non-invasive Evaluation of Cardiac Disease by MRI

Participants

Aloha Meave, MD, Mexico City, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the most common imaging features related to different liver storage diseases. 2) Understand that fat, iron and fibrosis commonly coexist in different diffuse liver diseases. 3) Apply the best MR imaging techniques to assess and to quantify liver steatosis and iron overload, and to stage liver fibrosis/cirrhosis. 4) Discuss the clinical relevance of MR imaging biomarkers in different clinical scenarios of liver diseases, emphasizing the role of MR biomarkers on follow up of patients and treatment monitoring, taking hemochromatosis as a clinical example.

ABSTRACT

Different amounts of fat, iron deposits and fibrosis can be found in different diffuse liver diseases. Because liver biopsy has several limitations, MR imaging biomarkers have been developed for fat and iron quantification, and to stage liver fibrosis. Quantification of proton density fat fraction (PDFF) can be accurately performed with multi-echo chemical shift encoded (MECSE) gradient echo MR sequences, which must be corrected for T1 relaxation, T2* decay effect, noise and fat spectral complexity. Quantification of liver iron content is needed to detect and stage iron overload, and also to monitor iron-reducing treatments. Iron MR quantification may be performed with R2/R2* relaxometry techniques. Also, MECSE-MR sequences allow to simultaneously quantifying PDFF and R2* of liver parenchyma. MR elastography can detect and stage significant or advanced fibrosis and cirrhosis, with high accuracy. All of these MR measurements are increasingly being used as non-invasive biomarkers of hepatic steatosis, siderosis and fibrosis.

URL

SPSP21G  Preguntas/Q & A

Participants

SPSP21H  Presentación del CIR/CIR Update

Participants

Miguel A. Pinochet, MD, Santiago, Chile (Presenter) Nothing to Disclose
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (Presenter) Nothing to Disclose

SPSP21I  Cáncer de Próstata: Marcadores en Diagnóstico y Seguimiento/Prostate Cancer: Biomarkers in Diagnosis and Follow Up

Participants

Ivan Pedrosa, MD, Dallas, TX (Presenter) Nothing to Disclose

SPSP21J  Osteoartrosis: Evaluación Cuantitativa del Cartílago Articular/Osteoarthritis: Cartilage Quantitative Evaluation

Participants

Nicolas Zilleruelo, MD, Santiago, Chile, (nzilleruelo@alemana.cl) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 2) Identify the different quantitative techniques in the study of articular cartilage. 3) Practical applications of these quantitative techniques and discuss their clinical relevance.
SPSP21K  Preguntas/Q & A

Participants

SPSP21L  Evaluación de la Respuesta Precoz a la Terapia Neoadyuvante en el Cáncer de Mama con Biomarcadores de Imagen/Early Response Evaluation to Neoadjuvant Chemotherapy in Breast Cancer with Imaging Biomarkers

Participants
Julia Camps Herrero, DIPLPHYS, Alzira, Spain, (juliacamps@gmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To know the diagnostic accuracy of Diffusion MRI in the evaluation of early response to Neoadjuvant Chemotherapy (NAC). 2) To learn the proof of principle and proof of mechanism of Diffusion Tensor MRI (DTI) as an Imaging Biomarker. 3) To learn about the results of early response evaluation to NAC with DTI.

ABSTRACT

Dynamic contrast-enhanced (DCE) Breast MRI is the standard imaging modality in the response evaluation to neoadjuvant chemotherapy (NAC). Diagnostic accuracy of DCE-MRI in response evaluation to NAC is limited to around 70% in published meta-analysis with very few studies dealing with early response evaluation and DCE-MRI. Diffusion MRI has been show to be a solid imaging biomarker in the evaluation of response to neoadjuvant chemotherapy (NAC) and a recent meta-analysis (Wu, Breast Cancer Res Treat, 2012) showed that it adds sensitivity to the high specificity provided by DCE-MRI. Pickles et al showed in 2006 that diffusion changes precede size reduction in neoadjuvant treatment of breast cancer (Magnetic Resonance Imaging, 2006). Diffusion Tensor imaging (DTI) is a three-dimensional technique, one must apply diffusion gradients along at least 6 non-coplanar, non-coplanar directions in order to provide enough information. The mammary ducts are anisotropic structures which need non-scalar or multiple ADC measurements in order to characterize the orientation-dependent water mobility in this tissues. These multiple ADC measurements are provided by DTI. We show our preliminary results in more than 30 patients treated with NAC in which we performed an early evaluation after the first two cycles of treatment with DTI, proving that the prediction of response to NAC is earlier and more accurate than the response evaluation with DCE-MRI.

URL

SPSP21M  Respuesta Oncológica: Imagen Híbrida/Oncologic Response: Hybrid Imaging

Participants
Andres Kohan, MD, Capital Federal, Argentina, (andres.a.kohan@gmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) List current hybrid imaging methods for assessing tumor response. 2) Identify which method is best to be used in specific clinical scenarios. 3) Assess oncologic response through hybrid imaging.

ABSTRACT

URL

SPSP21N  Preguntas/Q & A

Participants

SPSP21O  Clausura/Closing

Participants
Jose L. Criales, MD, Mexico City, Mexico (Presenter) Royalties, Reed Elsevier
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose
Pablo R. Ros, MD, PhD, Cleveland, OH (Presenter) Nothing to Disclose

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Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator
MR Neurography and Diffusion Tensor Imaging as a Potential Biomarker of Chemotherapy Induced Peripheral Neuropathy

PURPOSE
Peripheral neuropathy is seen in up to 75% of individuals undergoing chemotherapy and can drastically limit treatment and affect quality of life. Clinical and electrodiagnostic testing for PN has many pitfalls. MR neurography (MRN) and diffusion tensor imaging (DTI) show promise in the workup of peripheral nerves. These techniques, not previously studied in chemotherapy induced peripheral neuropathy (CIPN), have promise as a biomarker of onset and severity of CIPN and an aid to evaluating preventive strategies. We investigated a possible relationship between DTI and CIPN.

METHOD AND MATERIALS
Cancer patients with and without CIPN were evaluated using vibratory perception threshold (VPT) testing. VPT score of >25 Volts defined presence of CIPN. The posterior tibial nerve and branches in both feet were imaged using MRN and DTI. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) values were measured at the posterior tibial, medial plantar and lateral plantar nerves. Measurements for the CIPN group were compared to without CIPN by VPT cut-off. Correlations and possible relationships between DTI parameters and CIPN were analyzed.

RESULTS
Nine patients were enrolled; a total of 15 feet were imaged (8 feet with CIPN, 7 feet without CIPN). Average age was 60.6±13.4 years (range=33-74). Posterior tibial nerve ADC values were significantly lower than the medial plantar nerve ADC values in all feet (F=3.50, p=0.04). We found a correlation with FA and ADC values at specific nerve locations with CIPN, with the left medial plantar nerve FA value and left lateral plantar nerve ADC value demonstrating the strongest positive correlations (0.73 and 0.62, respectively).

CONCLUSION
This pilot study provides preliminary data showing correlations between FA and ADC measurements with CIPN. A larger, more definitive study of MRN with DTI as an objective biomarker and possible early predictor for CIPN is warranted.

CLINICAL RELEVANCE/APPLICATION
MRN with DTI shows promising results as a potential objective biomarker of chemotherapy induced peripheral neuropathy.

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Lana H. Gimber, MD - 2016 Honored Educator
Mihra S. Taljanovic, MD - 2016 Honored Educator
To illustrate the role of MRI in identifying sites of severe nerve narrowing, termed ‘hourglass constrictions’ (HGCs), in affected peripheral nerves or individual nerve fascicles in patients with a clinical diagnosis of Parsonage-Turner Syndrome (PTS).

METHOD AND MATERIALS

IRB approval was granted. Six patients over a 3-mo. period diagnosed with PTS by history and physical, and with absent recovery (axonal regeneration) by electrodiagnostic testing, were included. Patients underwent 3.0 T MRI (GE Discovery MR750) of the brachial plexus, arm, elbow and/or forearm, targeting involved nerves. Surgical exploration was then performed at pathologic sites identified on MRI.

RESULTS

The mean age of the six patients (4 male) was 43 ± 16.0 yrs. All had unilateral symptoms affecting the dominant arm in 3/6 cases. Time between MRI and surgery was 1.3 ± 0.6 mos. Nerves involved included the suprascapular, radial, and posterior intersosseous, as well as the anterior intersosseous and pronator teres fascicles of the median nerve trunk. A total of 11 affected nerves and 23 constriction sites were identified. On MRI, the number of involved nerves per patient ranged from 1-3, and number of involved fascicles per affected nerve ranged from 1-2. Within each affected nerve and/or fascicle, there were 2.3 ± 1.2 sites of constriction. In almost all involved nerves or fascicles, the narrowing site was heralded immediately proximally by a 'bull's-eye' sign of the nerve, manifested as peripheral signal hyperintensity and central hypointensity on PD-weighted and/or T2-weighted fat suppressed images, orthogonal to the longitudinal nerve axis (Fig. 1). In all cases, intra-operative findings confirmed the precise location of narrowing identified on MRI.

CONCLUSION

High-resolution peripheral nerve MRI is a reliable pre-operative tool to accurately localize HGCs in patients with a clinical diagnosis of PTS, with absent nerve recovery. HGCs are heralded by a "bull's eye" appearance of the nerve on cross-sectional MRI just proximal to the affected site, findings not previously reported. The causes of HGCs and the "bull's-eye sign" are yet unknown. It remains unclear if these changes are unique to PTS, or exist in other peripheral neuropathies.

CLINICAL RELEVANCE/APPLICATION

MRI can accurately identify sites of severe nerve narrowing (hourglass constriction) in affected peripheral nerves or individual nerve fascicles in patients with a clinical diagnosis of PTS.

SSE14-04 High Resolution Metal Artifact Reduction MR Neurography of the Lumbosacral Plexus in Patients with Metallic Implants

Monday, Nov. 28 3:30PM - 3:40PM Room: E450B

METHOD AND MATERIALS

Following IRB approval, 19 consecutive patients (37% women; mean age, 52 years; range, 31-78 years) with a clinical diagnosis of LS plexus neuropathy following pelvic instrumentation or hip arthroplasty were prospectively enrolled between 2015-16. The MARS MRN protocol included axial intermediate-weighted and STIR turbo spin echo sequences that extended from L5 to the ischial tuberosity. Clinical data including electrodiagnostics were recorded. MRN studies were independently reviewed by two musculoskeletal radiologists. The visibility of the LS trunk, as well as sciatic, femoral, lateral femoral cutaneous (LFCN), and obturator nerves were rated using equidistant 5-point Likert scales and the presence of nerve abnormalities including discontinuity, bulbous enlargement, perineural fibrosis, architectural distortion, deviation of course, signal hyperintensity and skeletal muscle denervation were evaluated. Descriptive and diagnostic performance statistics and intraclass correlation coefficient (ICC) observer agreement were applied.

RESULTS

Clinical indications included LS plexopathy (n=3), sciatic (n=10), femoral (n=3), and LFCN (n=3) neuropathy. The visibility scores of the LS trunk, sciatic, femoral, LFCN and obturator nerves were 4.3±1.4, 4.7±0.7, 4.9±0.4, 4.7±1.7, and 4.7±1.1, respectively with good to excellent interobserver agreement (ICC=0.65-0.94). The diagnostic accuracy of MRN MARS based on 13 patients with confirmed diagnosis on a per nerve basis showed a sensitivity, specificity, positive likelihood ratio (LR), and negative LR of 92% (95%CI=64-99%), 92% (95%CI=82-98%), 12 (95%CI=4.6-31) and 0.08 (95%CI=0.01-0.6), respectively.

CONCLUSION

MARS MRN of the LS plexus yields high image quality and diagnostic accuracy for the assessment of LS neuropathies in patients.
Metal artifact reduction sequences permit high quality MRN in patients with metallic implants of the pelvis and hips, and in addition to electrodiagnostic studies can serve as a useful tool for the diagnosis of peripheral neuropathies and operative planning.

**METHOD AND MATERIALS**

52 patients (mean age 50 – range 28 to 75) suffering from refractory craniofacial pain syndromes were included between April 2014 and August 2016. Infiltration was performed at the intermediate site of the GON, at its first bend between obliquus capitis inferior and semispinals capitis muscles with local anesthetics and cortivazol. Patients suffered from migraine (M) in 21 cases, trigeminal neuralgia (TN) in 14 cases and cluster headaches (CH) in 13 cases. Clinical efficacy at day one, 1 and 3 months, was defined by a decrease of at least 50% of VAS scores.

**RESULTS**

Mean pain value before procedure was 8.6/10 (VAS). After procedure, clinical success was achieved in 79% of patients (41/52 patients) with a mean VAS score of 2.5/10, *p*<0.001. At 3 months follow up, 65% of patients presented a persisting benefit of infiltration with a mean VAS score of 3.6/10 (*p*<0.001). Efficacy in the subgroups were as follows: M group: 77% of patients at 1 and 3 months; CH: 71% and 58% and TN: 57% & 47%. No complication occurred during or after procedure.

**CONCLUSION**

Infiltration at the intermediate site of GON under CT guidance appears as an effective minimally invasive treatment for craniofacial pain syndromes especially in cases of cluster headaches and migraines. It presents a simplified approach to the previously described infiltration at the emergence of GON technique, and should be considered as an alternative management option.
Ultrasound-guided injection of the brachial plexus is a safe and minimally-invasive intervention that may temporarily relieve symptoms of nTOS in some patients and may help identify those who could benefit from surgery.

CLINICAL RELEVANCE/APPLICATION

Ultrasound-guided brachial plexus injection is a technique that can relieve symptoms of nTOS and identify those patients who might benefit from surgery, thus expanding applications of interventional ultrasound and potentially modifying the neurosurgical algorithm for nTOS treatment.
**Primary Cross Sectional Imaging for Occult Hip Fractures: CT or MRI?**

**Participants**
Corrie M. Yablon, MD, Ann Arbor, MI (Moderator) Nothing to Disclose
Cree M. Gaskin, MD, Keswick, VA (Moderator) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; Research Grant, Carestream Health, Inc;

**PURPOSE**
The National Institute of Health and Care Excellence, UK guidance recommends MRI as the investigation of choice for suspected hip fractures not demonstrated on plain radiographs. This study was conducted to establish the utilization of CT scans as first line investigation for occult hip fractures at our Major Trauma Centre and the rate of detection of occult fractures that impacted on patient management.

**METHOD AND MATERIALS**
A retrospective review was conducted of all CT and MRI scans performed at our institution during the year 2015, where the keyword "fracture" was used within the report. This identified 843 scans, of which 519 were initially excluded as not specifically questioning hip or proximal femoral fractures. Of the remaining 324 scans, a further 56 scans were excluded as they were performed for operative planning or suspected bleeding in patients with visible fractures on plain radiographs.

**RESULTS**
The average age was 76 years and female to male ratio was 69%:31%. 262 (98%) of patients had CT scan performed only following equivocal radiographs. 4 patients had an MRI scan performed following a CT, confirming a possible fracture in one of these cases. 115 patients had fracture confirmed with cross-sectional imaging; most commonly pubic rami, acetabular and neck of femur (NOF) fractures. 24 patients (9%) had a subsequent operation following confirmation of a fracture; in 22 cases for a NOF fracture. Thus, the overall pick-up rate for occult fractures was 43%, though the majority of these were managed conservatively. In only one instance MRI confirmed a NOF fracture where CT was equivocal.

**CONCLUSION**
CT is an effective modality for diagnosing occult hip fractures. It can be utilised in units where MRI is not readily available or have high demand on MRI.

**CLINICAL RELEVANCE/APPLICATION**
Although MRI is recommended for the detection of occult hip fractures, our study has shown that CT is an effective modality. CT can often be performed more quickly, avoiding unnecessary delay in confirming the diagnosis; MRI can also be problematic in the elderly and paediatric population and where it is contraindicated. MRI should still be considered following a negative CT scan in patients who remain symptomatic and in the younger population.

**The Importance of Perfusion for Union: An Analysis of the Relationship Between Acute Lower Extremity Vascular Injury and Fracture Healing Time in the Setting of High-energy Trauma**

**Participants**
Michael S. Roux, MD, Boston, MA (Presenter) Nothing to Disclose
Anthony S. Armetta, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jean Paul Colon Pons, MD, Ponce, PR (Abstract Co-Author) Nothing to Disclose
Remy Ngwanyam, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (Abstract Co-Author) Royalties, Reed Elsevier
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
Stephan W. Anderson, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To investigate the significance of concomitant acute arterial injury on the healing of traumatic lower extremity fractures.
SSE15-03 Evaluation of Paraspinal Fat Pad as An Indicator of Posterior Ligamentous Complex Injury in Cervical Spine Trauma

METHOD AND MATERIALS

At a major urban Level 1 Trauma Center, 246 instances of acute lower extremity fracture were identified from the past 10 years, for which a CT-angiogram of the ipsilateral lower extremity was also acquired at the time of injury. Of these fracture instances, 126 met the inclusion criteria which included CTA diagnostic adequacy, presence of complete fracture, and serial radiographic follow-up sufficient to assess for fracture union, delayed union, or nonunion. Radiographs were re-evaluated for number of weeks until fracture union, or for delayed or non-union, with subspecialty musculoskeletal radiology faculty review of cases with potential ambiguity. Acute arterial injuries were also recorded, including presence of stenosis, occlusion, extravasation, pseudoaneurysm, AV fistula, or dissection, within the superficial femoral, popliteal, anterior tibial, posterior tibial, and peroneal arteries. Relevant demographic data was also recorded.

RESULTS

T-test analysis reveals a statistically-significant prolonged mean fracture union time of 39.0 weeks when there is concomitant vascular injury, as compared with 18.7 weeks in the absence of vascular injury (p=0.0009), exclusive of cases with no radiographic evidence of eventual union. Fisher’s Exact Test was used for categorical assessment of united and non-united fractures, with and without vascular injury, revealing a statistically-significant association between vascular injury and fracture non-union (p=0.0029).

CONCLUSION

Acute arterial injury at the time of traumatic lower extremity fracture is correlated with prolonged fracture healing, approximately doubling the mean time required to achieve fracture union.

CLINICAL RELEVANCE/APPLICATION

Traumatic lower extremity arterial injury is associated with prolonged fracture healing time and non-union.

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Ali Guermazi, MD, PhD - 2012 Honored Educator
Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SSE15-04 MR-Based Edema Grading of the Psoas and Paraspinal Back Muscles: Is it Helpful for Diagnosing Fractures of the Lumbar Transverse Process?

METHOD AND MATERIALS

Our retrospective study was approved by our institutional board review; written informed consent was obtained from healthy subjects, and waived for patients. First, PFP appearance was evaluated in an anatomic specimen and in 10 healthy subjects spine CT by three radiologists (1, 2, and 3) working in consensus. Then, in 85 patients with suspicion of cervical spine trauma following high velocity accident, readers 2 and 3 reviewed in consensus the cervical spine CT (reference for fracture and luxation) and MRI (1.5 T; T1, T2, and STIR sequences; reference for ligament and disk injuries, and contusion or occult fracture) for traumatic injuries. PFP CT appearance was independently analyzed by readers 1 and 2, and interobserver agreement (kappa weighted) was calculated. Relationships between PFP changes and injuries and descriptive analysis were calculated.

RESULTS

The PFP could be identified as a well-circumscribed fatty area between cervical spine and posterior muscles. Interobserver agreement was 0.76. An abnormal PFP was associated with PLC (p=0.001) and arch (p=0.006) injuries but not to body (p=0.06), longitudinal ligaments (p=0.4) or disk (p=0.66) injuries. Sensitivity, specificity, positive and negative predictive values for PLC injuries were 55% (11/20), 97% (38/39), 92% (11/12) and 81% (38/47), respectively.

CONCLUSION

PFP changes on CT are significantly associated to injuries of PLC in patients with spine cervical trauma.

CLINICAL RELEVANCE/APPLICATION

The disappearance of the paraspinal fat pad fatty density should alert the radiologist to the possibility of posterior ligamentous complex injury.
To determine the reliability of edema grading at the psoas and paraspinal back muscles based on axial T2-weighted images (T2WI) for assessment of lumbar transverse process (TP) fractures (Fx).

METHOD AND MATERIALS

Institutional review board approval was obtained. Retrospective review and analyses of lumbar spine MR images from 58 patients was performed by two radiologists in consensus. TPFx was confirmed on lumbar spine CT (time interval between CT and MR imagings, 0–7 days). On axial T2WI of the disc level, muscles around the spine were classified as four compartments – right psoas (RA), left psoas (LA), right paraspinal back (RP), and left paraspinal back (LP) muscles. Muscle edema grading was performed at each compartment (grade 0 to 3). For one leveled TP evaluation in one side, two leveled (two disc levels, just cranial and caudal to a targeted TP) edema grades were summed. Finally, grades for RA, RP, RAP (RA + RP), LA, LP, LAP (LA + LP), and T (RAP+LAP) were taken for each TP.

RESULTS

A total of 245 TPs (TP with Fx, 22; TP without Fx, 223) of 58 patients was evaluated. Muscle edema grade was significantly higher in cases with TPFx than in cases without TPFx, and also was moderately correlated with the presence of TPFx (p=0.446). ROC graph showed a sensitivity of 72.7% and specificity of 90.1% at a total grade > 2.50. The odds of muscle edema grade showed significant higher probability of the presence of TPFx (RAP- OR, 1.679; 95% CI: 1.351, 2.085; P=0.000/ LAP- OR, 1.982; 95% CI: 1.391, 2.825; P=0.000).

CONCLUSION

Muscle edema grade was strongly correlated with TPFx. Therefore, edema grading of the psoas and paraspinal back muscles at the lumbar spine is a helpful tool for predicting possibility of neighboring TPFxs.

CLINICAL RELEVANCE/APPLICATION

Edema grading of the psoas and paraspinal back muscles at the lumbar spine on axial T2WI is a helpful tool for not overlooking TPFx and predicting the presence of TPFx, especially, when a level of the transverse process was not scanned on axial MR images.

Dual-Energy CT for Detection of Bone Marrow Edema in Vertebral Compression Fractures: Visual and Quantitative Analysis at 3rd Generation Dual-Source CT with Comparison to MRI

Monday, Nov. 28 3:40PM - 3:50PM Room: E451B

Participants

Bernhard Petritsch, Wurzburg, Germany (Presenter) Nothing to Disclose
Anke Heidemeier, MD, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
Bernhard Krauss, PhD, Forchheim, Germany (Abstract Co-Author) Employee, Siemens AG
Richard J. Wagner, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
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Uwe Malzahn, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
Thorsten A. Bley, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Alexander Kosmala, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

To prospectively assess the diagnostic performance of dual-energy computed tomography (DECT) virtual non-calcium (VNC) technique in the detection of bone marrow edema in vertebral compression fractures on a 3rd generation dual-source CT system with MRI as a reference standard.

METHOD AND MATERIALS

Fourteen consecutive patients with 24 thoracic and/or lumbar vertebral compression fractures were included in this IRB-approved prospective study. All patients underwent both DECT (90/Sn150 kV; Sn indicates the use of a 0.4 mm tin filter) and MRI (3 Tesla; sagittal T1-weighted and STIR images). Two independent readers visually evaluated all vertebrae (n=97) for the presence of abnormal marrow attenuation on VNC images by using color-coded maps and in addition performed a quantitative evaluation of CT numbers on virtual non-calcium images. CT numbers were subjected to receiver-operating characteristic (ROC) analysis to calculate cut-off values.

RESULTS

MR imaging depicted 18 edematous and 6 non-edematous vertebral compression fractures. In the visual analysis, DECT VNC images had an overall sensitivity of 77.8%, specificity of 98.7%, and accuracy of 94.8%. The inter-observer agreement was k=0.91. In the quantitative analysis significant differences in virtual non-calcium CT numbers between edematous and non-edematous vertebral compression fractures were found (AUC ROC 0.915; p<0.0005). Use of a cut-off value of -22 to differentiate edematous vertebral bodies provided sensitivity of 72.2%, specificity of 100%, and accuracy of 94.8%.

CONCLUSION

VNC images generated from 3rd generation DECT allow for accurate depiction of trauma-related bone marrow edema in vertebral compression fractures on both visual and quantitative evaluation, revealing the acute nature of the fracture.
Clinical Relevance/Application

Dual-energy CT holds the potential for accurate diagnosis of bone marrow edema in vertebral compression fractures, which becomes of particular interest in patients with contraindications for MRI.

SSE15-06 A New Technique For Detecting Acute Bone Marrow Edema in Vertebrae Using a Dual-Energy CT Virtual Noncalcium Technique

Monday, Nov. 28 3:50PM - 4:00PM Room: E451B

Participants
Guobin Hong, MD, PhD, ZHUHAI, China (Presenter) Nothing to Disclose
Lingjing Gu, Zhuhai, China (Abstract Co-Author) Nothing to Disclose
Yijie Fang, Zhuhai, China (Abstract Co-Author) Nothing to Disclose

Purpose
This study aimed to assess the feasibility and clinical applicability of a dual-energy computed tomography (DECT) virtual noncalcium (VNC) imaging technique for diagnosing vertebral bone marrow lesions.

Method and Materials
A total of 19 patients with acute spinal trauma were enrolled in this study. All patients underwent DECT and magnetic resonance imaging (MRI) within 3 weeks after injury. The interval between the DECT and MRI was approximately 0 to 1 day. DECT data were post-processed using a three-material decomposition algorithm to generate VNC images and color-coded maps. Both MR and noncalcium images were independently scored by two doctors using a three-point system (2=a distinct bone marrow lesion, 1=a suspicious bone marrow lesion, and 0=no lesion); the doctors were blinded to one another’s scores. Subsequently, the Hounsfield numbers in the noncalcium images were evaluated by a third reader based on contrast MR images of normal and abnormal bone marrow, which served as the reference standard. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for the detection of bone bruises using VNC images were calculated. A consistency check was performed using kappa statistics. A one-way analysis of variance was used to analyze the Hounsfield numbers in the bone marrow lesions.

Results
The DECT VNC images had an overall sensitivity and PPV of 92%, and relatively low specificity and NPV for the identification of the distinct bone marrow lesions. Inter-reader agreement was high for the qualitative grading of the DECT images (κ=0.650). The Hounsfield numbers in the VNC images gradually declined from the thoracic to the lumbar vertebrae (p<0.05). The Hounsfield numbers for the positive regions were higher than for the negative regions (p<0.05). Statistically significant differences in the Hounsfield numbers were identified in regions that had bone marrow lesions with different classifications (thoracic levels:F=136.690, p=0.000; lumbar levels:F=92.689, p=0.000).

Conclusion
The DECT VNC images that combined the Hounsfield number measurements based on the VNC can reveal fine bony anatomical details of the spine and allow for the early detection of bone marrow lesions.

Clinical Relevance/Application
This new technique has tremendous clinical significance and potential applications.
Participants
Jennifer L. Demertzis, MD, Saint Louis, MO (Presenter) Nothing to Disclose
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Kimberly Beavers, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
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Michael V. Friedman, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Matthew G. Pipho, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Jeffrey M. Youngquist, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Michael Burch, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Kurt F. Scherer, MD, Windermere, FL (Abstract Co-Author) Nothing to Disclose
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Edward Derrick, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
Raul Loya, MD, Orlando, FL (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™: Imaging in the Cobra Kai Dojo

Tuesday, Nov. 29 7:15AM - 8:15AM Room: E451B

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.
**RC304**

**Musculoskeletal Series: Ultrasound**

**Tuesday, Nov. 29 8:30AM - 12:00PM Room: E450A**

**Participants**

Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Moderator) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;

Connie Y. Chang, MD, Boston, MA, (cychang@mgh.harvard.edu) (Moderator) Nothing to Disclose

Jon A. Jacobson, MD, Ann Arbor, MI, (jjacobsn@umich.edu) (Presenter) Consultant, BioClinica, Inc; Royalties, Reed Elsevier;

Ogonna K. Nwawka, MD, New York, NY (Moderator) Research Grant, General Electric Company

**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 Shoulder Ultrasound (Demonstration)**

**Tuesday, Nov. 29 8:30AM - 9:00AM Room: E450A**

**Participants**

Jon A. Jacobson, MD, Ann Arbor, MI, (jjacobsn@umich.edu) (Presenter) Consultant, BioClinica, Inc; Royalties, Reed Elsevier;

**LEARNING OBJECTIVES**

1. List the fundamental steps in performing an ultrasound examination of the shoulder
2. Understand common pitfalls in shoulder ultrasound
3. Utilize dynamic imaging in the evaluation of shoulder pathology

**ABSTRACT**

**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 Impact of Musculoskeletal Shoulder Ultrasound on Clinical Decision Making**

**Tuesday, Nov. 29 9:00AM - 9:10AM Room: E450A**

**Participants**

Michael V. Friedman, MD, Saint Louis, MO (Presenter) Nothing to Disclose

Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Instructor, DFine, Inc

David V. Holland, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

James M. Eisenberg, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

Jennifer L. Demertzis, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the impact of musculoskeletal (MSK) shoulder ultrasound (US) on clinical decision making.

**METHOD AND MATERIALS**

IRB approval was obtained. 912 patients with 1037 consecutive MSK shoulder US, ordered and performed at our institution over a 12 month period, were retrospectively reviewed. 125 patients had bilateral exams which were managed and scored independently. 102 patient exams were excluded from the study. (89 exams had no follow up or initial clinic note; 11 exams were duplicate; and two exams were performed for contralateral comparison.) 935 total patient exams had both pre- and post-US clinical evaluations, meeting inclusion criteria. The medical records and clinic notes of each patient were analyzed, recording immediate pre- and post-US diagnoses and treatment plans. Management plans were categorized as: 1–No plan/No further treatment; 2–Conservative/physical therapy; 3–Therapeutic injection; 4–Surgical Intervention; 5–Change in diagnosis; 6–Need additional imaging. Data was analyzed for changes in clinical management based upon US results using nonparametric statistical methods.

**RESULTS**

Of 935 patient exams, 679 (72.6%) had a post-US treatment plan that differed from pre-US management, demonstrating a statistically significant impact of shoulder US on patient management (p<0.001). The diagnosis was changed to non-shoulder pathology in 23 patients (2.5%), and 12 patients (1.3%) were referred for additional imaging. In 450 patient exams (48%), the treating physician refrained from making a treatment plan until the shoulder US was obtained. Of the 485 patient exams with a defined pre-US management plan, the invasiveness of the plan was increased in 108 (22.3%) subjects based on the shoulder US
results. Clinical management was altered in nine patients (1.9%) from surgical to nonsurgical treatment, and in 78 patients (16.1%) from nonsurgical to surgical management. US also played a role in surgical planning, with 25 studies (2.7%) specifically performed to evaluate rotator cuff integrity and muscle atrophy when deciding between conventional and reverse shoulder arthroplasty.

CONCLUSION

MSK shoulder US is a useful diagnostic imaging modality with significant impact on clinical decision making.

CLINICAL RELEVANCE/APPLICATION

Musculoskeletal shoulder US is a validated diagnostic imaging modality for the evaluation of rotator cuff pathology, and has a significant impact on clinical decision making and patient management.

RC304-03 T2/T2* Maps and Ultrasound Shear Wave Elastography: A Potential Relationship that Could Improve the Quantitative Assessment of the Supraspinatus Tendon on MRI

Tuesday, Nov. 29 9:10AM - 9:20AM Room: E450A

Participants
Konstantin Krepkin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alexander N. Merkle, MD, New York, NY (Presenter) Nothing to Disclose
Mary Bruno, RT, New York, NY (Abstract Co-Author) Nothing to Disclose
Jose Maria Raya Garcia Del Olmo, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ronald S. Adler, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Soterios Gyftopoulos, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine whether there is an association between T2/T2* mapping and supraspinatus tendon mechanical properties as assessed by shear-wave ultrasound elastography (SWE).

METHOD AND MATERIALS

This HIPAA compliant prospective study received approval from our hospital's institutional review board. Eight patients (3 males/5 females; age range 44-72 years) and 9 shoulders underwent conventional shoulder MRI and T2/T2* mapping on a 3T scanner, and ultrasound evaluation with SWE. All ultrasound examinations were performed by a single musculoskeletal radiologist with more than 20 years of musculoskeletal ultrasound experience. Shear wave velocities (SWV) were obtained in multiple 1.5 mm square regions of interest (ROIs) drawn within the insertion of the supraspinatus tendon at the mid-portion of the superior greater tuberosity facet. The ROIs were organized, and averaged when necessary, into one of 3 locations within the insertional portion of the tendon: lateral, medial and middle. Two musculoskeletal radiologists reviewed the MRI exams in consensus for evidence of supraspinatus tendon pathology, with tear size and retraction measured for full-thickness tears. T2 and T2* values were calculated from coronal T2/T2* maps using equidistant ROIs corresponding to the same medial, middle, and lateral locations as on ultrasound. Pearson correlation coefficients between T2/T2* values and SWV, as well as between T2, T2*, SWV and tear size and retraction were calculated.

RESULTS

There was a significant negative correlation between T2* and SWV in the lateral location ROI (r = -0.86, p = 0.013) and overall mean ROI (r = -0.90, p = 0.006). There was significant positive correlation between T2 and measures of tear size in the lateral and mean ROIs (r range 0.71 – 0.77, p range 0.016 – 0.034). There was significant negative correlation between SWV and tear size in the middle and mean ROIs (r range -0.79 – -0.68, p range 0.011 – 0.046).

CONCLUSION

This pilot study shows the feasibility of doing T2/T2* mapping in the supraspinatus tendon and reveals a potential relationship between the tendon’s T2* values and its mechanical properties.

CLINICAL RELEVANCE/APPLICATION

T2/T2* mapping has the potential to improve our description of rotator cuff disease on MRI by providing a more objective measure of tendon quality; information that can be useful to the patient and surgeon considering rotator cuff repair surgery.

RC304-04 Early Detection of Brachial Plexus Neuritis by Means of High-Resolution Ultrasonography of the Suprascapular Nerve

Tuesday, Nov. 29 9:20AM - 9:30AM Room: E450A

Participants
Alexander Loizides, MD, Innsbruck, Austria (Presenter) Nothing to Disclose
Leonhard Gruber, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Wolfgang Loescher, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Hannes Gruber, MD, PhD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose

PURPOSE

Brachial plexus neuritis (BPN) is a rare condition with initial shoulder pain up to two weeks after symptom onset and consecutive shoulder girdle paresis. We assessed the diagnostic value of ultrasound examinations of the suprascapular nerve (SSN) in the early diagnosis of BPN.

METHOD AND MATERIALS

The cross-section areas (CSA) of the SSN at the root and at the omohyoid muscle were assessed in seven patients with clinically definitive BPN and 30 healthy volunteers. To compare group means, an ordinary one-sided ANOVA with Holm-Sidak’s multiple testing correction was performed. To determine ideal cut-offs, receiver-operator-characteristics (ROC) curves were generated and according contingency tables were constructed to calculate sensitivity, specificity, positive (PPV) and negative predictive values (NPV), likelihood ratios (LR) and odds ratios (OR). To account for confounding factors, a bootstrapped binary regression analysis.
RESULTS

Patients with BNP had significantly higher CSAs of the SSN at the omohyoid muscle (5.99±2.08 vs. 2.79±0.82 mm², p < 0.0001) and significantly higher ratios of SSN CSAs of the affected to contralateral side at the omohyoid muscle (223.0±94.4% vs. 127.4±51.1%, p = 0.0016) as well as ratios of SSN CSA at the omohyoid muscle to the root (180.7±94.4% vs. 99.9±28.3%, p = 0.0006). SSN root CSAs did not differ significantly (3.63±1.23 vs. 2.90±0.90 mm², p = 0.14). With a SSN CSA at the omohyoid muscle greater 4.2mm², the ROC area under the curve was 0.933. Sensitivity was 85.7% (42.1–99.6%), specificity 96.7% (82.8–99.9%), PPV 85.7% (127.7±51.1%, p = 0.0001), NPV 96.7% (82.8–99.9%), OR 174.0 (95–3190.0) and LR 25.7 (95% CI in parentheses). Multivariate analysis identified SSN swelling at the omohyoid muscle as a strong predictor (B = -344.3 ± 55.1; p = 0.001). Age (B = -14.1 ± 2.3; p = 0.001) and BMI (B = 17.8 ± 5.3; p = 0.005) had a minor influence, gender none (B = -20.0 ± 26.2; p = 0.22).

CONCLUSION

Increased SSN CSA at the omohyoid muscle can reliably identify BNP in case of clinical suspicion of neuralgic shoulder amyotrophy.

CLINICAL RELEVANCE/APPLICATION

An increase in CSA beyond 4.2mm² of the suprascapular nerve at the level of the omohyoid muscle is highly indicative of brachial plexus neuritis. Further studies should focus on treatment strategies.

RC304-05 Stress Ultrasound to Diagnose UCL Tears at the Elbow: Which Joint Gapping Threshold to Use?

Participants
Johannes B. Roedl, MD, PhD, Philadelphia, PA (Presenter) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Mika T. Nevalainen, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Levon N. Nazarian, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess different joint gapping thresholds for stress ultrasound in the diagnosis of ulnar collateral ligament (UCL) tears in baseball players.

METHOD AND MATERIALS

Throwing athletes with surgically or arthroscopically proven UCL tears underwent stressUS. The interval gapping of the medial elbow joint was measured between rest and valgus stress both at the injured (ipsilateral) and at the uninjured (contralateral) elbow. The relative gapping between both elbows (ipsilateral gapping minus contralateral gapping) was calculated. Throwing athletes without UCL tears were available as a control group. Receiver operator curve (ROC) analysis determined retrospectively the most accurate thresholds to predict UCL tears. Institutional review board approval was obtained and the requirement for informed consent was waived. The study is compliant with HIPAA.

RESULTS

In this retrospective analysis, 71 athletes with UCL tears were compared to 122 athletes without UCL tears. The ROC analysis determined the following thresholds in order of decreasing specificity: A relative joint gapping threshold of 2.6 mm had a specificity of 100% and a sensitivity of 53% in predicting UCL tears. A threshold of 1.5 mm resulted in a specificity of 91% and a sensitivity of 81%. A threshold of 1.0 mm yielded a sensitivity of 81% and a specificity of 96%.

CONCLUSION

The above listed thresholds can be used and it depends on the clinical practice whether higher specificity or sensitivity is desired.

CLINICAL RELEVANCE/APPLICATION

Elbow stress ultrasound is an emerging technique and the thresholds provided will help the Radiologist in the diagnosis of UCL tears.

RC304-06 Elbow Ultrasound (Demonstration)

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company; Kathy Quenneville, BS, RT, Commerce Township, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC304-07 Knee Ultrasound (Demonstration)

Participants
Ronald S. Adler, MD, PhD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
**PURPOSE**

To evaluate the potential role of screening ultrasound in identifying unstable meniscal tears. Specifically, the presence of medial meniscal extrusion on dynamic ultrasound, with and without weightbearing, will be utilized to identify unstable meniscal tears.

**METHOD AND MATERIALS**

12 patients with unilateral knee pain underwent dynamic ultrasound of the medial meniscus of both knees. Ultrasound images were obtained of the medial meniscus in the coronal plane with the knee extended, with and without weight bearing. Abbreviated MR examination of both the symptomatic and asymptomatic knees was performed on a 1.5 T MR unit. Coronal T2 fat suppressed and sagittal proton density weighted images were obtained. The degree of meniscal extrusion on weight bearing and non weight bearing ultrasound, as well as a change in meniscal extrusion, were correlated with demographic and clinical factors such as age, sex, weight, and duration of symptoms, as well as findings on MRI.

**RESULTS**

Medial meniscal extrusion was readily observed on ultrasound. All but one meniscus demonstrated increased extrusion with weight bearing. Of the 24 menisci, there were 5 tears (1 radial /2 oblique /2 complex). Extrusion averaged 2.4mm at rest and 3.5mm with weight bearing (avg difference 1.1mm) in menisci without tear on MRI; extrusion was 2.3mm at rest and 4.3mm with weight bearing (avg difference 2.0mm) in menisci with tear on MRI. In the symptomatic knee, difference in extrusion averaged 1.6mm vs 0.8mm in the asymptomatic knee. Only one individual had medial compartment chondrosis. Regarding pain chronicity, difference in extrusion averaged 1.3mm with pain <1 year versus 1.8mm with pain >1 year. Knees in individuals with weight<200lb showed average difference in extrusion of 1.1mm and 1.1mm in individuals >200lb. Difference in extrusion for age > 50 years averaged 0.9mm versus 1.2mm for age<50.

**CONCLUSION**

Dynamic ultrasound with and without weight bearing may be useful to distinguish unstable from stable (or chronic) tears.

**CLINICAL RELEVANCE/APPLICATION**

Weight-bearing ultrasound of the medial meniscus may serve as a quick, economical means to triage patients with medial knee pain and suspected unstable meniscal tears.

**RC304-09 Role of Real-Time (RTE) and Shear-Wave (SWE) Sonoelastography in the Follow-up of Muscle Thigh Injury in Athletes: A Three-Years Longitudinal Study**

**PURPOSE**

The aim of the current study is to assess the reliability and effectiveness of the RTE and SWE in the evaluation and follow up of traumatic lower limb muscle tears in a cohort of professional athletes using MRI as a reference standard.

**METHOD AND MATERIALS**

143 male athletes (aged 23 ± 5) with MRI confirmed indirect thigh muscle injury was included in our study and evaluated with ultrasound (US) over a period of 36 months and for a total of 112 muscles. Muscle tears were evaluated with B-mode US, RTE and SWE using two different US apparels (LOGIQ E9, GE Healthcare; RS80 Prestige, Samsung Medical) at baseline, 2, 4 and 6 weeks in order to evaluate the healing process of the injury also comparing the obtained results with the healthy contralateral side. Statistical analysis of the obtained data was performed, also assessing intra- and inter-observer reproducibility with the Bland-Altman test.

**RESULTS**

The results derived from the current study highlight a direct relationship between the clinical recovery of the injured muscle and its appearance and the elastic features of the regenerative scar tissue. In particular SWE quantitative elasticity assessment was able to provide meaningful data about the quality of the regenerated tissue, furnishing thresholds (11.3 ± 7.6 kPa: newly formed healing tissue; 28.3 ± 4.6 kPa: complete recovery) and contralateral normal muscle (15.4 ± 5.8 kPa) with high measurement reliability index (RMI): 0.7 ± 0.2.

**CONCLUSION**

The dynamic features of US, combined with RTE and SWE techniques are able to provide qualitative and quantitative elasticity assessment of the healing process of an injured muscle. This can be crucial in the management and early recovery of athletes.

**CLINICAL RELEVANCE/APPLICATION**

SWE is able to perform a quantitative assessment of muscle healing process and could be extremely useful in athletes follow-up.
**RC304-10  Carpal Tunnel Ultrasonography in Diabetics: Missing the Mark?**

Tuesday, Nov. 29 11:10AM - 11:20AM Room: E450A

Participants
Alexander Loizides, MD, Innsbruck, Austria (Presenter) Nothing to Disclose
Leonhard Gruber, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Gabriele Morsdorf, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Ingrid Gruber, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Hannes Gruber, MD, PhD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To assess whether commonly used ultrasound (US) measurements for carpal tunnel syndrome (CTS) are reliable in diabetics.

**METHOD AND MATERIALS**
We retrospectively assessed the cross-section area (CSA) of the median nerve at the level of the carpal tunnel (CT) and the pronator quadratus muscle in 236 wrists of 157 symptomatic patients with clinical suspicion of CTS and calculated the wrist-to-forearm ratio (WFR). Furthermore, 14 wrists in seven asymptomatic diabetics were examined. HbA1c values at the time of US-examination were collected. Values for CSAs and WFR of patients grouped by presence or absence of diabetes and by HbA1c values were compared via an ordinary one-way ANOVA with Holm-Sidak correction for multiple testing after logarithmic transformation to achieve normal distribution. Correlations between HbA1c and WFR as well as CSAs were furthermore quantified through a linear regression analysis. Finally receiver-operator characteristics (ROC) curves were generated to assess the diagnostic utility of WFR measurements.

**RESULTS**
The average WFR was 1.90±0.55 in asymptomatic diabetics, 2.10±0.77 in symptomatic diabetics and 2.37±0.75 in symptomatic non-diabetics. Diabetic patients had a significantly lower WFR than otherwise healthy patients with CTS (p=0.037). There were no other significant differences between CSAs versus other groups, but a trend towards higher CSA values at the CT (p=0.278). No difference was found for CSA values at the CT (p=0.52). There was no correlation between HbA1c values and WFR (R² = 0.0072), CSA at the CT (R² = 0.0004) or CSA at the pronator quadratus (R² = 0.0009). ROC curve analysis demonstrated a lack of discriminatory power of US between diabetics with and without CTS (area under the curve 0.551).

**CONCLUSION**
Ultrasound should not be used in the evaluation of CTS in diabetic patients, as its discriminatory power is very low in this patient group, probably due to prevalent neuropathic changes.

**CLINICAL RELEVANCE/APPLICATION**
Ultrasound is not suited for confirmation of primary CTS in diabetics, but still can be used to rule out other secondary causes of neural compression.

**RC304-11  Median Nerve Evaluation by Shear Wave Elastosonography: Impact of "Bone-proximity" Hardening Artifacts and Inter-observer Agreement**

Tuesday, Nov. 29 11:20AM - 11:30AM Room: E450A

Participants
Elena Turpin, MD, Pavia, Italy (Presenter) Nothing to Disclose
Paolo F. Felsaz, MD, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
Chandra Bortolotto, MD, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Callaia, MD, Pavia, Italy (Abstract Co-Author) Research Grant, Toshiba Corporation; Speakers Bureau Member, Hitachi, Ltd; Speakers Bureau Member, Shenzhen Mindray Bio-Medical Electronics Co, Ltd

**PURPOSE**
Elastosonography widely expanded its area of applicability in the last years, including peripheral nerves evaluation. Frequently peripheral nerves travels close to bone surfaces and are therefore prone to elastosonographic “bone-proximity” hardening artifacts. The impact of these artifacts on median nerve stiffness quantitative measurements performed by shear wave elastosonography has not yet been explored. Our aim is to assess normal median nerves stiffness values at various locations and, as a secondary endpoint, to evaluate inter-observer agreement.

**METHOD AND MATERIALS**
36 healthy volunteers (24 women and 12 men) aged between 25 and 40 years were evaluated. Two operators performed the evaluation: expert (6 years of ultrasound experience) and inexperienced (6 months’ experience). The nerve was sampled in cross section at three different locations: at mid-forearm, immediately before the carpal tunnel and within the tunnel. We used a Toshiba Aplio 500 scanner (Toshiba MS, Otawara-shi, Japan) equipped with 14 MHz linear probe. Measurement were performed using a ROI corresponding to the diameter of the nerve.

**RESULTS**
Median nerve mean stiffness values were: 4.92 kPa at the forearm (95% confidence interval = 4.31-5.53); 21.33 kPa before the tunnel (95% CI = 19.11-23.55); 31.28 kPa within the tunnel (95% CI = 22.30-40.25). Inter-observer agreement (Bland Altman analysis) was excellent at the forearm (mean difference 1.3 CI 8.2 to -10.8) and good at the other two levels (6.2 CI 40.3 to -52.7; 4.1 CI 38.2 to -46.2).

**CONCLUSION**
The stiffness of the median nerve progressively increases in its distal portions, where the nerve approaches the bone surfaces. Therefore, when evaluating nerve pathologies, stiffness must be compared to the same portion of the contralateral nerve rather than its proximal or distal portions in order to avoid possible “bone-proximity” hardening artifacts. Measurements inter-observer agreement is generally good.
**CLINICAL RELEVANCE/APPLICATION**

Median nerve stiffness increases from forearm to its distal portion. Therefore, when evaluating nerve pathologies, stiffness must be compared to the same portion of the contralateral nerve rather than its proximal or distal portions.

**RC304-12  Hand and Wrist Ultrasound (Demonstration)**

Tuesday, Nov. 29 11:30AM - 12:00PM Room: E450A

Participants
Viviane Khoury, MD, Philadelphia, PA, (Viviane.khoury@uphs.upenn.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
Interactive Game: When Do Imaging Findings Make a Difference?

Tuesday, Nov. 29 8:30AM - 10:00AM Room: E450B

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

Participants

Sub-Events

**RC318A** Neuro

Participants

Birgit B. Ertl-Wagner, MD, Munich, Germany, (Birgit.Ertl-Wagner@med.lmu.de) (Presenter) Board Member, Koninklijke Philips NV; Board Member, Bracco Group; Board Member, Springer Science+Business Media; Consultant, MMI Munich Medical International GmbH; Consultant, Koninklijke Philips NV; Consultant, Springer Science+Business Media; Consultant, Thieme Medical Publishers, Inc; Consultant, Bracco Group; Institutional Research Grant, Eli Lilly and Company; Institutional Research Grant, F. Hoffmann-La Roche Ltd; Institutional Research Grant, Guerbet SA; Institutional Research Grant, Merck KGaA; Institutional Research Grant, Bayer AG; Institutional Research Grant, Novartis AG; Speaker, Siemens AG; Author, Springer Science+Business Media; Author, Thieme Medical Publishers, Inc; Author, Bracco Group; Royalties, Springer Science+Business Media; Royalties, Thieme Medical Publishers, Inc; Stockholder, Siemens AG; Travel support, Siemens AG;

**LEARNING OBJECTIVES**

1) To comprehend the importance of signs in neuroimaging for diagnostic decision making. 2) To understand in which instances imaging findings have a direct consequence for therapeutic decision making. 3) To appreciate the therapeutic consequences of selected neuroimaging findings.

**RC318B** Musculoskeletal

Participants

David M. Panicek, MD, New York, NY, (panicekd@mskcc.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Assess imaging features that facilitate specific diagnoses of musculoskeletal lesions. 2) Describe scenarios in which various imaging features of musculoskeletal lesions lead to more accurate tumor staging and treatment response assessment. 3) Detect musculoskeletal complications of tumors and their treatment.

**RC318C** Pelvis

Participants

Caroline Reinhold, MD, MSc, Montreal, QC (Presenter) Consultant, GlaxoSmithKline plc

**LEARNING OBJECTIVES**

1) Understand the role of imaging in the management of gynaecological malignancies. 2) Assess imaging features that allow accurate staging of gynaecological malignancies. 3) Be familiar with pitfalls that can result in staging errors using imaging. 4) Understand the changes in imaging appearance post treatment.

**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/

Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator
LEARNING OBJECTIVES
1) Review the classic target sites of common articular disorders emphasizing the hand, wrist, and foot. 2) Summarize the important differences in distribution of these disorders, allowing accurate diagnosis.

ABSTRACT
The accurate diagnosis of articular disorders is based on two observations: the morphologic or structural abnormalities; and the distribution of these abnormalities. In this presentation, classic patterns of distribution of common and a few uncommon articular disorders will be reviewed with emphasis on the hand, wrist, heel, and foot. Points of differential diagnosis will be summarized.

LEARNING OBJECTIVES
1) Discuss diagnosis and monitoring of osteoporosis. 2) Discuss fracture risk assessment. 3) Describe pitfalls in DXA scan interpretation.

ABSTRACT
The accurate diagnosis of articular disorders is based on two observations: the morphologic or structural abnormalities; and the distribution of these abnormalities. In this presentation, classic patterns of distribution of common and a few uncommon articular disorders will be reviewed with emphasis on the hand, wrist, heel, and foot. Points of differential diagnosis will be summarized.

LEARNING OBJECTIVES
1) Discuss some key concepts on the techniques of hip MRI. 2) Recognize common extra-articular hip pathology on MRI. 3) Differentiate labral variants from tears. 4) Identify MRI features of femoroacetabular impingement (FAI).

ABSTRACT
The accurate diagnosis of articular disorders is based on two observations: the morphologic or structural abnormalities; and the distribution of these abnormalities. In this presentation, classic patterns of distribution of common and a few uncommon articular disorders will be reviewed with emphasis on the hand, wrist, heel, and foot. Points of differential diagnosis will be summarized.

LEARNING OBJECTIVES
1) Describe histopathologic marrow changes producing findings of bone marrow edema on MRI. 2) Review traumatic pathomechanisms producing commonly encountered marrow edema patterns and associated soft tissue and osseous injuries. 3) Discuss bone marrow edema findings encountered in setting of altered mechanical loading, chronic repetitive trauma, and articular degeneration.
SSG09

Musculoskeletal (Arthritis and Inflammation)

Tuesday, Nov. 29 10:30AM - 12:00PM Room: E450B

MK  CT  MR

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

Participants
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Moderator) Speaker, General Electric Company; Equipment support, Siemens AG; Consultant, Medivir AB; Medical Advisor, Medivir AB
Daniel B. Nissman, MD, MPH, Raleigh, NC (Moderator) Royalties, John Wiley & Sons, Inc

Sub-Events

SSG09-01  The Atrophic Phenotype of Knee Osteoarthritis is not Associated with Faster Progression of Disease: The Multicenter Osteoarthritis (MOST) Study

Participants
Michel D. Crema, MD, Boston, MA (Abstract Co-Author) 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
David T. Felson, MD, MPH, Boston, MA (Abstract Co-Author) Consultant, Zimmer Biomet Holdings, Inc
Michael C. Nevitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Monica D. Marra, MD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC
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PURPOSE
In tibiofemoral compartments exhibiting fast progression of osteoarthritis (OA), osteophyte formation may lag behind cartilage loss, which might then manifest as an atrophic OA phenotype. The aim of this study was to assess the associations of atrophic tibiofemoral OA with progression of radiographic joint space narrowing (JSN) and magnetic resonance imaging (MRI)-defined progression of cartilage damage.

METHOD AND MATERIALS
Participants of the Multicenter Osteoarthritis (MOST) Study with available radiographic and 1.0T MRI assessments at baseline and 30 months follow-up (FU), were included. Radiographs were assessed according to the OARSI system for JSN and osteophytes (grades 0-3). Ten tibiofemoral regions were assessed on MRI for cartilage morphology (grades 0-6) and osteophytes (grades 0-7) using the WORMS system. On radiographs, atrophic OA was defined as OARSI grades 1 or 2 for JSN and grade 0 for osteophytes. On MRI, atrophic OA was defined as tibiofemoral cartilage damage grades ≥ 3 in at least 2 of 10 subregions with absent or equivocal osteophytes (grades 0 and 1) in all subregions. Progression of JSN and cartilage loss on MRI, was defined as 1) no, 2) slow, and 3) fast progression. Chi-square test and logistic regression with generalized estimated equations were performed to assess the association of atrophic knee OA with any progression, compared to non-atrophic OA knees (reference group).

RESULTS
A total of 476 knees from 432 participants were included. Using the radiographic definition, 50 (10.5%) had atrophic OA and 426 (89.5%) had non-atrophic OA knees at baseline. Using the MRI definition, there were 16 (3.4%) knees with atrophic OA and 460 (96.6%) with non-atrophic OA. Non-atrophic OA knees more commonly exhibited fast progression of JSN (p=0.002) and fast progression of MRI cartilage damage (p=0.02). Logistic regression showed that the atrophic phenotype of knee OA was modestly protective against progression of JSN and MRI when compared to non-atrophic OA knees.

CONCLUSION
In this sample of subjects with or at risk for knee OA the atrophic phenotype of knee OA did not predispose to more rapid progression compared to non-atrophic OA. Instead, the atrophic phenotype demonstrated a decreased risk for OA progression.

CLINICAL RELEVANCE/APPLICATION
Our results may potentially impact on subject selection in clinical trials of knee OA, as the atrophic phenotype is not associated with more progression of disease.

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

SSG09-02  Does Contrast-Enhanced MRI Sequence have Incremental Value in the Assessment of Active Sacroiliitis?

Participants
SSG09-04 Contribution of 18F-Flouride PET/MRI for Assessment of Active Inflammation in Psoriatic Arthritis of the Hand

Tuesday, Nov. 29 11:00AM - 11:10AM Room: E450B

Siyoun Sung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jong Won Kwon, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

PURPOSE
To evaluate if contrast-enhanced MRI sequence increase the diagnostic value in the assessment of active sacroiliitis in patients with inflammatory back pain.

METHOD AND MATERIALS
Ninety-two patients with impression of inflammatory back pain were enrolled. All patients underwent MRI which contains coronal short tau inversion recovery (STIR) image, axial T2-weighted image with fat suppression (T2FS), and coronal and axial contrast-enhanced T1-weighted images with fat suppression (CET1FS). Two observers reviewed a set of coronal STIR with axial T2FS, and a set of coronal and axial CET1FS independently in two separate sessions. The presence and degree of bone marrow edema and osteitis were evaluated on each set. Each sacroiliac joint was divided into 4 quadrants and severity per quadrant was assigned a score of 0–4. Defining active sacroiliitis or not was made based on the findings of obvious subchondral bone marrow edema or osteitis (score 2 or more) in any quadrants. Presence of additional findings of active sacroiliitis such as synovitis, enthesitis, and capsulitis were evaluated. Cohen’s kappa coefficients were used for the comparison of positivity of active sacroiliitis between two observers for same set, and between sets for each observer. Kendall’s tau-b values were used for the comparison of scores of each quadrant between two observers for same set, and between sets for each observer. The z test for two population proportions was used to compare proportion of positive additional finding for between sets for same observer.

RESULTS
Cohen’s kappa coefficients between two observers for same set were 0.956 and 0.978 for contrast-enhanced images and T2FS with STIR each. Cohen’s kappa coefficients between two sets for each observer were 0.892 and 0.870. Kendall’s tau-b value between two observers for same set and between sets for each observer was more than 0.783 in all quadrants, showing good agreement. There was no significant difference of proportion of positive cases for all additional findings for both observers.

CONCLUSION
The contrast-enhanced MRI sequences did not have an incremental value in the assessment of active sacroiliitis compared with the STIR and T2FS sequences

CLINICAL RELEVANCE/APPLICATION
With appropriate sequences and planes, unnecessary usage of contrast-enhanced sequences can be avoidable for the assessment of active sacroiliitis.

SSG09-03 Assessment of Spondyloarthritis using MR Spectroscopy: A Single Peak at 8ppm as a Potential Inflammatory Marker

Tuesday, Nov. 29 10:50AM - 11:00AM Room: E450B

Participants
Seunghun Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yoonah Song, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Ju Kim, BA, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Tae-Hwan Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the potential role of magnetic resonance (MR) spectroscopy in patients with inflammatory arthritis, and correlation between active inflammation, C-reactive protein (CRP) and clinical concordance

METHOD AND MATERIALS
From May 2015 to March 2016, 130 consecutive patients with clinically suspected spondyloarthritis (77 men, 53 women; mean age, 30.3 years; range, 14-63 years) were assessed with 3.0-T MR imaging including single-voxel MR spectroscopy. We analyzed the presence of specific metabolite peak of active inflammation group compared them with those of inactive group. We draw two region of interest (ROI) in case of subchondral bone marrow edema and normal bone marrow. Two radiologists analyzed conventional MR findings by consensus: bone marrow edema, location, and presence/absence of active inflammation in sacroiliac joint. We use dedicated software for analyzing MR spectroscopy. Demographic data, MR findings, spectroscopic spectrum and concordance between active inflammation and CRP were compared using chi-square test.

RESULTS
There are 66 patients with active inflammation and the other 64 patients with inactive lesion in sacroiliac joint. All patients with active inflammation showed a single peak of carnosine (8 ppm). However, only 29 patients with active inflammation in sacroiliac joint showed elevated CRP values. In discordant group, 71.7% (33/46) cases showed carnosine peak although negative serologic results. Diagnostic concordance between CRP and MR finding had statistically significant (p <0.001). Carnosine peak and active inflammation had also significant (p <0.001). There was no statistically significant between other variables.

CONCLUSION
MR spectroscopy at 3.0-T with metabolite detection is a helpful method in spondyloarthritis. 8 ppm carnosine peak may be a promising inflammatory marker to detect and follow up active inflammation in spondyloarthritis.

CLINICAL RELEVANCE/APPLICATION
8 ppm carnosine peak add knowledge regarding inflammation. In the future, carnosine may be an inflammatory marker to evaluate activity
Psoriatic arthritis is a common comorbidity of Psoriasis vulgaris and affects approximately 25% of all patients with psoriasis. Occult clinical alterations of psoriatic arthritis might precede the onset of axial symptoms. Early and complete detection of Psoriatic arthritis is essential for a timely treatment initiation to prohibit joint destruction. The purpose of the study was to evaluate the contribution of 18F-Flouride PET/MRI for assessment of active inflammation in psoriatic arthritis of the hand.

**METHOD AND MATERIALS**

Morphological features were differentiated according to early (synovitis, tendonitis, bone oedema, soft tissue oedema and effusion) and advanced changes observed in psoriatic arthritis (bone erosions, joint-space-narrowing, joint-subsuffusion, interphalangeal ankylosis, dactylitis). Altogether 357 joints of patients’ hands with psoriatic arthritis were examined. Participants’ hands were examined according to a dual time point protocol with the Magnetom Biograph mMR PET/MRI-scanner (Siemens Healthcare, Germany) 5 and 90min after injection of 150MBq18F. Inflammation was assessed based on MR images using a 3 pointed Likert scale (0 = not present, 1 = moderate, 2 = extensive) and based on 18F Flouride PET images in terms of SUVmax.

**RESULTS**

In all 134/357 joints showed signs of inflammation in PET/MRI. The joint most often affected was the distal interphalangeal joint (47%), followed by the carpometacarpal (28%) and proximal interphalangeal joint (17%). Pearson’s coefficient demonstrated significant correlation between SUVmax as well as early and advanced morphological changes (p<0.05; r=0.525).

**CONCLUSION**

Simultaneous 18F-PET/MRI bears substantial diagnostic potential for the assessment of inflammation and morphological changes in patients with early and advanced stage of psoriatic arthritis.

**CLINICAL RELEVANCE/APPLICATION**

Integrated PET/MRI provides information about both, inflammation activity and morphological features observed in early as well as in advanced stage of psoriatic arthritis.

**Purpose**

Calcium pyrophosphate disease (CPPD) is a common condition involving hyaline and fibrocartilage. It’s potential for cartilage damage is now recognized. The aim of this study was to investigate the prevalence of CPPD of the temporomandibular joint (TMJ) in patients with CPPD in other joints.

**Method and Materials**

Medical record search over 1 year period revealed 227 patients who had a radiographic diagnosis of CPPD in the wrist, hand, or knee as well as a CT examination of the head. All radiographs and CT examinations were retrospectively reviewed by consensus of 2 PGYS to confirm CPPD in the peripheral joints, and assess for presence of calcification in the TMJ. The cases of TMJ calcification were then reviewed by an experienced musculoskeletal radiologist for confirmation of their findings. The prevalence was determined and the association with gender and age were statistically tested.

**Results**

There were 166 women, and 61 men (age range, 54-99 years). TMJ calcification was seen in 41 of 227 patients (18%). This included 3 men (7 %) and 38 women (93%). The involvement was bilateral in 34%, left sided in 46%, and right sided in 20%. There was a statistically significant increase with age, and the findings were significantly more common in women.

**Conclusion**

CPPD of the TMJ in patients with peripheral CPPD is common. The prevalence increases with age and is higher in women than men. Since CPPD may lead to cartilage damage in peripheral joints, it may play a similar role in the TMJ, resulting in TMJ pain and dysfunction.

**Clinical Relevance/Application**

1. CPPD of the TMJ is very common in patients with CPPD in other joints.2. Since CPPD may cause cartilage damage it could be involved in TMJ pain and dysfunction.
PURPOSE

To evaluate whether there is an association between meniscal extrusion at baseline and the incidence of knee OA after 6.6 years in a high-risk population, free of clinical and radiological knee OA at baseline.

METHOD AND MATERIALS

For our analysis we used data of the PROOF study. This preventive RCT evaluated a high-risk population of 407 middle-aged overweight and obese women (BMI ≥ 27kg/m²) at baseline and after 2.5 and 6.6 years of follow-up. Meniscal extrusion at baseline was defined as having an extrusion of grade 2 or higher on MRI according to the MOAKS criteria (≥ 3mm), which is scored in the medial as well as the lateral meniscus centrally (coronal image) and anteriorly (sagittal image). The primary outcome measure was either incidence of clinical OA according to the ACR criteria or radiographic knee OA (Kellgren & Lawrence grade 2 or higher), determined after both 2.5 and 6.6 years. Using generalized estimating equations (GEE), we determined the association between knees with and without meniscal extrusion and both outcomes, corrected for the baseline differences between the two groups.

RESULTS

645 knees were available for statistical analysis at baseline. Due to a dropout percentage of 33%, 431 knees remained after 6.6 years. At baseline, the completers showed a small but significant difference compared to the dropouts regarding BMI (p=0.013), physical activity level (p=0.048) and maximum strength of the quadriceps muscle (p<0.001). 24% had meniscal extrusion at baseline of which 95% involved the medial meniscus and 8% the lateral meniscus. A significant higher incidence of clinical OA was found in knees with meniscal extrusion compared to the control group (25.2% vs. 13.5%, adjusted odds ratio (OR) 2.19, 95% CI 1.15, 4.16). The incidence of radiographic knee OA was more than three times higher, but after 6.6 years this finding was not significant (31.3% vs. 9.9%, OR 1.76, 95% CI 0.86, 3.59).

CONCLUSION

Meniscal extrusion was associated with a significantly higher incidence of clinical knee OA after 6.6 years in a high-risk population of middle-aged overweight and obese women. Over time meniscal extrusion also leads to a rising incidence of radiographic knee OA.

CLINICAL RELEVANCE/APPLICATION

The results demonstrate the independent effect of baseline meniscal extrusion on the development of knee OA and therefore it is important that radiologists report the presence of meniscal extrusion on MRI.

SSG09-07 Changes in Subchondral Bone Mineral Density of the Femur and Tibia in Knee Osteoarthritis

Participants

Patrick Omou, MD, Lausanne, Switzerland (Presenter) Nothing to Disclose
Julien Favre, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Hugo Babel, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Brigitte Jolles-Haebeni, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE

Knee osteoarthritis (OA) is a painful and incapacitating disease affecting about one third of the population above 65 years old. There is currently no efficient cure to OA, due to an incomplete understanding of its pathophysiology. Previous studies suggest that bone could play a central role in the pathogenesis of OA. Bone mineral density (BMD) is particularly interesting because it is related to loads transmission (Wolff’s law) and thus to the mechanical constraints on cartilage. Traditionally, BMD has been assessed using two-dimensional dual-energy x-ray absorptiometry (DXA), thus allowing only crude evaluation of proximal BMD at the tibia. Recently, a method based on computed tomography (CT) was introduced, allowing 3D tibial and femoral assessment. This study aimed at characterizing the femoral and tibial subchondral BMD (sBMD) in non-OA and OA knees and determining the performance of sBMD at distinguishing healthy and OA knees.

METHOD AND MATERIALS

CT exams from 10 non-OA knees and 10 knees with severe medial OA, matched for age (60 ± 3 years old), gender (50% male) and bones size, were analyzed. Bones were segmented and three-dimensional models were reconstructed using custom software. Next, sBMD was calculated as three-dimensional maps based on the CT intensity in the most superficial 3mm of subchondral bone. Finally, average sBMD in the medial and lateral load-bearing regions were calculated to determine the tibial and femoral medial-to-lateral (M/L) sBMD ratios. Data were analyzed using unpaired t-tests and receiver operating characteristic (ROC).

RESULTS

The M/L sBMD ratios were significantly higher in OA compared to non-OA knees for the femoral condyles (1.13 HU± 0.08 Vs. 1.06 HU ± 0.02; p = 0.01) and tibial plateaus (1.14 HU± 0.03 Vs. 1.09 HU± 0.06; p = 0.01). High classification performances were obtained for the femur and the tibia, with area under the ROC curve of 0.95 and 0.83, respectively.

CONCLUSION

Femoral and tibial sBMD increase with knee OA, which could correspond to an adaptation of the bone to biomechanical changes, as supported by previous gait analyses. Our method is the first to allow the quantification of the femoral sBMD, which yielded to higher classification performance than the tibia.
CLINICAL RELEVANCE/APPLICATION

The analysis of sBMD following our technique based on clinical CT could improve our understanding of the pathophysiology of OA.

SSG09-08 Assessment of Metabolic and Structural Bone Abnormalities in Knee Osteoarthritis with Simultaneous PET and MR Imaging

Tuesday, Nov. 29 11:40AM - 11:50AM Room: E450B

Participants
Feliks Kogan, PhD, Stanford, CA (Presenter) Research Grant, General Electric Company
Audrey Fan, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Emily McWalter, PhD, Stanford, CA (Abstract Co-Author) Research support, General Electric Company
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Garry E. Gold, MD, Stanford, CA (Abstract Co-Author) Consultant, Boston Scientific Corporation Consultant, Olea Medical Research support, General Electric Company

PURPOSE

This study aims to investigate 18F-NaF PET-MR imaging to detect and characterize osseous metabolic abnormalities in patients with knee OA and correlate bony features of OA observed on MRI with 18F-NaF uptake on PET.

METHOD AND MATERIALS

Both knees of 12 subjects with radiographic knee OA were imaged on a 3T PET-MR hybrid system following injection of 2-5 mCi of 18F-NaF. Two MSK radiologists identified the following bony features of OA on MR images: Bone marrow lesions (BMLs) and osteophytes and subchondral sclerosis. The maximum pixel standardized uptake values (SUVmax) from volumes of interest (VOI) on PET images corresponding to bone pathology identified on MRI were compared. VOIs with SUV greater than 5 times the mean background bone SUV were identified (VOIhigh) on PET SUV maps.

RESULTS

BMLs observed on MRI consistently correlated with 18F-NaF PET VOIhigh (27/28). Further, SUVmax associated with BMLs was significantly higher than that of osteophytes or sclerosis (p<0.001), suggesting that BMLs are significantly more metabolically active. Additionally, significant correlations were observed between SUVmax and BML grade based off MOAKS scoring (p<0.05). Association between 18F-NaF VOIhigh and MRI findings of osteophytes (56/82) and sclerosis (6/11) was less consistent. However, there were significant correlations between SUVmax and osteophyte grade (p<0.05). Further, many of the small osteophytes used as early signs of OA on radiographs did not show uptake on PET. The sensitivity of 18F-NaF PET-MR to bone remodeling may help us to better understand and characterize these lesions in subchondral bone. A lack of metabolic activity may signal that certain pathology play a reduced role in OA progression. Of significant interest, high 18F-NaF uptake in subchondral bone did not always correspond to structural damage detected on MRI (42/132 VOIhigh). Subchondral bone is associated with pain as well as cartilage degeneration, and 18F-NaF PET-MR data suggests that metabolic abnormalities in the bone may occur prior to structural changes are seen on MRI.

CONCLUSION

PET-MRI allows for better understanding of the role of bony changes in OA pathogenesis. Additionally, 18F-NaF PET-MR may detect knee abnormalities unseen on MRI alone and is a promising tool for detection of early metabolic changes in OA.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates the potential of 18F-NaF PET-MR to evaluate metabolic bone activity in subchondral bone.

SSG09-09 To Evaluate the Role of 18F-FDG PET-CT in Evaluating the Lower Limb Prosthesis Implants infection

Tuesday, Nov. 29 11:50AM - 12:00PM Room: E450B

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (Presenter) Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the role of using 18F-FDG PET-CT for the detection of infection associated with lower limb prosthetic implants.

METHOD AND MATERIALS

Thirty seven prosthetic implants in 31 patients in whom infection was suspected after artificial hip or knee placement were evaluated with this technique. PET-CT images were obtained 60 -90min after an intravenous injection of FDG. The images were interpreted as positive for infection if tracer uptake was increased at the bone–prosthesis interface with or without CT structural abnormality. A final diagnosis was made by surgical exploration or clinical follow-up for 1 y. PET-CT results were compared with the follow-up outcome in all these patients.

RESULTS

The sensitivity, specificity, and accuracy of PET-CT for detecting infection associated with knee prostheses were 90.9%, 72.0%, and 77.8%, respectively. The sensitivity, specificity, and accuracy of PET–CT for detecting infection associated with hip prostheses were 90%, 89.3%, and 89.5%, respectively. Overall, the sensitivity was 90.5% and the specificity was 81.1% for detection of lower limb prosthesis infections.

CONCLUSION

Thus FDG PET-CT Is a useful imaging modality for detecting infections associated with lower limb arthroplasty and is more accurate for detecting infections associated with hip and knee prostheses as compared to other imaging modalities.

CLINICAL RELEVANCE/APPLICATION
PET-CT is more sensitive compared with other modalities for evaluation of Prosthetic infection
Musculoskeletal Tuesday Poster Discussions
Tuesday, Nov. 29 12:15PM - 12:45PM Room: MK Community, Learning Center

MK
AMA PRA Category 1 Credit ™: .50

Association of Weight Change with Progression of Meniscal Degeneration over 48 months: Data from the Osteoarthritis Initiative
Station #1

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

Sub-Events

MK314-SD-TUA1

PURPOSE
To investigate the association of different degrees of weight loss and weight gain with the rate of progression of meniscal degeneration over 48 months compared to weight-matched stable weight subjects.

METHOD AND MATERIALS
We selected 487 subjects (61.8±8.9 years, 302 women) from the Osteoarthritis Initiative with meniscal intrasubstance degeneration shown as hyperintense signal changes on baseline 3T MR images, but without more severe pathologies such as meniscal tears, who over 48 months lost weight (≥3% weight loss (WL), n=141), gained weight (≥3% weight gain (WG), n=92) or maintained a stable weight (SW; n=254). Subjects were frequency-matched for age, sex, baseline BMI, trauma, knee alignment and Kellgren-Lawrence scores. MRIs of the right knee were assessed for progression of meniscal intrasubstance degeneration to degenerative meniscal tears over 48 months and rates of progression were compared between the stable weight and two weight change groups, using multivariable linear and logistic regression models and generalized estimating equations.

RESULTS
The odds of meniscal intrasubstance degeneration worsening to meniscal tears in subjects with weight gain over 48 months were significantly higher compared to those of subjects with stable weight for both menisci (OR: 5.1 (95% CI 2.75-9.59), p<0.001) as well as for each meniscus separately (medial meniscus: OR: 7.0 (95% CI 3.72-13.34), p<0.001; lateral meniscus: OR: 2.9 (CI 1.23-6.85), p=0.01). Odds of progression of meniscal intrasubstance degeneration to meniscal tears in the WL group over 48 months were substantially lower compared to the SW group in the medial meniscus (OR: 0.5 (95% CI 0.30-1.10), p=0.09), yet this finding, as well as both menisci combined (OR: 0.6 (95% CI 0.33-1.26), p=0.2) were not statistically significant.

CONCLUSION
Our findings suggest that subjects with meniscal intrasubstance degeneration that gain weight are at significantly higher risk of developing meniscal degenerative tears. Also, weight loss in these subjects may be protective and decrease the risk of developing meniscal tears.

CLINICAL RELEVANCE/APPLICATION
Our study shows that weight gain in subjects with meniscal intrasubstance degeneration has a significant impact on the development of meniscal degenerative tears.

Assessment of Femoral Trochlear Morphology on Cross Sectional Imaging: Comparing the DeJour Classification and Quantitative Measurements in Patients Later Treated with Deepening Trochleoplasty
Station #2

Participants
Michael G. Fox, MD, Charlottesville, VA (Presenter) Stockholder, Pfizer Inc
Barrett Luce, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
David Diduch, MD, Charlottesville, VA (Abstract Co-Author) Consultant, Johnson & Johnson
Dustin Boatman, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of the study was to evaluate interobserver variability in the qualitative application of the DeJour classification for trochlear dysplasia with subsequent correlation to quantitative measurements of femoral trochlear morphology.
METHOD AND MATERIALS

A retrospective review was performed of CT and MRI knee exams from patients having deepening trochleoplasty surgery. Images were independently assessed by MSK radiologists with 1 and 19 years of experience. Each case was assigned to a Dejour category of trochlear dysplasia with quantitative measurements performed of the sulcus angle, tibial tubercle to trochlear groove distance (TT-TG), trochlear depth, lateral trochlear inclination, trochlear facet symmetry, and patellar lateralization.

RESULTS

31 knees from 27 patients were included in the study. In 77% (24/31) of the cases, the two readers were in exact agreement using the Dejour classification (kappa 0.69 [95% CI 0.48,0.89]) to qualitatively grade the degree of dysplasia. Of the remaining 7 cases, only 3 showed disagreement between a grading of low-grade (LG=Dejour A) versus high-grade (HG=Dejour B, C, or D) dysplasia. When comparing those considered LG (n=4) and HG (n=24) by both readers, there was agreement in >90% (28/31) of the cases when performing the assessment 3 cm cranial to the tibiofemoral joint. When analyzing the mean measurements of the 24 cases of exact Dejour agreement, sulcus angle (mean LG=153, mean HG=167, p<0.001), trochlear depth (mean LG=4, mean HG=0, p<0.001), lateral trochlear inclination (mean LG=12, mean HG=3, p<0.01), and lateralization of the patella (mean LG=6, mean HG=12, p<0.05) were significantly different between LG and HG dysplasia. Trochlear depth and lateral trochlear inclination were also significantly different between categories B and C and B and D (both with p<0.05).

CONCLUSION

There is good interobserver agreement when qualitatively applying the Dejour classification in grading trochlear dysplasia. The agreement improved when using a simplified LG (Dejour A) versus HG (Dejour B, C, and D) approach. In addition, quantitative measurements of femoral trochlear morphology can be used to differentiate between LG and HG trochlear dysplasia.

CLINICAL RELEVANCE/APPLICATION

Varying degrees of trochlear dysplasia can be reliably differentiated using both qualitative Dejour classification as well as quantitative measurements of femoral trochlear morphology.

MK316-SD-TUA3 Ultrasound- versus CT-guidance for Treatment of Sacroiliac Joint Arthritis with Steroid and O2-O3 Mixture Injections: Main Aspects, Advantages and Clinical Response in Young Women

Station #3

Participants

Fernando Smaldone, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Simone Quarchioni, 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
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the efficacy, accuracy and clinical response of US- versus CT-guided sacroiliac joint injections in young women affected by sacroiliac joint (SI) arthritis

METHOD AND MATERIALS

77 young female patients (mean age 38) affected by SI arthritis were treated with anaesthetics, steroid and O2-O3 mixture injections. Thirty-two out of 77 (41.5%) patients (Group A) were treated using US-guided injection and 45 out of 77 (58.4%) (Group B) with CT-guided injection. The patients were randomly assigned to each group. Exclusion criteria were histories of significant allergic reactions to inject solutions, local malignancy, bleeding disorders and diabetes. Symptoms intensity were evaluated with VAS scale before and after 3 and 6 months from treatment. We considered the advantages of both techniques in terms of procedure time, radiation exposure and clinical outcome

RESULTS

Twenty-four out of 32 (75%) patients (Group A) and thirty-three out of 45 (73%) patients (Group B) showed a significant improvement of symptomatology after 3 and 6 months. We observed a faster execution procedure and also no radiation dose exposure for patients belonging to Group A. We did not observe any major complications in both groups

CONCLUSION

Us-guided injection is a safe and effective procedure for sacroiliac joint arthritis with same results if compared to CT-guided treatment in terms of improvement of symptoms.

CLINICAL RELEVANCE/APPLICATION

US is preferred in young women in fertile age for its shorter duration times and lack of radiation dose exposure.

MK317-SD-TUA4 The Atrophic Phenotype of Knee Osteoarthritis is not Associated with Faster Progression of Disease: The Multicenter Osteoarthritis (MOST) Study

Station #4

Participants

Michel D. Crema, MD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC
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David T. Felson, MD, MPH, Boston, MA (Abstract Co-Author) Consultant, Zimmer Biomet Holdings, Inc
Michael C. Nevitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Monica D. Marra, MD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC
PURPOSE

In tibiofemoral compartments exhibiting fast progression of osteoarthritis (OA), osteophyte formation may lag behind cartilage loss, which might then manifest as an atrophic OA phenotype. The aim of this study was to assess the associations of atrophic tibiofemoral OA with progression of radiographic joint space narrowing (JSN) and magnetic resonance imaging (MRI)-defined progression of cartilage damage.

METHOD AND MATERIALS

Participants of the Multicenter Osteoarthritides (MOST) Study with available radiographic and 1.0T MRI assessments at baseline and 30 months follow-up (FU), were included. Radiographs were assessed according to the OARSI system for JSN and osteophytes (grades 0-3). Ten tibiofemoral regions were assessed on MRI for cartilage morphology (grades 0-6) and osteophytes (grades 0-7) using the WORMS system. On radiographs, atrophic OA was defined as OARSI grades 1 or 2 for JSN and grade 0 for osteophytes. On MRI, atrophic OA was defined as tibiofemoral cartilage damage grades ≥ 3 in at least 2 of 10 subregions with absent or equivocal osteophytes (grades 0 and 1) in all subregions. Progression of JSN and cartilage loss on MRI, was defined as 1) no, 2) slow, and 3) fast progression. Chi-square test and logistic regression with generalized estimated equations were performed to assess the association of atrophic knee OA with any progression, compared to non-atrophic OA knees (reference group).

RESULTS

A total of 476 knees from 432 participants were included. Using the radiographic definition, 50 (10.5%) had atrophic OA and 426 (89.5%) had non-atrophic OA knees at baseline. Using the MRI definition, there were 16 (3.4%) knees with atrophic OA and 460 (96.6%) with non-atrophic OA. Non-atrophic OA knees more commonly exhibited fast progression of JSN (p=0.002) and fast progression of MRI cartilage damage (p=0.02). Logistic regression showed that the atrophic phenotype of knee OA was modestly protective against progression of JSN and MRI when compared to non-atrophic OA knees.

CONCLUSION

In this sample of subjects with or at risk for knee OA the atrophic phenotype of knee OA did not predispose to more rapid progression compared to non-atrophic OA. Instead, the atrophic phenotype demonstrated a decreased risk for OA progression.

CLINICAL RELEVANCE/APPLICATION

Our results may potentially impact on subject selection in clinical trials of knee OA, as the atrophic phenotype is not associated with more progression of disease.

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

MK318-SDS-TUA5

T2* MAPPING OF PERONEAL TENDONS USING CLINICALLY RELEVANT SUBREGIONS IN AN ASYMPTOMATIC POPULATION

Participants

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Presenters

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PURPOSE

Quantify and analyze T2* mapping values in clinically relevant subregions of the peroneal brevis and longus tendons in an asymptomatic cohort. This will provide baseline normative values for future comparison with chronic and acute injuries of the tendon and will improve our understanding of the normal variation of these biomarker values within the tendons.

METHOD AND MATERIALS

Unilateral ankle scans with T2* mapping were acquired of 26 asymptomatic subjects in the prone position with a 3.0 T MRI system (axial plane, 2.5mm slice thickness, 0.54 x 0.54 mm in plane resolution, 4:47 acquisition time). The peroneal brevis and longus tendons were manually segmented and a bony landmark was placed at the most inferior and lateral point of the lateral malleolus. Six subregions, each 1 cm in length, were isolated along the length of the tendon including three subregions proximal to the lateral malleolus and three subregions distal (Table 1). Summary statistics for T2* values in each subregion were calculated as well as for the whole 6cm length of tendon (i.e. all subregions combined).

RESULTS

The peroneal brevis and longus tendons exhibited similar mean T2* values when the 6 cm length of tendon was analyzed as a whole, with 10.28 ± 2.37 ms (mean ± standard deviation) found in the brevis tendon and 10.75 ± 2.08 ms in the longus tendon. However, a trend of higher T2* values in the distal subregions was found. The distal subregions had significantly higher T2* values than the two most proximal subregions (proximal 2 and 3) of both the brevis and longus tendons (p<0.05). The subregional results are summarized in Table 1.
CONCLUSION

T2* mapping values were presented for the peroneal tendons with a focus on clinically relevant subregions. Regions immediately distal to the tip of the lateral malleolus had significantly higher T2* values than those proximal to the lateral malleolus. This study provides a quantitative methodology and a normative baseline of T2* mapping values for comparison with clinically compromised peroneal tendon patients (acute and chronic cases) in the future.

CLINICAL RELEVANCE/APPLICATION

Higher T2* values distal to the lateral malleolus could be clinically relevant to peroneal tendon tears that often initiate near the lateral malleolus, 5th metatarsal, inferior retinaculum and cuboid.

MK319-SD-TUA6  Efficacy of Ultrasound-guided Needle Tenotomy for the Treatment of Chronic Tendinopathies: Preliminary Results

Station #6

Participants
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PURPOSE

To determine the effectiveness of ultrasound-guided percutaneous needle tenotomy in terms of clinical improvement and tendon morphological recovery in patients with chronic tendinopathies.

METHOD AND MATERIALS

30 tendons (10 Achilles, 10 supraspinatus, 10 common extensor elbow) in 24 patients (14 men, 10 women, mean age 32.5 years, range 20-45). The patients underwent MRI and ultrasound examination following referral with clinical diagnosis of tendinosis (mean symptom duration 6 months) that had failed conservative treatment. Pre- and post-procedure (at 6 months follow-up) VAS scores were collected to assess patient clinical response. All patients were treated with sonographically guided percutaneous tenotomy. The procedure was performed twice, 3 weeks apart. All complications were recorded. Follow up ultrasound and MRI examination was performed 6 months after the treatment to evaluate tendon morphology.

RESULTS

Mean VAS scores were significantly lower at 6th month follow-up (2.2 ± 0.7) compared with the baseline (5.8 ± 0.6) in 80% of patients. The imaging follow up with sonographic assessment showed a reduction in overall tendon thickness and in the size of the area of tendinosis in 21 tendons (70%). MRI findings confirmed improvement of the tendon morphology and signal intensity in the same cases. 6 tendons showed no improvement (20%), in 3 tendons (10%) degenerative changes evolved.

CONCLUSION

The results of our study show that sonographically guided percutaneous needle tenotomy as a stand alone procedure is effective in reducing pain in patients with chronic tendinopathy without complications. Our imaging results confirm the effectiveness of the treatment in modifying tendon morphology.

CLINICAL RELEVANCE/APPLICATION

Dry needling shows promise as a cheap, safe and effective treatment, suitable for patients with degenerative tendon disease.

MK320-SD-TUA7  Comparing CT Derived Measures of Sarcopenia with Serum Biomarkers for Prediction of Survival in Patients with Colorectal Cancer

Station #7

Participants
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PURPOSE

Depleted muscle mass (sarcopenia) has been associated with adverse outcome for patients with colorectal cancer. The goal of this study is to compare CT derived measures of sarcopenia with established serum biomarkers for prediction of overall survival.

METHOD AND MATERIALS

Patients with colorectal cancer between were followed for at least 5 years following diagnosis. Baseline CT and CT 1 year after diagnosis were analyzed. Skeletal Muscle Index (SMI) of psoas and paraspinal muscles, and mean Hounsfield Units (HU) were measured at baseline, and 1year CTS. Interval change in parameters between baseline and 1 year were calculated. Measurements were taken at L4 level. Baseline carcinoembryonic antigen (CEA), Glasgow Prognostic Score (GPS) and neutrophil-lymphocyte ratio were measured. Multivariate Cox proportional hazard regression model was used to evaluate independent predictors of survival. Age, tumor stage and body mass index (BMI) were included in the model.
RESULTS

99 patients were included, mean (SE) age 65.1 (1.30) years, 36 females. Controlled for age, tumor stage and BMI, 1 year interval decrease in psoas muscle SMI was the strongest predictor of survival, Hazard Ratio (HR) = 26.80, p = 0.008. Baseline paraspinal SMI was also an independent predictor, HR = 0.53, p = 0.024. Neutrophil-lymphocyte ratio was also an independent predictor, HR = 1.16, p = 0.004. CEA, baseline psoas SMI, 1 year decrease in paraspinal SMI, GPS, were not significant independent predictive factors.

CONCLUSION

The decrease of psoas muscle SMI one year after diagnosis of colorectal cancer is an independent predictor of survival, as are, to a lesser extent, baseline paraspinal SMI and neutrophil-lymphocyte ratio.

CLINICAL RELEVANCE/APPLICATION

The findings of this study highlight the importance of CT derived measures of sarcopenia as imaging biomarkers predictive of clinical outcome for patients with colorectal cancer.

MK115-ED-TUA8 The Scapulothoracic Articulation: Often Imaged, but Rarely Discussed

Station #8

Participants
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TEACHING POINTS

Review the anatomy and biomechanics of the scapulothoracic (ST) articulation Review clinical presentations Present an approach to the imaging findings within congenital, systemic, inflammatory/infectious, neoplastic, traumatic, and surgical categories Present case examples to illustrate approach to ST articulation pathology

TABLE OF CONTENTS/OUTLINE

Background The ST articulation is important in coordinating movement of the shoulder Although this articulation is imaged on all chest radiographs and CT studies, pathology is often unexpected and may be overlooked in this location Knowledge of the anatomy, biomechanics, clinical presentation, and systematic approach will help radiologists characterize and identify pathologyAnatomy Scapula ST articulationBiomechanics Motion StabilityClinical Presentation ST dislocation ST crepitus Scapular winging and dyskinesiaCase Examples Congenital - Sprengel deformity, hemiatrophy Systemic - calcification from dermatomyositis, renal osteodystrophy Inflammatory/infectious - bursitis, abscess, osteomyelitis Neoplastic - elastofibroma dorsi, lipoma, multiple hereditary exostosis, myeloma, metastasis Trauma - fracture, hematoma, subcutaneous emphysema, winging, dissociation Surgical - thoracic wall resection, forequarter amputation

MK213-ED-TUA9 Multiligamentous Knee Injury: Putting Together the Pieces

Station #9

Participants
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TEACHING POINTS

After reviewing this exhibit, the learner will be able to:1. Discuss the anatomy and function of the major and minor static and dynamic stabilizers of the knee2. Describe the common imaging patterns of multiligamentous knee injuries using a mechanism-based approach3. List pearls for increasing recognition of injuries to specific stabilizing structures4. Appreciate the orthopedic surgeon's perspective on multiligamentous knee reconstructions

TABLE OF CONTENTS/OUTLINE

Introduction-Anatomy of key posterolateral, posteromedial, anterolateral and anteromedial supporting structures of the knee Function of key static and dynamic stabilizers of the knee-Case-based, mechanism-specific imaging review of multiligamentous knee trauma (i.e. pivot shift injury, posterior knee dislocation, etc.)-Orthopedist perspective on multiligamentous knee reconstruction including: -How the radiologist adds value -Which structures are repaired and why -Patient population specific surgical approaches (i.e. elite athlete, weekend warrior, etc.)Outcomes of multiligamentous knee reconstructionImaging evaluation of ligamentous reconstructionSummary

MK269-ED-TUA10 Imaging findings in Polymyalgia Rheumatica: A Pictorial Essay

Station #10

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It's Not a Tumor! A Comprehensive Review of Musculoskeletal Masses Often Mistaken for Neoplasm

TEACHING POINTS

LEARNING OBJECTIVES
• This study aims to illustrate the cases of polymyalgia rheumatica (PR) emphasizing the imaging findings that may contribute for the specific diagnosis of this entity.
• Illustrate the main image patterns of polymyalgia rheumatica that should make the radiologist think of this pathology: including the classical imaging findings and some possible new findings related to this pathology that we have been observed in our institution.
• Illustrate the main affected sites of this pathology.
• Illustrate the typical patterns of PR in different imaging methods, such as ultrasonography, PET-scan and magnetic resonance imaging (MRI).
• Emphasize the differential diagnosis of PR

TABLE OF CONTENTS/OUTLINE

1. Introduction: prevalence PMR and its clinical importance
2. Brief diagnostic approach review - clinical setting - laboratory findings - imaging examination approach
3. Review of the imaging findings: in ultrasonography, PET-scan and magnetic resonance imaging (MRI) - classical findings already described in literature - some possible new imaging finding that may be related to this pathology
4. Review of imaging findings based on clinical cases
5. Review of the main differential diagnosis
6. Conclusion

MK259-ED-TUA11

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TEACHING POINTS

Understand general imaging features that can help differentiate between non-neoplastic and neoplastic masses
Describe the characteristic imaging features of the most common non-neoplastic masses
Develop a differential diagnosis for etiologies of non-neoplastic masses

TABLE OF CONTENTS/OUTLINE

I. Pre-test
II. Post-Traumatic Masses
   A. Heterotopic ossification (myositis ossificans)
   B. Hemolymphatic collection (Morel-Lavallee lesion)
   C. Hematoma
III. Iatrogenic and Postsurgical Masses
   A. Fat extravasation from augmentation gluteoplasty
   B. Vascularized soft tissue graft
   C. Calcium gluconate extravasation
IV. Cystic Masses
   A. Para-meniscal cyst
   B. Para-labral cyst
   C. Ganglion cyst
   D. Synovial cyst
V. Masses in the Setting of Deposition Disease or Dysplasia
   A. Intraosseous migration of calcific tendinosis
   B. Tophaceous gout
   C. Pyrophosphate arthropathy with pseudomass
   D. Giant cell tendon sheath tumor and pigmented villonodular synovitis
   E. Tumoral calcinosis
   F. Melorheostosis
VI. Fibrous/Reactive Masses
   A. Elastofibroma
   B. Fibromatosis
   C. Morton Neuroma
VII. Bursae
   A. Anatomic bursae
   B. Adventitial bursae
VIII. Post-test
**Evaluation of the Synovium using Double Inversion Recovery Sequence at the Knee Joint: Comparison with Contrast-enhanced T1-weighted Fat-Saturated Image**

Station #1

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

Sub-Events

**Purpose**
To investigate the efficacy of the double inversion recovery (DIR) in evaluation of the synovium at the knee joint without contrast enhancement.

**Method and Materials**
Institutional review board approval was obtained. 34 knees from 33 patients (M:F = 11:22; mean age, 41.35 years) were included. Two radiologists (R1 and R2) performed independent analysis of paired MR images [DIR image and contrast-enhanced T1-weighted fat-saturated image (CET1FS)] at each five level of the knee joint for four-point visual score and a location with the thickest synovium. If both visual scaling and the location of the thickest synovium were concordant by two reviewers, the maximum synovial thickness on each sequence and each level was measured by consensus between R1 and R2. The synovium-to-effusion signal ratio (SER) and the synovium-to-bone signal ratio (SBR) for DIR and CET1FS images were assessed at each level.

**Results**
Inter-observer agreement between R1 and R2 for four-point scale was good (κ = 0.736). And inter-observer agreements for location of the thickest synovium on DIR and CET1FS were very good (κ = 0.955 and 0.954, respectively). Inter-sequential agreements between DIR and CET1FS for location of the thickest synovium were very good (R1, κ = 0.845; R2, κ = 0.828). The mean thicknesses of the synovium, mean SERs, and mean SBRs were 3.62±1.75 mm on DIR and 3.08±1.55mm on CET1FS; 4.55 and 2.22; and 14.63 and 4.07, respectively. The synovial thickness on DIR and CET1FS showed a statistically excellent correlation (r=0.872).

**Conclusion**
DIR sequence for evaluating the synovium at the knee joint showed good correlation with CET1FS sequence. DIR may be a one of useful MR techniques for evaluating the synovium of the knee without contrast enhancement.

**Clinical Relevance/Application**
The application of DIR sequence makes it possible to differentiate the synovium of the joint without contrast enhancement, and also may be helpful for patients with contrast allergy and for reducing the imaging time.

**Voxel-based Analysis of SUVs and ADCs in a PET/MR System: Initial Experience in the Evaluation of Treatment Effect of Soft-tissue Tumors**

Station #2

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**Purpose**
To investigate the feasibility of the voxel-by-voxel comparisons of SUVs and ADCs in the evaluation of the treatment effect in soft-tissue tumors.

**Method and Materials**
Eight patients with soft-tissue tumors (3 osteosarcomas, 2 pleomorphic sarcomas, 1 synovial sarcoma, 1 MPNST and 1 clear cell sarcoma) were examined with Ingenuity TF PET/MR system (Philips Healthcare) before and after the treatment. Five patients underwent chemotherapy and 3 patients underwent heavy-particle radiotherapy. Zoomed diffusion-weighted image (DWI) (b = 0 and 800), and 18FDC-PET (4.0 MBq/kg FDG) were acquired along with fat-suppressed T2-weighted image (T2WI). Image registration was performed on a workstation (ISP6.0, Philips Healthcare) and post-processing was performed by using Image J software (version 1.43, NIH). The regions of interest (ROIs) were manually drawn on T2WI to include the tumor in all slices. The ROIs were copied and pasted on the ADC maps and PET images. The tumor ROIs were extracted and reconstructed in 4 mm resolution. The ADCs and SUVs within the tumor ROIs were recorded in a voxel-by-voxel manner, and voxel-based SUV/ADCs were calculated. The scatter plots of SUV vs. ADC and SUV/ADC vs. ADC were generated for each tumor. The indicators of SUVpeak, ADCmin, tumor volume, slopes of linear regression of SUV/ADC vs. ADC and correlations between SUVs and ADCs were compared between the pre- and post-treatment.

RESULTS
The correlation coefficient between SUV and ADC significantly increased (-0.52 ± 0.14 vs. -0.23 ± 0.21, P < 0.01) and the slope of linear regression of SUV/ADC vs. ADC significantly decreased (-3.42 ± 1.22 vs. -1.82 ± 1.79, P < 0.05) after treatment. In contrast, the conventional indicators of tumor volume, SUVpeak, and ADCmin did not show significant differences between pre- and post-treatment. In a representative case of pleomorphic sarcoma, the treatment effect was clearly demonstrated after heavy-particle radiotherapy (figure).

CONCLUSION
Voxel-based analysis of SUVs and ADCs with PET/MR hybrid systems is useful for the evaluation of the treatment effect in soft-tissue tumors.

CLINICAL RELEVANCE/APPLICATION
Voxel-based analysis of SUV and ADC with PET/MR system provides unique biomarkers such as the SUV-ADC correlation coefficient and the slope of SUV/ADC for the early determination of tumor response.

Contrast-Enhanced Ultrasound (CEUS) in Diagnosis, Evaluation, and Management of Soft Tissue Sarcoma (STS)

METHOD AND MATERIALS
20 patients with clinically suspected STS underwent CEUS. All underwent subsequent image-guided biopsy. Enhancement pattern: masses were categorized as P1 (non-enhancing), P2 (peripherally enhancing with central necrosis), P3 (heterogeneously enhancing with necrotic foci), or P4 (homogeneously enhancing). QA included evaluation of enhancing tumor, necrotic tumor, and adjacent skeletal muscle (control) parameters including time to peak (TTP) and wash in slope (WIS), with generation of time-intensity curves (TIC). Comparison was made to contrast-enhanced CT/MRI as available. Follow-up CEUS exams were also performed on 3 patients after neoadjuvant chemotherapy (NAC). The ADCs and SUVs within the tumor ROIs were recorded in a voxel-by-voxel manner, and voxel-based SUV/ADCs were calculated. Comparison was made to contrast-enhanced CT/MRI as available. Follow-up CEUS exams were also performed on 3 patients after neoadjuvant chemotherapy (NAC).

RESULTS
Enhancement pattern: Of the 20 masses, none were non-enhancing (P1) on initial CEUS. 7 (35%) were peripherally enhancing with central necrosis (P2), and 11 (55%) were heterogeneously enhancing with internal necrotic foci (P3). All 18 masses with either P2 or P3 enhancement patterns were biopsy proven STS (100%). 2 masses demonstrated homogenous enhancement (P4); both were biopsy-proven lymphoma. Interestingly, both masses with P4 pattern were clinically suspected to be STS until CEUS and biopsy. QA: All 18 biopsy-proven STS demonstrated a typical enhancement pattern on TIC, with higher P1 and steeper WIS of tumor relative to control (skeletal muscle). 3 patients demonstrated a quantifiable increase in tumor necrosis following NAC, from a mean of 21% necrosis on pre-therapy CEUS to 54% necrosis following NAC. CEUS exam results correlated closely with contemporaneous CT/MRI (available in 18 of 20 patients, or 90%).

CONCLUSION
CEUS enhancement patterns of STS are distinct (P2 or P3), and may differentiate STS from lymphoma, which typically shows homogeneous enhancement (P4); STS also demonstrate a typical TIC on CEUS, with higher P1 and steeper WIS than adjacent muscle. Finally, a subgroup of patients undergoing NAC demonstrated an expected, quantifiable increase in tumor necrosis during STS treatment, correlating closely with CT/MRI.

CLINICAL RELEVANCE/APPLICATION
CEUS may aid in initial diagnosis, evaluation, and treatment monitoring of STS.

Magnetic Resonance Imaging of the Sacroiliac Joints in SpA: The Real Added Value of Intravenous Contrast Media

METHOD AND MATERIALS
Eight patients with SpA underwent MRI before and after intravenous injection of a contrast agent (gadolinium). The images were analyzed for the presence of erosions, bone remodeling, and bone marrow edema. The efficacy of the contrast agent was compared to that of a conventional agent, and the results were correlated with clinical outcomes.

RESULTS
The contrast agent showed superior visualization of bone marrow edema compared to the conventional agent. The sensitivity and specificity for detecting erosions were increased with the contrast agent. The correlation between MRI findings and clinical outcomes was stronger with the use of the contrast agent.

CONCLUSION
The use of intravenous contrast agents in MRI for the evaluation of SpA can provide additional information beyond that obtained with conventional agents, improving the accuracy of diagnosis and prediction of treatment response.
This study showed that beyond demographic data, X-ray based KL score, and MRI-based WORMS and cartilage T2 aid in the prediction of symptomatic or radiographic OA over 8 years. The IDI showed that baseline KL grade (IDI=0.03, p=0.00009), WORMS max. score (the maximum of all compartments), and cartilage T2 (5 knee compartments) improve the prediction of radiographic or symptomatic OA.

**RESULTS**

Thirty patients (16 females, mean age of 51 years, range 29–75, with a diagnosis of SpA and active sacroiliitis at MRI with I.V. contrast material, were considered for a follow up MRI after 6 months of TNF antagonists therapy. Finally, 25 patients completed the study. Disease activity was monitored in 17 patients by a BASDAI questionnaire every 2 weeks and BASFI at baseline and at 6 months. MRI was performed with a 1.5 T MR unit (Signa Twin Speed Hdxt; General Electric Healthcare), before and after I.V. injection of gadobenate dimeglumine (Gd-BOPTA, 0.1mg/kg).

**CONCLUSION**

The evaluation of enhancement is a clear predictor of response to therapy in SIJ involvement in SpA, better than BMO; hence it should be strongly advised in the MRI of these patients.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates the improved accuracy of MRI with contrast media in the assessment of active sacroiliitis, both at the time of diagnosis and in evaluating the response to anti TNF therapy.

**Purpose**

Predicting the Development of Osteoarthritis over 8 Years using Baseline Clinical Data and MR Imaging: A Preliminary Study using Data from the Osteoarthritis Initiative

**Method and Materials**

775 subjects with no or mild radiographic OA (Kellgren Lawrence (KL) 0-2) and no or mild symptoms (WOMAC 0-3) in the right knee were selected from the Osteoarthritis Initiative (OAI) database. Compartment-specific baseline 3T MRI readings (WORMS scoring) and cartilage T2 quantification were performed. The outcome was moderate to severe radiographic or symptomatic OA defined by: progression of any knee replacement (TKR) over 8 years, progression to KL 3-4 over 8 years, or progression to a WOMAC pain score of >=5 at 7 or 8 year follow-up. Integrated discrimination Index (IDI, a measure of the prognostic improvement of a model when adding variables) was used to determine baseline risk factors (previous injury, family history of TKR), KL score, WORMS max. score (the maximum of all compartments), and cartilage T2 (5 knee compartments) improve the prediction of radiographic or symptomatic OA compared to a base model (age, gender, BMI) using stepwise forward selection.

**Results**

Subjects had a mean age of 56.1±7.1 years, a mean BMI of 27.2±4.3 kg/m2, and 58.3% were female. 57 subjects (7.4%) developed symptomatic or radiographic OA at follow-up. The IDI showed that baseline KL grade (IDI=0.03, p=0.00009), WORMS max. score (IDI=0.02, p=0.001), and cartilage T2 (medial femur: IDI=0.02, p=0.03; patella: IDI=0.006, p=0.008) significantly improved model performance compared to the base model. The AUC of the base model was 0.59; the AUC of the base+KL model was 0.70 (p=0.01 vs. base model); the AUC of the final model (base+KL+WORMS+T2) was 0.76 (p=0.0003 vs. base model; p=0.05 vs. base+KL), Figure 1.
This study showed that, beyond demographic data, X-ray based KL score, and MRI-based WORMS and cartilage T2 aid in the prediction of symptomatic or radiographic OA.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates that the addition of MR imaging data to baseline clinical and demographic data improves the prediction of symptomatic or radiographic osteoarthritis over 8 years.

**MK326-SD-TUB6**  
**An Imaging-based Method to Identify Regulators of Muscle Regeneration**

Participants

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**PURPOSE**

In order to enable the development of new musculoskeletal therapeutics, we devised and applied a small animal imaging-based strategy to identify secreted proteins (biologics) capable of enhancing stem cell-mediated muscle regeneration.

**METHOD AND MATERIALS**

All animal procedures were approved by the Stanford University School of Medicine IACUC. Primary muscle stem cells (MuSC) were isolated from donor mice expressing a luciferase-GFP transgene, and were treated in vitro with pools of recombinant proteins derived from a library of secreted or transmembrane proteins (563 clones representing 329 genes). Stem cell proliferation was monitored by bioluminescence imaging (BLI) over 6 days in vitro, followed by direct intramuscular transplant of treated cells into immunodeficient recipient mice. Stem cell engraftment and proliferation were monitored by BLI in vivo at 7, 30 and 60 days post-transplant. Positive pools were deconvolved to individual proteins through iterative rounds of imaging-based re-screening.

**RESULTS**

Biluminescence imaging allowed quantitative evaluation of the response of stem cells to biologics. Our imaging-based screening strategy succeeded in evaluating complex mixtures of proteins for biological activity in vivo, leading to the identification of the IL-6 family cytokine Oncostatin M (OSM) as a potent inducer of muscle stem cell engraftment. Treatment of stem cells with OSM allowed their prolonged culture in vitro while maintaining 'stemness' and transplantation potential. Genetic deletion of the OSM receptor in muscle stem cells severely blocked regeneration after muscle injury, demonstrating a critical but previously unknown role for OSM in muscle repair.

**CONCLUSION**

We conclude that in vivo imaging techniques can be successfully applied to identify novel, pharmacologically relevant pathways of musculoskeletal regeneration. This imaging-based approach is sensitive, specific, generalizable, and bypasses many traditional inefficiencies of drug discovery by moving pathway and target identification in vivo.

**CLINICAL RELEVANCE/APPLICATION**

Biologics which activate muscle regeneration may improve the treatment of disorders characterized by stem cell dysfunction, including sarcompenia, cancer cachexia, and congenital muscular dystrophies.

**MK327-SD-TUB7**  
**In Need of Reference Values: Shear Wave Elastography (SWE) of Healthy Achilles Tendons: A Comparison Between Professional Athletes and the Non-Athletic General Population**

Participants

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Christiane K. Kuhl, Aachen, 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 a useful tool to evaluate tendon stiffness, e.g. in diagnosing tendinopathies, as diseased tendons are intra-individually softer than healthy ones. But inter-individual reference values between different population groups and ages are still missing. Purpose of this prospective clinical study was to comparatively analyze tendon stiffness in professional athletes and non-athletic persons.

**METHOD AND MATERIALS**

Prospective study in 70 asymptomatic healthy participants, 35 (50 %) of them professional athletes with at least 3 training units of running per week and 35 (50 %) normal non-athletic persons, asymptomatic respectively. A consecutive of 140 Achilles tendons underwent standardized multi-modal US consisting of B-mode US (US), power Doppler (PD-US), and SWE, using a high-resolution linear 15 MHz probe (Aixplorer, Supersonic). Semi-quantitative-analysis of SWE-color-charts and quantitative, ROI-based-analysis of tendon elasticity were performed. SWE values of athletes and non-athletes were compared using student’s t-test.

**RESULTS**

Mean SWE-value for Achilles tendon was 183.8 kPa (± 98 kPa) in athletes and 103.6 kPa (± 30.5 kPa) in the non-athletic control group. The difference between athletes and non-athletic participants was statistically significant (p<0.001). No significant changes were found between right and left side intra-individually. At semi-quantitative analysis of SWE-color-charts, athlete-tendons were rated as “soft” in 1/70 (1.4 %), as “intermediate” in 12/70 (17.1 %) and as “rigid” in 57/70 tendons (81.5 %). Non-athlete tendons
were rated as "soft" in 25/70 (35.7%), as "intermediate" in 34/70 (48.6%) and as "rigid" in 11/70 (15.7%).

**CONCLUSION**

Tendon stiffness differs significantly between healthy athletes and healthy non-athletes. Athletes exhibit significantly higher SWE-values in Achilles tendons, that is to say they have stiffer tendons. This might be caused by repeated training effects. SWE is able to measure and display these effects. Inter-individual varieties should be taken into consideration, especially when rating tendon-stiffness in symptomatic persons, emphasizing that intra-individual comparison is of particular interest.

**CLINICAL RELEVANCE/APPLICATION**

SWE appears to be useful to monitor tendon stiffness, especially in athletes or patients with tendinopathies. Knowledge about reference values is crucial in this context.

**Awards**

Certificate of Merit

**Participants**

Antonio Leone, MD, Rome, Italy (Presenter) Nothing to Disclose
Victor N. Cassar-Pullicino, MD, Oswestry, United Kingdom (Abstract Co-Author) Nothing to Disclose
Cesare Colosimo, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

1. Provide sonographic imaging features of commonly encountered palpable masses
2. To demonstrate that some palpable masses can be definitively diagnosed with ultrasound, while concerning features should prompt further evaluation.

**TABLE OF CONTENTS/OUTLINE**

1. Commonly Encountered Palpable Masses Imaging Features of common lesions
   a. Knee - Baker's cyst; Popliteal aneurysm
   b. Lower Extremity - venous thrombosis.
   c. Foot - Morton's neuroma; Plantar fibroma.
2. Neoplasm- imaging features that lead to definitive diagnosis and those that should prompt further evaluation.
   a. Lipoma
   b. Atypical Lipoma
   c. Hemangioma
   d. Nerve Sheath Tumor
   e. Lymphadenopathy
   f. Sarcoma3. Miscellaneous- Ganglion
   g. Abscess
   h. Hematoma
   i. Morel Lavallee
   j. Sebaceous cyst/Epidermal cyst4. Mimics of Masses:
   a. Tendon tears - biceps, planters, quadriceps, achilles.
   b. Bursitis - prepatellar bursitis, olecranon bursitis.
   c. Ligament tear - UCL tear; stener lesion.
Musculoskeletal Abnormalities: A Clue to Systemic Diseases

Station #11

Participants
Leonor G. Savarese, MD, Ribeirao Preto, Brazil (Presenter) Nothing to Disclose
Mateus A. Hernandes, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Marcelo N. Simao, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Douglas J. Racy, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo M. Agnollitto, MD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Marcello H. Nogueira-Barbosa, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Jorge Elias Jr, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose
Valdair F. Muglia, MD, PhD, Ribeirao Preto, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To describe the most relevant musculoskeletal imaging findings of systemic diseases.
2. To recognize clues that may suggest a systemic cause for musculoskeletal abnormalities.
3. To list the main differential diagnosis based on musculoskeletal manifestations and suggest further investigation of a previously unsuspected systemic disease.

TABLE OF CONTENTS/OUTLINE
Many systemic diseases share underlying musculoskeletal (MSK) manifestations, which may respond for the patient’s initial symptoms. In this review, we describe systemic conditions that may manifest by MSK abnormalities, grouping by etiology: a-metabolic and deposition diseases (e.g., renal osteodystrophy, amyloidosis, Gaucher’s disease); b-inflammatory diseases (e.g., inflammatory bowel disease-associated arthropathy, mastocytosis); c-infectious diseases (e.g., tuberculosis, paracoccidiodomycosis); d-vascular diseases (e.g., Maffucci syndrome); e-hematologic diseases (e.g., sickle cell disease) and; f-neoplastic diseases (e.g., Erdheim Chester, Gardner’s syndrome). All cases were confirmed either by histology or based on clinical history, serologic tests and follow-up. This exhibit will provide a comprehensive imaging review, helping general radiologists to recognize a previously unsuspected systemic disease based on an initial MSK manifestations and suggests further investigation.
Interventional Oncology Series: Lung and Musculoskeletal

Tuesday, Nov. 29 1:30PM - 6:00PM Room: S405AB

Participants
Matthew R. Callstrom, MD, PhD, Rochester, MN, (Callstrom.matthew@mayo.edu) (Moderator) Research Grant, Thermedical, Inc. Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd
Sean M. Tutton, MD, Milwaukee, WI (Moderator) Consultant, Benvenue Medical, Inc

LEARNING OBJECTIVES
1) Describe patients that are appropriate for ablation for lung and MSK tumors. 2) Describe the relative role of ablation with other treatments for lung and MSK tumors. 3) Describe outcome of the use of ablation for the treatment of lung and MSK tumors.

ABSTRACT

Sub-Events
VSIO31-01 Ablation Should Be First Option for Limited Metastatic Disease

Tuesday, Nov. 29 1:30PM - 1:50PM Room: S405AB

Participants
Stephen B. Solomon, MD, New York, NY (Presenter) Research Grant, General Electric Company

VSIO31-02 Possibility of Pathological and Genetic Analysis of Percutaneous Needle Biopsy Performed Immediately after Lung Radiofrequency Ablation

Tuesday, Nov. 29 1:50PM - 2:00PM Room: S405AB

Participants
Takaaki Hasegawa, Nagoya, Japan (Presenter) Nothing to Disclose
Chiaki Kondo, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Yozo Sato, MD, PhD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Yoshitaka Inaba, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Hidekazu Yamaura I, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Mina Kato, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Shinich Murata, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Yui Onoda, MD, Shinagawa-ku, Japan (Abstract Co-Author) Nothing to Disclose
Yasushi Yatabe, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the possibility of pathological diagnosis and genetic mutation analysis for the specimen of percutaneous needle biopsy obtained immediately after lung radiofrequency ablation (RFA).

METHOD AND MATERIALS
During May 2013 to February 2016, 19 patients (8 male and 11 female; median age, 68 years; range, 52–88 years) underwent percutaneous needle biopsy immediately after RFA for 19 lung tumors of 0.5–2.6 cm (mean, 1.6±0.5 cm). Thirteen tumors were solid and 6 were consisted dominantly of ground-glass opacity (GGO). All specimens were pathologically classified using standard hematoxylin and eosin (H&E) staining and adding immunostaining as necessary. Genetic mutation of EGFR and KRAS was examined for the specimens containing tumor cells. The safety and technical success of the procedure and the possibility of pathological diagnosis and genetic mutation analysis were evaluated. Safety of the whole procedure was evaluated by using complication grading system of the Society of Interventional Radiology.

RESULTS
Nineteen patients were completed with both lung RFA and needle biopsy. Major complications occurred in 2 patients (11%, 2/19) (grade-D aseptic pleuritis (n=1) and grade-C pneumothorax with tube placement (n=1)) and minor complications occurred in 9 patients (47%, 9/19) (grade-B pneumothorax without tube placement (n=8) and self-limiting hemoptysis (n=1)). Tumor seeding was not seen during the median follow up of 9 months (range, 1-28 months). Tumor tissue was obtained in 16 patients, so technical success rate was 84% (16/19). Only normal pulmonary epithelium was obtained in 3 patients (16%, 3/19) with GGO dominant tumors. Pathological diagnosis was achieved in 14 patients, so pathological diagnosability rate was 74% (14/19). Although atypical cell was obtained, pathological diagnosis was not able to determine in 2 patients. Among 16 specimens containing tumor cell, both EGFR and KRAS mutation was able to analyze in 13 specimens (68%, 13/19). EGFR mutation could not be evaluated in 1 patient and KRAS mutation could not be in 2 patients, due to insufficient tumor cells.

CONCLUSION
Pathological diagnosis and genetic analysis were possible even for specimen obtained immediately after RFA for lung tumor.

CLINICAL RELEVANCE/APPLICATION
Percutaneous needle biopsy was feasibly performed immediately after lung RFA and the obtained specimen could be evaluated pathologically or genetically.
METHOD AND MATERIALS

This prospective, single arm, two-centre study received IRB approval. 102 patients (female: 38, male: 64, mean age: 62.3) with painful bone metastases were enrolled. 121 non-spinal lesions underwent MRgFUS treatment using ExAblate 2100 system (InSightec). European Organization for Research and Treatment of Cancer QLQ- BM22 was used for clinical assessment additionally to Visual Analog Scale (VAS), at baseline and 1, 3 and 6 months after treatment. All patients underwent CT and MRI before treatment (InSightec). Participants

Participants

Alessandro Napoli, MD, Rome, Italy (Presenter) Nothing to Disclose
Andrea Leonardi, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Andrani, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Vincenzo Noce, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Alberto Bazzocchi, MD, Bologna, Italy (Abstract Co-Author) Nothing to Disclose

LEARNING OBJECTIVES

1) Develop an understanding of the technique using CT-guided placement of radionucleotide to localize small indeterminate lung nodules to facilitate thoracoscopic resection. At the conclusion of the presentation the learner should have an understanding of the rationale for such an approach, the technical details of performing this technique, the indications for the technique and the outcomes of surgery performed using this technique.

ABSTRACT

VATS Resection with Radionucleotide Localization - Effective Treatment for Small Lung Nodules

Tuesday, Nov. 29 2:20PM - 2:40PM Room: S405AB

Participants

Robert K. Shen, MD, Rochester, MN, (shen.krobert@mayo.edu) (Presenter) Nothing to Disclose

PURPOSE

To evaluate the efficacy of non-invasive high intensity MR guided focused Ultrasound Surgery (MRgFUS) for pain palliation of bone metastasis in patients over a large population.

METHOD AND MATERIALS

This prospective, single arm, two-centre study received IRB approval. 102 patients (female: 38, male: 64, mean age: 62.3) with painful bone metastases were enrolled. 121 non-spinal lesions underwent MRgFUS treatment using ExAblate 2100 system (InSightec). European Organization for Research and Treatment of Cancer QLQ- BM22 was used for clinical assessment additionally to Visual Analog Scale (VAS), at baseline and 1, 3 and 6 months after treatment. All patients underwent CT and MRI before treatment and 3-6 months afterward.

RESULTS

No treatment-related adverse events were recorded. 48/102 (47%) patients reported complete response to treatment and discontinued medications. 39/102 (38.2%) experienced a pain score reduction >2 points, consistent with partial response. Remaining 15 (14.7%) patients had recurrence after treatment. Statistically significant differences between baseline (6, 95%CI 5-
8) and follow-up (2, 95%CI 0-3) VAS values and medication intake were observed (p<0.05). Similarly a significant difference was found for QLQ-BM22 between baseline and follow-up (p<0.05).

CONCLUSION
MRgFUS can be safely and effectively adopted for treatment of painful bone metastases.

CLINICAL RELEVANCE/APPLICATION
MRgFUS can be safely and effectively used as totally noninvasive treatment for pain palliation of acoustically accessible bone metastasis

**VSI031-06 Cryoablation is the Best Option for Ablation of Pulmonary Metastases**

Tuesday, Nov. 29 2:50PM - 3:10PM Room: S405AB

Participants
Thierry Debaere, Villejuif, France (Presenter) Consultant, Terumo Corporation; Speaker, Terumo Corporation; Proctor, Galil Medical Ltd; Data Safety Monitoring Board, Medtronic plc

LEARNING OBJECTIVES
1) Select best candidate for lung cryoablation. 2) Apply adequate treatment algorithm for cryoablation in the lungs. 3) Understand pattern of imaging follow-up after lung cryoablation.

**VSI031-07 MW not RF Ablation is the Best Option for Ablation of Pulmonary Metastases**

Tuesday, Nov. 29 3:10PM - 3:30PM Room: S405AB

Participants
Damian E. Dupuy, MD, Providence, RI (Presenter) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

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/

Damian E. Dupuy, MD - 2012 Honored Educator

**VSI031-08 Mid-Term Ablation Zone Evolution Following Microwave Ablation of Normal Swine Lung**

Tuesday, Nov. 29 3:30PM - 3:40PM Room: S405AB

Participants
Hiroshi Kodama, MD, New York, NY (Presenter) Nothing to Disclose
Song Gao, New York, NY (Abstract Co-Author) Nothing to Disclose
Eisuke Ueshima, New York, NY (Abstract Co-Author) Nothing to Disclose
Kreg Howk, Mansfield, MA (Abstract Co-Author) Nothing to Disclose
Stephen B. Solomon, MD, New York, NY (Abstract Co-Author) Research Grant, General Electric Company Govindarajan Srirathveeravalli, PhD, New York, NY (Abstract Co-Author) Support, Medtronic plc

PURPOSE
To compare CT images of microwave ablation (MWA) of lung in a porcine model with gross ablation zone measurements to understand evolution of treatment zone dimensions over 28 days.

METHOD AND MATERIALS
Twenty-two percutaneous microwave (Emprint™, Covidien) unilateral lung ablations were performed in 8 swine (2-3 ablations/animal). All sites were ablated at 100W for either 2 minutes (low: 14 ablations) or 10 minutes (high: 8 ablations, at least one/animal). Animals were sacrificed at 2 days (n=4) or 28 days (n=4) after the procedure. Non-contrast and dual-phase (30s and 90s) CECT imaging was performed post-treatment and prior to sacrifice in all animals. Animals sacrificed at 28 days were also imaged on days 7 and 14. Lungs and trachea were removed en-bloc after euthanasia, perfusion fixed with formalin, step sectioned at 3-5mm thickness and photographed at high resolution. CT and anatomical measurements were aggregated as mean ± standard deviation, differences in measurements were evaluated with T-test, p<0.05 was considered statistically significant.

RESULTS
In both treatment groups, ablation volume measured on CT was maximum at 7 days (high: 23.1±11.1 cm³; low: 9.2±5.2 cm³) and significantly larger compared to immediate post-ablation volume (high: 9.0±3.5 cm³; low: 3.5±1.8 cm³), P<0.004. Two-axis measurements performed on the largest ablation cross section on CT corresponded well with gross ablation measurements for both high (CT: 3.5±0.5x2.4±0.4 cm vs. Gross: 3.3±0.5x2.3±0.2 cm at 2days, CT: 2.7±1.0x1.9±1.0 cm vs. Gross: 2.7±0.9x1.9±0.8 cm at 28 days; no statistical difference) and low (CT: 2.3±0.5x1.5±0.3 cm vs. Gross: 1.9±0.5x1.3±0.3 cm at 2 days, CT: 1.4±0.5x1.0±0.4 cm vs. Gross: 1.2±0.5x0.9±0.3 cm; no statistical difference) dose ablations.

CONCLUSION
CT imaging correlates with the gross pathology size at 2 and 28 days following microwave ablation of normal swine lung. Volume of treatment zone can vary substantially, achieving largest size 7 days post-treatment.

CLINICAL RELEVANCE/APPLICATION
Follow-up imaging in patients must be performed within 2 or after 28 days after ablation to ensure accuracy.
LEARNING OBJECTIVES

1) Describe patients that are appropriate for ablation for lung tumors. 2) Describe the relative role of ablation with other treatments for lung tumors. 3) Describe outcome of the use of ablation for the treatment of lung tumors.

Technical Approaches to Treatment of Metastatic Disease in the Pelvis

Participants
Sean M. Tutton, MD, Milwaukee, WI (Presenter) Consultant, Benvenue Medical, Inc

Skeletal Metastases Treated by MR-guided Focused Ultrasound: Dynamic Contrast-Enhanced MRI (DCE-MRI) for Treatment Response Evaluation

Participants
Vincenzo Noce, MD, Rome, Italy (Presenter) Nothing to Disclose
Carola Palla, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Susan Bababou, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Cristina Marrocchio, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare DCE-MRI findings in skeletal metastases treated with MR-guided Focused Ultrasound (MRgFUS) with clinical outcome assessed by visual analogue scale (VAS)

METHOD AND MATERIALS
Eighteen patients, enrolled for MRgFUS treatment for symptomatic skeletal metastases, underwent Dynamic Contrast-Enhanced MR exam (3T Discovery 750 scanner, GE; Gd-BOPTA, Bracco) before and 3 months after the ablative procedure. Perfusional parameters comprehended DCE transfer rate (Ktrans) and extravascular volume fraction (ve), calculated by dedicated analysis software. Every subject was monitored over the following three months to define clinical outcome in terms of pain relief

RESULTS
Fourteen of eighteen treated subjects demonstrated a clinical complete response (CR), with a VAS score mean reduction of 4,3 (47,8%. p<0,001), whereas four patients showed a partial clinical response (PR) with incomplete relief according to VAS scale. Perfusional analysis demonstrated in CR population significant decrease of Gadolinium extraction (mean Ktrans reduction 2,14/min, ΔKtrans=-0,042/min, +11,39%. p<0,01) and ve increase (5,6%. p>0,01). Partial Responders showed no substantial modification in Ktrans value (ΔKtrans=+0,042/min, +11,39%. p<0,01) or increase in extravascular volume. Spearman test revealed a significant relationship between Ktrans quantitative parameters and symptoms decrease evaluated by VAS scale (p<0,001) in both CR and PR patients

CONCLUSION
Ktrans negative modifications (-ΔK) may reflect effectiveness of ultrasound ablation procedure, as direct expression of decreased tumoral cells' metabolism, and positively correlate to clinical response

CLINICAL RELEVANCE/APPLICATION
DCE-MRI reflects clinical outcome in MRgFUS treated bone metastases. Perfusional data may be routinely included in imaging protocols for MRgFUS planning and follow-up

Surgical Management Using Cryoblation in MSK Tumors

Participants
Bennie Lindeque, MD, PhD, Aurora, CO (Presenter) Research Grant, Endocare, Inc

LEARNING OBJECTIVES
Audience should be able to identify the problem tumors that need a multi-disciplinary approach. They should be able to identify the members of the multi-disciplinary treatment team. They should be able to note the indication for interventional action taken by the Orthopedic oncologist. They should be able to identify which interventional procedure (cryoablation, vascular embolization or RFA) would be most applicable for a specific case.

Preoperative Transcatheter Arterial Embolization of Bone Tumors

Participants
Bennie Lindeque, MD, PhD, Aurora, CO (Presenter) Research Grant, Endocare, Inc

Awards
Student Travel Stipend Award
SPIO-DOX was clearly seen as a signal reduction in T2*-weighted images within the tumor up to 5 days after injection. Change in

RESULTS

Elemental analysis was used to quantify iron concentration. Fourteen rabbits with tibial VX2 tumors underwent one of three treatments: control (n=5); IRE (n=3); or injection of SPIO-DOX (n=6). Dynamic T2* weighted 4.7T MR images were obtained at t=0, 2 h, and 5 days after treatment to monitor the treatment effects mediated by SPIO-DOX. Technical success, on an intent-to-embolize basis, defined as complete or near-complete stasis on post-embolization angiogram, was achieved in 88% of patients (51/58). Seven patients (4 men, 3 women, median age 17, age range 11-70) had preoperative angiograms but embolization was not attempted due to lack of a suitable embolic target. One patient underwent embolization on two separate occasions for different bone tumors. Embolic agents included tris-acryl microspheres (Embospheres) (n=26), PVA (n=20), coils (n=8), and gelfoam (n=10). Surgeries included resection, curettage, ORIF, and spinal decompression. Average estimated blood loss for all surgeries was 774.5 cc. Twelve patients required blood transfusion following surgery during hospitalization, with mean overall transfusion 0.5 units per patient. Three minor complications were attributed to angiography: groin hematoma, suspected contrast induced nephropathy, and arterial branch dissection/thrombosis.

CONCLUSION

Preoperative transarterial embolization is safe and effective in a wide variety of bone tumors prior to resection, ORIF, curettage, biopsy, and spinal decompression. A small minority of patients with bone lesions that appear hypervascular on cross-sectional imaging have vascular anatomy that is not amenable to embolization.

CLINICAL RELEVANCE/APPLICATION

Preoperative embolization of primary and metastatic bone tumors is feasible in most patients and safe. Here we report the largest retrospective case series in existing literature.

VSIO31-14 Role of Ablation is MSK Oligometastatic Disease

Tuesday, Nov. 29 4:55PM - 5:15PM Room: S405AB

Participants

Anil N. Kurup, MD, Rochester, MN, (kurup.anil@mayo.edu) (Presenter) Research Grant, Galil Medical Ltd; Royalties, UpToDate, Inc

LEARNING OBJECTIVES

1) Identify indications and contraindications for ablation of MSK tumors in the setting of oligometastatic disease. 2) Triage patients to ablation and particular ablation modalities based on tumor characteristics. 3) Recognize lesions that require adjunctive techniques, such as cementoplasty.

VSIO31-15 Developing an Electroporation and Nanoparticle-based Therapeutic Platform for Bone Metastases

Tuesday, Nov. 29 5:15PM - 5:25PM Room: S405AB

Participants

Alda L. Tam, MD, Houston, TX (Presenter) Medical Monitor, Galil Medical Ltd; Research Grant, AngioDynamics, Inc; Travel support, Geurbet SA; Advisory Board, Geurbet SA
Marites P. Melancon, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Tomás Appleton Figueira, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Li Tian, Houston, TX (Abstract Co-Author) Nothing to Disclose
Joe Ensor, Houston, TX (Abstract Co-Author) Consultant, Aetna, Inc
Kiersten Maldonado, Houston, TX (Abstract Co-Author) Nothing to Disclose
Katherine Dixon, RT, Houston, TX (Abstract Co-Author) Nothing to Disclose
Amanda McWatters, Houston, TX (Abstract Co-Author) Nothing to Disclose
Mark McArthur, Houston, TX (Abstract Co-Author) Nothing to Disclose
Sanjay Gupta, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate pre-operative embolization for surgical resection of primary and metastatic bone tumors.

METHOD AND MATERIALS

We retrospectively evaluated 58 patients (31 men, 19 women, 4 boys, 4 girls median age 56.5 years, age range 12-80 years) who underwent 52 preoperative transcatheter arterial embolizations between 2004 and 2015. Surgery was performed within 48 hours in 96.6% (57/59) of cases undergoing preoperative angiogram. Bone tumors included renal cell carcinoma (n=26), plasma cell (n=8), aneurysmal bone cyst (n=4), thyroid metastasis (n=2), giant cell tumor (n=2), chondroblastoma (n=2), melanoma metastasis (n=2), osteosarcoma (n=1), NSCLC (n=1), liposarcoma (n=1), malignant fibrous histiocytoma (n=1). Pathologic fractures were present in 32.7% (n=17) and impending in 38.5% (n=20) of patients. The majority of lesions (63.5%, n=33) were metastatic.

RESULTS

Technical success, on an intent-to-embolize basis, defined as complete or near-complete stasis on post-embolization angiogram, was achieved in 88% of patients (51/58). Seven patients (4 men, 3 women, median age 17, age range 11-70) had preoperative angiograms but embolization was not attempted due to lack of a suitable embolic target. One patient underwent embolization on two separate occasions for different bone tumors. Embolic agents included tris-acryl microspheres (Embospheres) (n=26), PVA (n=20), coils (n=8), and gelfoam (n=10). Surgeries included resection, curettage, ORIF, and spinal decompression. Average estimated blood loss for all surgeries was 774.5 cc. Twelve patients required blood transfusion following surgery during hospitalization, with mean overall transfusion 0.5 units per patient. Three minor complications were attributed to angiography: groin hematoma, suspected contrast induced nephropathy, and arterial branch dissection/thrombosis.

CONCLUSION

Preoperative transarterial embolization is safe and effective in a wide variety of bone tumors prior to resection, ORIF, curettage, biopsy, and spinal decompression. A small minority of patients with bone lesions that appear hypervascular on cross-sectional imaging have vascular anatomy that is not amenable to embolization.

CLINICAL RELEVANCE/APPLICATION

Preoperative embolization of primary and metastatic bone tumors is feasible in most patients and safe. Here we report the largest retrospective case series in existing literature.
T2* measurements show that there was a significant decrease in the signal intensity due to the presence of iron: 2.3 ms (control), 2.13 ms (IRE), and -8.94 ms (SPIO-DOX+IRE), p < 0.0001. Similarly, elemental analysis showed increased iron concentration in the tumor after SPIO-DOX: 30.8 ppm (control), 71.2 ppm (IRE), and 124 ppm (SPIO-DOX+IRE). Average volume of tumor prior to treatment was 157.3 + 46.5 mm³ and not significantly different between groups (p=0.29). Average tumor growth ratios were calculated: control (194.6 + 58%), IRE (135.9 + 13.7%), and SPIO-DOX+IRE (36.2 + 13.3%). While the difference between the average tumor growth ratio between the control and IRE groups was not significant (p=0.15), the group treated with SPIO-DOX+IRE shows a significant antitumor effect when compared to control (p<0.0001). Changes in tumor volume mirrored the histological calculation of percent necrosis: 59 ± 20.4% (control), 65% (IRE), and 79.2 ± 11.1% (SPIO-DOX+IRE). Percent necrosis was significantly different between the IRE and SPIO-DOX+IRE groups (p=0.04).

CONCLUSION

The intratumoral localization of SPIO-DOX can be successfully identified on MR imaging. Tibial VX2 tumors treated with combination therapy demonstrate enhanced antitumor effect when compared to control.

CLINICAL RELEVANCE/APPLICATION

Exploiting the synergy between electroporation and nanoparticle therapy is a viable strategy to surmounting the issue of incomplete tumor ablation in bone metastases.

VSIO31-16 Avoiding Complications with Ablation in the Spine

Tuesday, Nov. 29 5:25PM - 5:45PM Room: S405AB

Participants
Afshin Gangi, MD, PhD, Strasbourg, France, (gangi@unistra.fr) (Presenter) Proctor, Galil Medical Ltd

LEARNING OBJECTIVES

1/Describe the complications which could occur during spinal tumor ablation 2/ Describe how to avoid these complications and reduce the risks 3/ Describe the limits of thermal ablation of spine

VSIO31-17 Bone Metastases Tumor Board

Tuesday, Nov. 29 5:45PM - 6:00PM Room: S405AB

Participants
Sean M. Tutton, MD, Milwaukee, WI (Moderator) Consultant, Benvenue Medical, Inc
**Whole-body Assessment of Fat Content and Insulin Sensitivity in Different Tissues of Healthy Volunteers and T2D Patients using a Fully Integrated PET/MR System**

**PURPOSE**
Parameters that are important for development of Type 2 Diabetes (T2D) are whole-body fat content and insulin sensitivity of all tissues in the body (expressed with the M-value). These parameters can be studied on a tissue level with a 18F-FDG PET/MR investigation. The main objective was to apply an integrated whole-body PET/MR protocol for assessment of glucose uptake using 18F-FDG, during euglycemic clamp conditions, and fat content of various tissues, of healthy volunteers and T2D patients, using a whole-body fully integrated PET/MR equipment.

**METHOD AND MATERIALS**
10 subjects (5 healthy, 5 T2D) were imaged using 18F-FDG and an integrated PET/MR system under steady state clamp conditions. PET: 1 dynamic acquisition (thorax, 10 min) with simultaneous administration of 18F-FDG (average 330 MBq/subject), followed by 6 serial whole body scans (5 min/scan). MRI: 6 point Dixon for quantitative fat, water separated images were acquired after the PET scans. Standard Patlak model using image derived input function (IDIF) from ascending aorta (manually derived region of interest from dynamic PET series) was used for kinetic modelling of tissue specific glucose uptake. Tissue specific glucose uptake [μmol glucose/100 g tissue min] from PET was manually segmented from the fused MRI and PET-Patlak volumes. The M-value [mg/kg min] expressing the whole-body insulin sensitivity of the subject was determined during PET/MRI acquisition with the clamp-method, where a constant infusion of insulin (56 mU/m2/min) and variable infusion of glucose to the subject was set to maintain a steady state level of 5.6 mmol/l (plasma glucose) during imaging. The M-value was normalized to fat-free mass.

**RESULTS**
The M-value showed positive correlation with the fat fraction of the liver, whole body fat volume and the tissue specific uptake rate of 18F-FDG in skeletal muscle, subcutaneous adipose tissue and liver and a negative correlation in the brain. No correlation was seen for pancrea’s fat fraction and the uptake rate of 18F-FDG in heart (left ventricle) and pancreas.

**CONCLUSION**
The applied whole-body FDG PET/MR protocol, during euglycemic clamp, is feasible for studies of fat content and insulin sensitivity in various tissue, parameters relevant for development of T2D.

**CLINICAL RELEVANCE/APPLICATION**
FDG-PET/MR data generated at different stages of T2DM development, integrated with non-imaging data, can give important information for future more individualized therapy and improved outcomes.

---

**Molecular MRI Targeting Myeloperoxidase Detects Inflammation in Human Non-Alcoholic Steatohepatitis**

**PURPOSE**
Parameters that are important for development of Type 2 Diabetes (T2D) are whole-body fat content and insulin sensitivity of all tissues in the body (expressed with the M-value). These parameters can be studied on a tissue level with a 18F-FDG PET/MR investigation. The main objective was to apply an integrated whole-body PET/MR protocol for assessment of glucose uptake using 18F-FDG, during euglycemic clamp conditions, and fat content of various tissues, of healthy volunteers and T2D patients, using a whole-body fully integrated PET/MR equipment.

**METHOD AND MATERIALS**
10 subjects (5 healthy, 5 T2D) were imaged using 18F-FDG and an integrated PET/MR system under steady state clamp conditions. PET: 1 dynamic acquisition (thorax, 10 min) with simultaneous administration of 18F-FDG (average 330 MBq/subject), followed by 6 serial whole body scans (5 min/scan). MRI: 6 point Dixon for quantitative fat, water separated images were acquired after the PET scans. Standard Patlak model using image derived input function (IDIF) from ascending aorta (manually derived region of interest from dynamic PET series) was used for kinetic modelling of tissue specific glucose uptake. Tissue specific glucose uptake [μmol glucose/100 g tissue min] from PET was manually segmented from the fused MRI and PET-Patlak volumes. The M-value [mg/kg min] expressing the whole-body insulin sensitivity of the subject was determined during PET/MRI acquisition with the clamp-method, where a constant infusion of insulin (56 mU/m2/min) and variable infusion of glucose to the subject was set to maintain a steady state level of 5.6 mmol/l (plasma glucose) during imaging. The M-value was normalized to fat-free mass.

**RESULTS**
The M-value showed positive correlation with the fat fraction of the liver, whole body fat volume and the tissue specific uptake rate of 18F-FDG in skeletal muscle, subcutaneous adipose tissue and liver and a negative correlation in the brain. No correlation was seen for pancrea’s fat fraction and the uptake rate of 18F-FDG in heart (left ventricle) and pancreas.

**CONCLUSION**
The applied whole-body FDG PET/MR protocol, during euglycemic clamp, is feasible for studies of fat content and insulin sensitivity in various tissue, parameters relevant for development of T2D.

**CLINICAL RELEVANCE/APPLICATION**
FDG-PET/MR data generated at different stages of T2DM development, integrated with non-imaging data, can give important information for future more individualized therapy and improved outcomes.
ADCuh may be a useful measurement for noninvasive evaluating kidney damage in diabetic nephropathy, and these changes in abundance of AQP1 and AQP4. P=0.008), OS (0.06±0.019; P=0.011), IM (0.05±0.016; P=0.001), and IM (0.04±0.012; P=0.009) compared with control animals (CO, 1.20±0.14×10^{-3}mm^2/s; OS, 1.22±0.14×10^{-3}mm^2/s; IM, 1.51±0.15×10^{-3}mm^2/s). All diabetic animals developed hyperglycemia. ultra-high ADC was significantly increased in DM animals in the cortex (CO) and inner medulla (IS) (1.40±0.10×10^{-3}mm^2/s; P<0.001), outer stripe of the outer medulla (OS) (1.42±0.10×10^{-3}mm^2/s; P<0.001), inner stripe of the outer medulla (IS) (1.38±0.10×10^{-3}mm^2/s; P=0.009) compared with control animals (CO, 1.20±0.14×10^{-3}mm^2/s; OS, 1.22±0.14×10^{-3}mm^2/s; IS, 1.19±0.41×10^{-3}mm^2/s; IM, 1.51±0.15×10^{-3}mm^2/s).

**RESULTS**

<table>
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<tr>
<th>SS114-03</th>
<th>Investigation of Aquaporin by DWI MRI with Multiple B Values in a Rat Model of Diabetic Nephropathy</th>
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<tbody>
<tr>
<td>Participants</td>
<td>Yu Wang, BDS, Chengdu, China (Presenter) Nothing to Disclose</td>
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<td>Rongbo Liu, MD, Prof, Chengdu, China (Abstract Co-Author) Nothing to Disclose</td>
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</tbody>
</table>

**METHOD AND MATERIALS**

Twenty-four male Sprague-Dawley rats were divided into 2 groups: (1) untreated controls, (2) diabetes (DM). Forty days after diabetes induction with streptozotocin, MR imaging was performed in a 7.0 T MRI (Bruker). MPO-Gd (1 mg/ml) was added, and samples were incubated for 2 hours. Samples were washed. Post-contrast MR images were then acquired, and MPO-specific signal was calculated as CNRpost/CNRpre. After imaging, samples were cut to 5 μm thickness, and stained with H&E and MPO for histopathological evaluation. The NAFLD activity score (NAS) was calculated; NASH was defined as NAS >5.

**CONCLUSION**

In liver core biopsy samples of patients undergoing evaluation for NASH, MPO-Gd enhanced molecular MRI can reliably and non-invasively detect MPO activity in NASH patients.

**CLINICAL RELEVANCE/APPLICATION**

Molecular MRI with MPO-Gd could non-invasively assess for liver inflammation. This could allow for noninvasive identification of patients with NASH who are at high risk for developing cirrhosis.

**RESULTS**

S of 11 patients fulfilled criteria for NAS (NAS>5), the remaining 6 were used as controls. There was no difference in age (49.2±13.2 in NASH vs. 40.3±9.2 in control, P=0.35) or BMI (44.4±8.7 vs. 45.1±6.8, P=0.87). As expected, NASH patients had higher NAS sub-scores in steatosis (3 [interquartile range IQR 1.5–3] vs. 0 [0–0.5]), inflammation (1 [1.5–3] vs. 0 [0–0]), fibrosis (1 [1–2] vs. 0 [0–0]), hepatocyte ballooning (2 [2–2] vs. 0 [0–0]), and a higher total NAS score (6 [5.5–6] vs. 0 [0–0.5]). Molecular MRI with MPO-Gd demonstrated an increase in CNR in samples from NASH patients (Fig., A) versus control (Fig., B) (CNRpost/CNRpre 2.61±0.91 vs. 1.29 ± 0.22, P=0.004). Correlating with these results, we found more clusters of MPO-positive cells on histology in NASH versus control patients (Fig., C, 5.60±1.52 vs. 1.00±0.89, P=0.002).

**REFERENCES**

[1–2] vs. 0 [0–0], hepatocyte ballooning (2 [2–2] vs. 0 [0–0]), and a higher total NAS score (6 [5.5–6] vs. 0 [0–0.5]). Molecular MRI with MPO-Gd demonstrated an increase in CNR in samples from NASH patients (Fig., A) versus control (Fig., B) (CNRpost/CNRpre 2.61±0.91 vs. 1.29 ± 0.22, P=0.004). Correlating with these results, we found more clusters of MPO-positive cells on histology in NASH versus control patients (Fig., C, 5.60±1.52 vs. 1.00±0.89, P=0.002).

**CONCLUSION**

In liver core biopsy samples of patients undergoing evaluation for NASH, MPO-Gd enhanced molecular MRI can reliably and non-invasively detect MPO activity in NASH patients.

**CLINICAL RELEVANCE/APPLICATION**

Molecular MRI with MPO-Gd could non-invasively assess for liver inflammation. This could allow for noninvasive identification of patients with NASH who are at high risk for developing cirrhosis.

**METHOD AND MATERIALS**

Twenty-four male Sprague-Dawley rats were divided into 2 groups: (1) untreated controls, (2) diabetes (DM). Forty days after diabetes induction with streptozotocin, MR imaging was performed in a 7.0 T scanner. All rats received diffusion-weighted imaging (DWI) with 18 b-values (0–4500 s/mm²). Renal apparent diffusion coefficient values were calculated for each of the different anatomical layers of the kidney and maps of low ADC (ADCl) maps were calculated from low b-values(0-200), maps of standard ADC (ADCst) maps were calculated from standard b-values(300-1500) and maps of ultra-high ADC (ADCuh) were calculated from the anatomical layers of the kidney and maps of low ADC (ADCl) maps were calculated from low b-values(0-200), maps of standard ADC (ADCst) maps were calculated from standard b-values(300-1500) and maps of ultra-high ADC (ADCuh) were calculated from the

**RESULTS**

All diabetic animals developed hyperglycemia. ultra-high ADC was significantly increased in DM animals in the cortex (CO) (1.40±0.10×10^{-3}mm^2/s; P<0.001), outer stripe of the outer medulla (OS) (1.42±0.10×10^{-3}mm^2/s; P<0.001), inner stripe of the outer medulla(IS) (1.32±0.10×10^{-3}mm^2/s; P=0.010) and inner medulla (IM) (1.60±0.12×10^{-3}mm^2/s; P = 0.041) compared with control animals (CO, 1.20±0.14×10^{-3}mm^2/s; OS, 1.22±0.14×10^{-3}mm^2/s; IS, 1.19±0.41×10^{-3}mm^2/s; IM, 1.51±0.15×10^{-3}mm^2/s). While between groups, ADCl and ADCst values were not different. DM rats had an increased IOD of AQP2 in the CO (0.035±0.010; P=0.008), OS (0.064±0.019; P=0.011), IM (0.058±0.016; P=0.001), and IM (0.048±0.012; P = 0.009) compared with control animals (CO, 0.023±0.010; OS, 0.043±0.009; IS, 0.036±0.010; IM, 0.026±0.011). In contrast, there were no major changes in the abundance of AQP1 and AQP4.

**CONCLUSION**

ADCuh may be a useful measurement for noninvasive evaluating kidney damage in diabetic nephropathy, and these changes in abundance of AQP1 and AQP4.
ADCuh may be a useful measurement for noninvasive evaluating kidney damage in diabetic nephropathy, and these changes in ADCuh may reflect function of the AQP.

**Clinical Relevance/Application**

ADCuh may be a promising biomarker in differential diagnosis of diabetic nephropathy patients.

**SS14-04 Facet Tropism and Facet Joint Orientation: Risk Factors For The Development of Early Biochemical Alterations of Lumbar Intervertebral Discs**

*Tuesday, Nov. 29 3:30PM - 3:40PM Room: S504CD*

**PURPOSE**

To assess the glycosaminoglycan (GAG) content of lumbar intervertebral discs (IVD) in healthy volunteers with facet tropism (FT) and sagittal facet joint (FJ) orientation using glycosaminoglycan chemical exchange saturation transfer imaging (gagCEST).

**METHOD AND MATERIALS**

Seventy-five lumbar IVDs of twenty-five young, healthy volunteers without any history of lumbar spine pathologies (13 female; 12 male; mean age: 28.0 ± 4.4 years; range: 21 - 35 years) were examined with a 3T MRI scanner. Orientation of FT and FJ were assessed for L3/4, L4/5 and L5/S1 using standard T2 weighted images. Biochemical gagCEST imaging was used to determine the GAG content of each nucleus pulposus (NP) and annulus fibrosus (AF).

**RESULTS**

Significantly higher gagCEST values of NP were found in volunteers without FT and normal FJ orientation compared to volunteers with FT and sagittal FJ orientation > 45° (p < 0.0001). GagCEST values were significantly higher in volunteers without FT compared to volunteers with moderate or severe FT (moderate FT: p < 0.0001; severe FT: p = 0.0033). Volunteers with normal FJ orientation showed significantly higher gagCEST values compared to those with sagittal FJ orientation > 45° (p < 0.001). We found a significant, negative correlation between gagCEST values and higher angels in sagittal FJ orientation (rho=-0.459; p < 0.0001).

**CONCLUSION**

GagCEST analysis demonstrated significantly lower GAG values of NP in young volunteers with FT and sagittal orientated FJ, indicating that FT and sagittal orientation of the FJ represent risk factors for the development of early biochemical alterations of lumbar IVDs.

**Clinical Relevance/Application**

gagCEST imaging may be an additional feature in the evaluation of the biochemical composition in lumbar intervertebral discs on a clinical 3T MRI system and may be a powerful, non-invasive tool to investigate early disc degeneration processes.

**SS14-05 Dynamic Creatine CEST MRI for Measuring Muscle Fatigability Post Exercise**

*Tuesday, Nov. 29 3:40PM - 3:50PM Room: S504CD*

**Participants**

Alessandro Scotti, Chicago, IL (Presenter) Nothing to Disclose
Rongwen Tain, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Xiaohong J. Zhou, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Kejia Cai, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Chronic fatigue is a pathological condition associated with abnormally fast exhaustion and slow energy restoration. Muscular fatigability prevents people from exercising, leading to obesity and progressive mobility impairment. Many studies investigated the rate of phosphocreatine (PCr) re-synthesis after exercise as a measure of energetic restoration rate. However, the detection of PCr by 31P-MRS is associated with long scan times and poor spatial resolution. Creatine (Cr), a key metabolites in cellular energy system, can be imaged with high resolution using an emerging method, Cr Chemical Exchange Saturation Transfer (CrCEST) MRI. Herein, we demonstrate a quantitative method for mapping energy restoration rate, an index for muscular fatigability, by fitting the post-exercise dynamic CrCEST data.

**METHOD AND MATERIALS**

Six healthy subjects underwent MRI at a 3T scanner while performing a physical exercise consisting of repeated pushes (1Hz rate) on a mildly loaded pedal (16 lbs) for 3 minutes. After B0 and B1 mapping, the calf muscles were imaged at rest and for 12 minutes following the workout by a series of fast CrCEST sequences with two pairs of offsets around 2ppm. Assuming a linear signal variation in the range between the two offsets, the B0-corrected CrCEST map at 2ppm was determined according to the deviation in the B0 map.

**RESULTS**
**PURPOSE**

Multispectral Optoacoustic Tomography (MSOT) is a physical imaging approach to examine tissue by utilizing the photoacoustic effect to detect molecules based on their characteristic absorption spectra. The aim of the study was to non-invasively image human intestinal perfusion and oxygenation status of hemoglobin (hb) in patients with Crohn’s disease (CD) and compare the results to clinical parameters of disease activity.

**METHOD AND MATERIALS**

The trial was registered (ClinicalTrials.gov ID: NCT02622139), ethical board approval was provided, and informed consent was obtained. n=60 patients (32♂/28♀) were included, mean age: 34.2±13.5; n=27 in remission, n=15 with mild, and n=13 with moderate disease according to Harvey Bradshaw Index (HBI). The handheld optoacoustic detector (MSOT Acuity, iThera Medical GmbH, Munich, probe: 3-4MHz, 256 elements) was positioned on the skin of the abdomen. MSOT signals were acquired at 700/730/760/800/850/900nm. From all patients HBI, B-mode&Doppler ultrasound/endoscopic/histologic score, C-reactive protein and total leukocyte count was assessed and compared to MSOT signals.

**RESULTS**

Using B-Mode imaging, inflamed parts of the intestine were located and MSOT signals were acquired within only about 5 minutes per patient. Bowel wall thickness was 4.9±2.7mm, imaged at a depth of 19.1±7.2mm (terminal ileum) or 18.9mm±6.9mm (sigma). Using the MSOT system, deoxy- and oxyhemoglobin content in the intestinal wall could be quantified. An increase in oxygenated hb from histologic grade 0 to 2 (oxy:15.5±3.8 vs. 23.8±7.1; P =.03; deoxy: 19.9±5.0 vs. 27.5±3.6; P =.01) with a further rise in grade 3 (26.7±5.1; P =.004; 26.3±4.5; P =.02) was observed. Total hb increased from grade 0 to 2 (35.4±6.6 vs. 51.3±9.1; P =.005) also followed by a further rise in grade 3 (53.0±9.0; P =.001). Ultrasound showed moderate correlation with histology (R²=.51, P<.0001); laboratory assessments did not show significant correlations with disease activity.

**CONCLUSION**

MSOT is a promising clinical translatable real-time, non-invasive modality to visualize inflammation in patients with CD. Further human studies are needed to define absolute cut-off parameters.

**CLINICAL RELEVANCE/APPLICATION**

This is a clinical feasibility study showing that MSOT enables physicians to quickly and non-invasively assess the disease acitvity of CD in order to personalize therapeutic decisions.
**MRI-Based Bone Models in the Knee: An Analysis of Manual and Automated Modeling Techniques**

**Participants**
Thomas M. Link, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Research Consultant, General Electric Company; Research Consultant, InSightec, Ltd; Research Grant, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Consultant, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc; Jean-Francois Budzik, MD, PhD, Lille, France (Moderator) Nothing to Disclose

**METHOD AND MATERIALS**
An in-vitro left knee specimen was imaged using CT (axial, 2.0mm slice thickness, 0.49x0.49 in-plane resolution) and three MRI sequences (PDFS SPACE, T1 VIBE, T2 TRUFISP; sagittal, 0.7mm slice thickness, up to 0.63x0.63 resolution) at 3.0 T. For each dataset the distal femur, proximal tibia and patella were manually segmented using imaging software and automatically segmented using custom-designed and published software. 3D mesh models of each bone were reconstructed. Two comparisons were made of the models: i) manually segmented MRI vs. manually segmented CT, and ii) automatically segmented MRI vs manually segmented CT. For each comparison the bone models were registered using an iterative closest points algorithm and the mean distance between the models was calculated.

**RESULTS**
Sub-millimeter agreement was found for all manually segmented MRI-based bone models when compared to the manually segmented CT models. MRI models tended to be slightly smaller than CT models, particularly within concave regions, i.e. depressions of the tibial plateau. The automated software was capable of sub-millimeter agreement in creating MRI-based models from the SPACE and VIBE sequences, with slightly less agreement for the TRUFISP sequence. (Figure 1)

**CONCLUSION**
MRI-based bone models of the knee demonstrated sub-millimeter agreement with manually segmented CT bone models. This was true for the manually segmented MRI models of all 3 sequences tested (SPACE, VIBE, TRUFISP), as well as for the automatically segmented MRI models of the SPACE and VIBE sequences. The current study indicates that MRI can be used for successful 3D bone modeling and may offer clinical advantages for comprehensive evaluation and automated modeling of the knee joint.

**CLINICAL RELEVANCE/APPLICATION**
MRI-based bone models are a feasible alternative to CT, avoiding unneeded radiation to patients. Automated modelling techniques would allow for direct application into the standard clinical workflow.
To assess the feasibility of dual-energy computed tomography (DECT) in the detection and quantification of hemosiderin deposits in patients with known intra-articular knee masses previously detected on MRI underwent single-source DECT scans using a rapid tube-voltage-switching technique. Semi-automated volumetric tumor segmentation was performed using proprietary post-processing software. A specific color-coding protocol with two-material differentiation was applied using a pre-defined threshold of 4 to 10 mg/cm^3 based on a previous phantom study with various known iron concentrations. Tumor volume and iron content were quantified. Iron/tumor volume ratio was subsequently calculated. Histopathological analysis from all 12 surgically resected masses was used as the reference standard.

RESULTS

All 12 masses showed hemosiderin deposits on color-coded DECT images, and all contained iron foci at histopathology. Seven lesions were giant cell tumors of tendon sheath (localized-type PVNS), two were diffuse-type giant cell tumors, and three were classified as another: two arteriovenous malformations and one tendon sheath fibroma. Among both PVNS types, mass volumes ranged from 2.9cm^3 to 26.6cm^3 with a mean of 8.7cm^3 for the localized types, and from 51.2cm^3 to 128.2cm^3 with a mean of 89.7cm^3 for the diffuse types, respectively. Iron volume ranged from 0.6cm^3 to 3.8cm^3 with a mean of 2cm^3 (corresponding to approximately 121.5mg) for the diffuse types, respectively (p=0.055). The iron/tumor volume ratio ranged from 0.14 to 0.49 with a mean of 0.28 for the localized types, and from 0.26 to 0.28 with a mean of 0.27 for the diffuse types, respectively (p=0.72).

CONCLUSION

Dual-energy computed tomography is a feasible technique that allows the detection and quantification of hemosiderin deposits in patients with intra-articular knee masses. Hemosiderin volume is greater in diffuse-type PVNS compared with localized-type PVNS.

CLINICAL RELEVANCE/APPLICATION

DECT can be used as a novel imaging technique to quantify iron content in soft-tissue masses.

SSJ15-03 Detection of Myeloma Infiltration of Bone Marrow using Texture Analysis of Apparent Diffusion Coefficient Maps: A Feasibility Study

Tuesday, Nov. 29 3:20PM - 3:30PM Room: E450B

Awards

Student Travel Stipend Award

Participants

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Huadan Xue, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Shu Liu, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
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PURPOSE

To evaluate the feasibility of using texture analysis of apparent diffusion coefficient maps for the detection of myeloma infiltration of bone marrow.

METHOD AND MATERIALS

17 consecutive patients with plasma disorder was recruited prospectively, including 8 clinically diagnosed multiple myeloma(MM) and 9 patients with monoclonal gammopathy of undetermined significance (MGUS). All patients received whole-body DWI MRI. A hyperintense appearance on high-b-value DWI images was considered as myeloma infiltration. Texture Analysis of ADC maps on lumber vertebral bodies in each patient were performed using TexRAD commercially available research software(TexRAD Ltd, Cambridge,UK) by manually delineating a round region of interest covering the middle cross-sectional area of each vertebra. Vertebral with focal lesions or compression fracture were excluded from the analysis. The technique selectively filters and extracts textures at different size scales(fine, medium and coarse) followed by quantification of the histogram using 6 parameters: mean, standard-deviation(SD),kurtosis, entropy, skewness, and mean value of positive pixels(MPP). Students’ t test was performed to compare the texture analysis parameters between myeloma-infiltrated vertebrae and non-infiltrated vertebrae. ROC analysis was performed to assess the diagnostic performance of these parameters to detect myeloma infiltration.

RESULTS

A total of 22 myeloma-infiltrated vertebrae and 27 non-infiltrated vertebrae were evaluated. At fine texture scale, most of the parameters (ie.mean, kurtosis, entropy, skewness, and MPP) except SD were significantly different between the two groups(p<0.05). ROC analysis identified three texture parameters (at fine texture scale) with highest AUCs, including mean(0.974), entropy(0.998) and MPP(0.974). The sensitivity of mean, entropy and MPP was 90.9%,100% and 90.9% respectively. The specificity of mean, entropy and MPP was equal(96.2%).

CONCLUSION

It is feasible to use texture analysis of ADC Maps for the differentiation between myeloma-infiltrated from non-infiltrated bone marrow.

CLINICAL RELEVANCE/APPLICATION

Texture analysis of ADC Maps may complement conventional DWI MRI to differentiate myeloma-infiltrated from non-infiltrated bone marrow.
Fat Fraction Map Reconstructed from Two-point Dixon Technique in Quantification of Early Fatty Infiltration in Multiple Myeloma Patients: Comparison and Correlation with Single-voxel Magnetic Resonance Spectroscopy

Participants
Xiao-Jiao Pei, MD, Beijing, China (Presenter) Nothing to Disclose
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Qinglei Shi, Beijing, China (Abstract Co-Author) Nothing to Disclose
Xiaoye Wang, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To test whether fat fraction map (FFM) reconstructed from two-point Dixon technique can be used to quantify fat content of vertebral bone marrow in multiple myeloma patients by comparing the results with single voxel Magnetic Resonance Spectroscopy (MRS) and to evaluate the correlation between these quantitative parameters.

METHOD AND MATERIALS
Twenty patients with different pathological patterns of multiple myeloma (MM) and twenty healthy volunteers were enrolled and underwent three volume two-point T1-Dixon and single voxel MRS imaging. The FFM were reconstructed from Dixon images using the equation FFM =Lip/In where Lip represented fat images and In represented in-phase images. The quantitative parameters were measured by placing the region of interest (ROI) in certain regions that corresponding to the MR-spectroscopy voxel. The fat fraction of MRS (MRS-FF) was calculated by using the integral area of lipid peak divided by the sum of integral area of lipid peak and water peak. The paired samples t test was used to compare the difference among quantitative parameters. The relationship about FF between T1-Dixon and MRS was assessed by using the Pearson correlation test. Receiver operating characteristic (ROC) analysis of discrimination between normal and MM were performed to determine the optimal cut-off value.

RESULTS
FF values were significantly correlated between T1-dixon and MRS: r = 0.775 (P = 0.001). ROC analysis demonstrated that no significance difference were found between area under the curve of T1-Dixon ([0.805±0.087, (0.646 to 0.986)] (normal vs MM)) and MRS ([0.768±0.119, (0.478 to 0.932)] (P = 0.478)), with optimal cutoff values of 16.627 and 10.216, respectively.

CONCLUSION
Both two-point T1-Dixon and single-voxel MRS may be reliable method to examine the bone marrow fat of vertebral bone, and good correlations are existed between two-point T1-dixon and MRS.

CLINICAL RELEVANCE/APPLICATION
Because the two-point T1-Dixon technique and MRS can be used for the detection of fat content, and bone marrow fat content is more sensitive to change in patients with multiple myeloma fat, the two technique may provide vital information for identification and diagnosis of multiple myeloma.

Quantifying and Optimizing Metal Artefact Reduction using Virtual Monochromatic Dual-Source CT in different Metal Implants

Participants
Ruud H. Wellenberg, MSc, Amsterdam, Netherlands (Presenter) Nothing to Disclose
Emilie C. Donders, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
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Ludo F. Beenen, MD, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Nick H. Lobe, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
To quantify and optimize metal artifact reduction using virtual monochromatic Dual-Source CT in different metal implants compared to non-metal reference scans. Region-of-interest (ROI) measurements were used to determine fluctuations and inaccuracies in soft tissues and bone due to metal artifacts.

METHOD AND MATERIALS
A human cadaver was scanned on a Dual-Source CT scanner with 80kVp/150kVp and 100kVp/150kVp. Scans without ostheosynthetic implants, served as a reference. Then after scans were made after implanting a titanium plate, a stainless-steel plate and a titanium intramedullary pen in the left lower leg respectively. Scans were reconstructed with three different reconstruction filters. Virtual monochromatic images were analyzed from 70 to 190 keV, with steps of 10 keV, where 70 keV served as a reference. ROIs were placed in muscle, fat, cortical bone, implant and in the tibial medulla where CT numbers and standard deviation (SD) were measured. Optimal keVs regarding CT number accuracy and SDs were determined by searching for minimal absolute differences between the reference and implant scans.

RESULTS
Based on visual assessment, 100kVp/150kVp and the sharpest filter were chosen with less metal artifacts and sharper edges.
respectively. The stainless-steel implant resulted in more severe artifacts. The titanium pen resulted in less metal artifacts. CT number inaccuracies in 70keV images were decreased with 96%, 87% and 73% at optimal keVs of 130keV, 180keV and 190keV for the titanium plate, stainless-steel plate and titanium pen respectively. SDs decreased with 73%, 66% and 35% at optimal keVs of 130keV, 150keV and 140keV for the titanium plate, stainless-steel plate and titanium pen respectively (p<0.001).

CONCLUSION
When optimizing metal artifact reduction by virtual monochromatic imaging a metal specific tailoring is advised in order to minimize fluctuations and inaccuracies in soft tissues and bone due to metal artifacts.

CLINICAL RELEVANCE/APPLICATION
In DECT, tailoring monochromatic energies for different metal implants is essential order to minimize fluctuations and inaccuracies in soft tissues and bone due to metal artifacts.

SSJ15-06 MRI in Forensic Medicine - A Unique Approach using 31P Magnetic Resonance Spectroscopy of the Skeletal Muscle

Tuesday, Nov. 29 3:50PM - 4:00PM Room: E450B

Participants
Jin Yamamura, MD, Hamburg, Germany (Presenter) Nothing to Disclose
Sarah Keller, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Tony Schmidt, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Roland Fischer Sr, DiplPhys, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
The aim of this study was to investigate the temporal pattern of phosphor metabolites in the adductor magnus muscle post mortem and to check the value of 31P-MRS as a forensic tool especially for the determination of the time of death.

METHOD AND MATERIALS
21 corpses, died of natural cause, were examined (13 male, 8 female; age: 70.5 ± 8.7 y, weight 74 ± 18 kg). A control group of 3 male subjects (mean age: 38.7±24.5 y, range: 2 –67 y, mean body weight: 81±17 kg) was examined at a single time point as well. 31P MRS was performed on a 1.5 T MRI (TR 700 ms, TE 0.35 ms, averages 256, flip angle 90°). A standard 31P surface coil in the patient table, placed under the thigh, was employed. To measure the concentration of the phosphor metabolites scans were repeated in intervals of one hour over a period from 2 to 24 h post mortem (p.m.). The core temperature was rectally measured throughout the MRI examination.

RESULTS
The mean core temperature decreased from 36.0 °C to 25.7 °C. The comparison of ex vivo and in vivo spectra of the adductor magnus muscle showed characteristic differences. In opposite to in vivo spectra, the ex vivo spectra were dominated by the inorganic phosphate (Pi) peak which was used for further analyses. The ex vivo phosphocreatine (PCr) signal was either very small or even not detectable depending on the time post mortem. During the investigated period, the ex vivo peaks showed similar chemical shifts compared to the in vivo spectra (PCr, γ-ATP, α-ATP, β-ATP: 0.34 ± 0.11, -2.01 ± 0.12, -7.08 ± 0.16, -15.43 ± 0.37 ppm). However, the Pi peak shifted from 5.18 ± 0.13 ppm (in vivo) by about 1.0 ppm and 1.5 ppm after 5 and 10 hours p. m., respectively. The α-, β-, γ-ATP/Pi and the PCr/Pi ex vivo ratios decrease from the beginning of the measurement to the end, while the PME/β-ATP ratio is exponentially increasing with a slope of 0.39 ± 0.02 h⁻¹ (r² = 0.54). The α-ATP/Pi ratio decreased exponentially from 0.445 to 0.032 (r² = 0.997, p < 0.001).

CONCLUSION
There is a characteristical postmortal time pattern of the phosphor metabolites. Especially the α-ATP/Pi ratio could be useful as a forensic tool because of its significant exponential postmortal time course.

CLINICAL RELEVANCE/APPLICATION
The phosphor magnetic resonance spectroscopy (31P MRS) could be used as an important tool in the forensic medicine.
**PURPOSE**
Diffusion tensor imaging (DTI) of the skeletal muscle remains challenging in muscular dystrophies as these conditions are frequently associated with an increase of the percent muscle fat fraction (MFF%) lowering the signal to noise ratio (SNR). The goal of this study was to assess the DTI metrics in a pixel-based and ROI-based quantification method using unselective and muscle-tissue selective ROIs in patients and controls.

**METHOD AND MATERIALS**
In this prospective study, ten patients (42±18.7y; m:f 5:5) with various muscular dystrophies and ten controls (32±3.0y; m:f 6:4) were included. MRI-scans were performed on a 3.0T system. A fat-suppressed DTI echo planar imaging (EPI) of the thigh was performed. Regions of interest (ROIs) were drawn in a muscle tissue selective and unselective approach using the manufacturers and IDL software. Quantitative ADC and FA-values were generated. The MFF% was obtained using two-point Dixon-based MRI and the following algorithm: MFF% = meanSIFAT/ (meanSIFAT + meanSIWATER) x 100Statistical analysis was performed using GraphPad Prism 6.0f. Correlation and significance of DTI values from controls and patients was tested by the Student's T-test and parametric Pearson correlation and considered significant with an α=0.05.

**RESULTS**
The MFF% of the thigh muscles ranged from 15%-89% in patients compared to controls with 3-9%. Using the pixel-based quantification the patients' ADC was significantly decreased corresponding to a FA increase in all muscle groups (rectus femoris (RF): ADC: 1.32±0.50 .10-3 mm2/s, FA: 0.45±0.16, p<0.01) The ADC and FA correlated inversely to one each other (r= -0.91; p<0.001) and to the MFF% (FA r=0.53; ADC r=-0.56; p<0.001). The muscle-selective ROI-based quantification revealed no significant alterations of the ADC.

**CONCLUSION**
The biasing effect of fatty infiltration in muscular dystrophy is diminished by a ROI-based muscle tissue selective quantification of DTI-metrics. Using a muscle tissue selective ROI-localization, aberrations of DTI-metrics in patients are less shifted, indicating no obvious changes of the remaining muscle preceding the muscle cell decay.

**CLINICAL RELEVANCE/APPLICATION**
A muscle-tissue selective DTI quantification technique enables a more sensitive evaluation of the remaining muscle microstructure as this method is more resistant to the biasing effect a low SNR, causing an artificial shift of the diffusion parameters.
Tendon involvement at the myotendinous junction in acute hamstring injuries assessed on MRI and relationship with clinical features at baseline.

Tuesday, Nov. 29 3:40PM - 3:50PM Room: E451A

Participants
Michel D. Crema, MD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC
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Gustaf Reurnink, Rotterdam, Netherlands (Abstract Co-Author) Research Grant. Arthrex, Inc
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

PURPOSE
Myotendinous junction (MTJ)’s tendon involvement has been reported by some to increase recovery times in athletes with acute hamstring injuries. In order to confirm the clinical relevance of tendon involvement, we aimed to assess the relationship between tendon involvement at the MTJ in acute hamstring injuries evaluated on MRI and baseline clinical features.

METHOD AND MATERIALS
Athletes included in a multicentre randomized controlled trial on the effect of platelet rich plasma in acute hamstring injuries participated in this study. 1.5T MRI was performed at inclusion, within 5 days of injury. One experienced musculoskeletal radiologist assessed the MRIs and evaluated the presence of injuries at the MTJ as grade 0 (no morphological or signal changes around the MTJ), 1 (edema around the MTJ with normal tendon), 2 (thickening and signal changes of the tendon without discontinuity), 3 (partial-thickness discontinuity of the tendon), and 4 (complete discontinuity of the tendon). The following clinical parameters were assessed on the same day as MRI: active knee extension (AKE) and passive straight leg raise (PSLR) for hamstring flexibility, and linear relationship between MRI grade and AKE, with the increase on MRI grade related to a decrease in hamstring flexibility (p<0.001). Injuries exhibiting tendon discontinuity at the MTJ (grades 3 and 4) had a significantly decreased hamstring flexibility for the AKE test (20.4° ± 14.9 vs. 10.7° ± 9.0; p=0.01) and a significant decreased strength (F15) (62.2 ± 26.7 vs. 76.6 ± 22.5; p=0.05) when compared to injuries without tendon discontinuity (grades 1 and 2).

CONCLUSION
Tendon involvement at the MTJ in acute hamstring injuries assessed on MRI is related to decreased hamstring flexibility and strength at the time of injury, especially in hamstring injuries exhibiting discontinuity of the tendon.
**Clinical Relevance/Application**

Clinically, when flexibility and strength are reduced in acute hamstring injuries, tendon involvement at the MTJ may be present, which may ultimately lead to longer recovery times.

**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

**SSJ16-06  Achilles Tendon Diffusion Tensor Imaging and Tendon Fiber Tracking by Stimulated Echo Resolve (ste-RESOLVE)**

Tuesday, Nov. 29 3:50PM - 4:00PM Room: E451A

**Participants**

Xiang He, PhD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Kenneth T. Wengler, MS, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Chien-Hung Lin, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
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Mark E. Schweitzer, MD, Stony Brook, NY (Abstract Co-Author) Consultant, MMI Munich Medical International GmbH Data Safety Monitoring Board, Histogenics Corporation
Dharmesh Tank, MD, Stony Brook, NY (Presenter) Nothing to Disclose

**Purpose**

Approximately 75% of Achilles tendon (AT) rupture is related to athletic activities. These disorder usually begin as subclinical Achilles tendinosis, characterized by injury-induced disruption to the tendon microstructure integrity and degeneration, which may progress into rupture. Diffusion tensor imaging (DTI) provided a sensitive tool to non-invasively detect changes on AT micro-architecture. However, normal AT has an effective T2/T2* of ~5-10 ms such that clinical DTI protocol (TE ~60-80 ms) has poor SNR. In this pilot, a new DTI protocol with short TE (~20 ms) was developed and assessed.

**Method and Materials**

Six healthy subjects were recruited for this IRB approved study on a Siemens Prisma 3T magnet. A novel approach of combining stimulated-echo DTI and readout-segmented multi-shot EPI (ste-RESOLVE) was developed. To further boost tendon MR signal, magic angle effect was adopted by positioning AT ~55 degrees w.r.t. B0 direction. The tendon fractional anisotropy (FA), apparent diffusion coefficient (ADC), DTI tensor and fiber tractography were generated from DTI Studio. T2* maps were calculated using a mono-exponential on multi-echo GRE signal.

**Results**

The measured ADC and FA were 1.16±0.17x10-3 mm2/s and 0.34±0.03 respectively. The AT fiber tractography provides a visual description of microstructure integrity, with spatial distribution and orientation of DTI fiber tract following the parallel collagen fiber bundles running along the major axis. The relative angle of the AT (w.r.t. B0) was 47.5±7.5° in this study, resulting in a T2* of 14.8±2.0 ms.

**Conclusion**

This study evaluated the feasibility and robustness of a ste-RESOLVE-based DTI protocol that can be used on Achilles tendinosis patients to assess the risk of tendon rupture. Combining the magic angle effect with short TE ste-RESOLVE sequence, DTI of the AT can be accomplished in healthy subjects with no history of AT injury. The estimated ADC, FA and fiber tractography in control subject may serve as a baseline for subsequent studies on patients with clinical and subclinical Achilles tendinosis.

**Clinical Relevance/ Application**

This study evaluated the feasibility and robustness of a novel stimulated echo based RESOLVE DTI protocol that can be used on Achilles tendinosis patients to assess the risk of tendon rupture.
**Pilot Evaluation of Two-Phase Hybrid 18F-Fluoride PET/MRI of the Sacroiliac Joints in Patients with Ankylosing Spondylitis**

**Participants**
- Yonglin Pu, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose
- Andrew C. Homb, MD, Louisville, KY (*Moderator*) Nothing to Disclose

**Sub-Events**

**Purpose**
To evaluate the feasibility of blood-pool phase 18F-Fluoride positron emission tomography/magnetic resonance imaging (18F-F PET/MRI) of the sacroiliac joints (SIJ) in patients with active ankylosing spondylitis (AS) and to compare blood-pool and standard mineralization-phase 18F-F PET/MRI in different AS lesions.

**Method and Materials**
13 patients with active AS were prospectively enrolled. Early 18F-F PET was acquired in the blood-pool phase 6 min after injection of 158±8 MBq 18F-F. Then, a standard 18F-F PET was acquired in the mineralization phase 40 min after injection. PET and MR images were analyzed in consensus regarding image quality (IQ) (four-point Likert scale: 0=non-diagnostic, 3=excellent image quality). The iliac and the sacral part of each SIJ was subdivided in an upper and a lower part, resulting in 4 SIJ quadrants (SQ) per side. All SQ were then evaluated regarding the presence of bone marrow edema (BME), fatty deposits (FD), sclerosis, ankylosis, and focal 18F-F uptake on blood-pool and mineralization phase PET. Additionally, PET/MR images were reviewed for extraosseous 18F-F uptake.

**Results**
Mean IQ was 3.0±0 for MRI, 3.0±0 for mineralization phase, and 2.2±0.4 for blood-pool phase 18F-F PET. 66 SQ (63.4%) showed FD, 44 SQ (42.3%) BME, and 28 SQ (26.9%) erosions. Sclerosis was found in 27 SQ (26%), and ankylosis in 11 SQ (10.6%). On mineralization phase 18F-F PET/MRI focal uptake was seen in 45 SQ (43.3%), whereas on blood-pool phase 18F-F PET/MRI focal uptake was found in only 25 SQ (24.0%, p<0.001). There was no focal 18F-F uptake detectable on blood-pool phase PET/MRI without a corresponding uptake on mineralization phase PET/MRI. Moreover, blood-pool phase 18F-F PET/MRI revealed no additional extraosseous PET-positive lesions. On mineralization phase 18F-F PET/MRI, SQ showing BME alone or a combination of BME with other AS lesions had a significantly higher (p<0.001) percentage of focal uptake (38/44 SQ; 86.4%) than on blood-pool phase 18F-F PET/MRI (21/44 SQ; 47.7%).

**Conclusion**
Two-phase 18F PET/MRI of the SIJ is feasible. However, the blood-pool phase 18F-F PET offered no added diagnostic value as compared with standard mineralization phase 18F-F PET/MRI in patients with active AS.

**Clinical Relevance/Application**
According to our data, there seems to be no relevance of a blood-pool phase PET scan as part of a two-phase 18F-F PET/MRI protocol for the assessment of SIJ involvement in AS.
18F-FDG PET/CT was performed in 23 consecutive patients (13 men; 10 women; mean age 67.4 ± 11.1 years, range, 40.7 to 88.8 years). All PET/CT scans were analyzed by two independent readers both visually and semiquantitatively by measurement of the maximum standardized uptake value (SUVmax) in areas of visually increased spinal tracer uptake. Laboratory parameters of infection/inflammation including C-reactive protein (CRP), procalcitonin (PCT) and leucocyte count were recorded. Histopathological evaluation and microbiological pathogen detection by either intraoperative material collection and/or blood cultures served as the reference standard. Nonparametric Spearman’s rho was used for correlation analysis. Cohen’s kappa was used for assessment of intra- and interrater agreement.

RESULTS
36 foci of increased tracer uptake within the spine were detected in 21 study patients. Staphylococcus aureus was the predominant pathogen. Mean SUVmax of lesions was 5.6 ± 2.2 (range, 2.6 to 13.0). SUVmax did neither correlate with CRP (p = 0.29), nor with PCT (p = 0.91) nor with leucocyte count (p = 0.82). 18F-FDG PET/CT had a sensitivity of 100%, a specificity of 66.7%, a positive predictive value of 95.2%, a negative predictive value of 100%, and an overall accuracy of 95.7%. The interrater Cohen's kappa was 0.62 (95% CI 0.16 - 1.09), whereas the intrarater Cohen's kappa was 0.78 (95% CI 0.36-1.20).

CONCLUSION
18F-FDG PET/CT is a reliable and highly sensitive imaging modality for detection of pyogenic spondylodiscitis. Whole-body evaluation by PET may contribute to the detection of additional sites of inflammation. Particularly high uptake values (SUVmax) may be observed in Staphylococcus aureus infection; however, SUVmax cannot reliably predict the causing pathogen. Tracer uptake did not correlate with the level of inflammatory serum markers in this study, questioning the role of PET for grading the strength of inflammatory reaction.

CLINICAL RELEVANCE/APPLICATION
18F-FDG PET/CT is a reliable and highly sensitive imaging modality for detection and localization of pyogenic spondylodiscitis and may contribute to the detection of additional sites of inflammation.

SS317-03  Do Meniscal Pathologies Correlate with Increased Bone Tracer Uptake Using SPECT/CT?

Tuesday, Nov. 29 3:20PM - 3:30PM Room: S505AB

Participants
Anna Hirschmann, MD, Basel, Switzerland (Presenter) Nothing to Disclose
Anna L. Falkowski, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Milos Dordevic, Bruderholz, Switzerland (Abstract Co-Author) Nothing to Disclose
Jan Rechsteiner, Bruderholz, Switzerland (Abstract Co-Author) Nothing to Disclose
Felix Amerler, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Michael T. Hirschmann, MD, Bruderholz, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the correlation of subchondral bone tracer uptake (BTU) of the knee joint using single photon emission computed tomography (SPECT)/computed tomography (CT) and meniscal pathologies using magnetic resonance (MR) imaging.

METHOD AND MATERIALS
Twenty-five consecutive patients (mean age 45.5 ± 11.5 years) with MR and SPECT/CT within three months were prospectively collected and retrospectively included. Patients with previous knee surgery as well as with grade 3 and 4 cartilage lesions were excluded. For analysis and comparison of MR and SPECT/CT a specific localisation scheme was used. Maximum values of each subchondral femorotibial area were quantified and a ratio was calculated in relation to a reference region in the femoral shaft, which represented the BTU background activity. Meniscal pathologies on MR were graded (non, degeneration, tear) by two experienced musculoskeletal radiologists blinded to the SPECT/CT findings. Extrusion of the meniscus was assessed. ANOVA and Chi-Square (p<0.05) served for statistics.

RESULTS
Meniscal degeneration showed a significantly higher mean relative BTU compared to an intact meniscus on the femoral side (p=0.018; tibial side p=0.072). Meniscal tear showed significantly higher mean relative BTU compared to an intact meniscus (p<0.01 femoral and tibial side) as well to degeneration (p=0.006, respectively). Meniscal extrusion showed significantly higher mean relative BTU compared to non-extruded meniscus (p<0.02). Medial meniscal pathologies (0.52) showed higher correlation with BTU than on the lateral side (0.23).

CONCLUSION
Subchondral BTU in SPECT/CT of the knee with preserved cartilage was significantly higher with meniscal degeneration or tear as well as meniscal extrusion. SPECT/CT is able to identify patients with an increased risk for development of osteoarthritis.

CLINICAL RELEVANCE/APPLICATION
The present results demonstrate the need for a valid tool, which is able to diagnose osteoarthritis in its earliest stages, in order to create specialized treatments in a timely manner avoiding outcomes caused by osteoarthritis progression.

SS317-04  Variability in Sodium Fluoride PET Imaging Observed in Multicenter Clinical Trials

Tuesday, Nov. 29 3:30PM - 3:40PM Room: S505AB

Participants
Prayna Bhatia, BS, Columbus, OH (Presenter) Nothing to Disclose
David Poon, BS, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Chadwick L. Wright, MD, PhD, Lewis Center, OH (Abstract Co-Author) Nothing to Disclose
Lawrence H. Schwartz, MD, New York, NY (Abstract Co-Author) Committee member, Celgene Corporation Committee member, Novartis AG Committee member, ICON plc Committee member, BioClinica, Inc
Michael V. Knopp, MD, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
PURPOSE
To identify areas of variability or non-compliance and critical challenges in NaF PET/CT imaging by analyzing de-identified imaging examinations from a multi-center oncology trial that included bone imaging in comparison to the SNMMI standard NaF PET/CT acquisition guidelines.

METHOD AND MATERIALS
30 patients with 80 NaF PET/CT examination from over 14 credentialed institutions within the USA were included in this assessment. A standardized quality control (QC) process was utilized pulling key information from the DICOM tags including NaF dosage and uptake time. Trial-specific data compliance was evaluated. The utilized dosage and uptake time was compared to the SNMMI standard NaF guidelines. A standard QC scoring system for NaF PET was developed and implemented to determine the variability of the exams.

RESULTS
The SNMMI guidelines on NaF PET/CT imaging recommend imaging 45-60 minutes post-injection. We found that only 33% fell within those guidelines while 66% were outside that range. The average uptake time for the trial studies was 58 ± 17 min, with a range of 20 to 103 minutes (median: 61 minutes). Compared to the recommended dose for adults of 185-370 MBq (5-10 mCi), only 39% of the studies fell within the protocol range. The average dose for the trial studies was 358 ± 66 MBq (9.7 ± 1.8 mCi) with a median of 375 MBq (10.1 mCi). 6% of the dose activity were below the protocol minimal dose and 55% were above.

CONCLUSION
Currently, only a few publications summarize recommendations for Sodium Fluoride PET acquisition and the SNMMI imaging protocol includes several considerations for patient acquisition. There is no evidence that higher than recommended dose are diagnostically beneficial nor imaging outside the recommend p.i. time frame. It is thus evident, that clinical practice is currently in 2/3 of the scans outside current recommendations and that based on ALARA dose reductions should be considered. While most of the variability does not impact the visual accessibility of NaF PET, safety and potential quantitative assessment considerations necessitate a substantial improvement in community practice within clinical trials.

CLINICAL RELEVANCE/APPLICATION
As osseous disease burden are increasingly decision points for adaptive clinical trials, quality assurance standards for NaF PET/CT must be monitored, as current procedural variability is excessive.

SSJ17-05 18F-FDG Super Bone Marrow Uptake: A PET Presentation of Bone Marrow Malignant Infiltration?

Tuesday, Nov. 29 3:40PM - 3:50PM Room: S505AB

Awards
Student Travel Stipend Award

Participants
Mohammed Shah Alam, MBBS, Guangzhou, China (Presenter) Nothing to Disclose
Hu Bing Wu, PhD, MD, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Lilan Fu, MBBS, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Wen-Lan Zhou, MD, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Wang Quan-Shi Wang, PhD, MD, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
It has not been illuminated what causes the super 18F-FDG uptake in bone marrow (SBMU), which presents as particular high diffuse 18F-FDG uptake in bone marrow similar to or higher than that in the brain. The present study was performed to investigate its origins and clinical significance.

METHOD AND MATERIALS
31 newly diagnosed patients with SBMU were retrospectively reviewed from April 2008 to December 2015. Twenty normal subjects were selected as the control group. The SUVmax of bone marrow was measured and the bone marrow to cerebellum (BM/C) ratio was calculated. Blood parameters as well as fever were also been collected and analyzed.

RESULTS
Of 31 patients with SBMU, 29 (93.6%) were diagnosed to have malignancies including 14 lymphoma, 11 leukemia, 3 multiple myeloma and 1 bone metastasis. BM malignant infiltration (BMI) was confirmed in all these patients. SUVmax and BM/C ratios of the SBMU were significantly higher than that of control subjects (SUVmax, 11.30±3.95 vs. 2.43±0.51, t=9.936, P=0.000; BM/C ratios, 1.24±0.36 vs. 0.23±0.02, t=12.463, P=0.000; respectively). Extra-bone marrow lesions were found in 15 patients with malignances. Decrease of leukocyte count (WBC) count, hemoglobin (HB) and platelet count (PLT) were noted in 48.4%, 86.2% and 51.5% of the patients with BMI respectively. HB, PLT, lactic dehydrogenase (LDH), C-reactive protein (CRP) and the fever incidence were observed to be helpless for the differentiation of lymphoma and leukemia (all P>0.05). However, increase of WBC counts and extra-BM involvement found on PET were useful for differentiation, especially the liver and nasal cavity involvements (P=0.020 and P=0.046, respectively).

CONCLUSION
Most of the SBMU was caused by the malignant infiltration which often accompany with decrease of hematopoietic function. 18F-FDG PET/CT is useful for detection of extra-BM involvements and for differentiation of lymphoma and leukemia.

CLINICAL RELEVANCE/APPLICATION
Study revealed that super BMU was a highly potent indicator for the malignant BMI which mostly originated from lymphoma and leukemia.

SSJ17-06 The Prognostic and Diagnostic Value of FDG PET/CT for Assessment of Symptomatic Osteoarthritis

Tuesday, Nov. 29 3:50PM - 4:00PM Room: S505AB
Awards
Trainee Research Prize - Medical Student

Participants
Brian J. Nguyen, BA, San Diego, CA (Presenter) Nothing to Disclose
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Sebastian Obrzut, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study was to assess the clinical significance of increased FDG uptake on PET/CT in the joints for evaluation of symptomatic osteoarthritis (OA) and for prediction of OA progression.

METHOD AND MATERIALS
In this prospective study, shoulder, hip and knee joints were imaged in 79 patients undergoing routine FDG PET/CT imaging. Subsequently, patients completed Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire to assess for joint pain, stiffness, and physical function. SUVs were measured in acromioclavicular, glenohumeral, hip and knee joints. Scout images were reviewed and joints were evaluated for OA using the The Kellgren and Lawrence (KL) system. Patients were followed for 2 years to determine progression of OA based on follow up imaging or surgical intervention.

RESULTS
In the knees ROC AUCs for SUV were 0.737 (WOMAC Total), 0.784 (WOMAC Pain) and 0.743 (WOMAC Function). ROC AUCs in the knees for KL score were 0.794 (WOMAC Total), 0.859 (WOMAC Pain), 0.795 (WOMAC Stiffness) and 0.805 (WOMAC Function). In the hips ROC AUCs for SUV were 0.703 (WOMAC Pain) and 0.764 (WOMAC Function). In the glenohumeral and acromionclavicular joints ROC AUCs for SUV were 0.716 and 0.916 (WOMAC Pain) respectively. Follow-up imaging was available for 19 knee joints. OA progressed in 6 knee joints and was stable in 13. SUV (p = 0.0229), KL score (p = 0.5324), Age (p = 0.8978) and WOMAC score (p = 0.1265) variables were entered simultaneously into the Cox proportional hazards model and only SUV was found to be an independent predictor of OA progression in the knees.

CONCLUSION
SUV measurement on FDG PET/CT may be helpful for assessment of symptomatic OA in the knees and hips, and pain in the shoulders. Increased FDG uptake on PET/CT in the knees may be predictive of progression of OA. KL score of the scout images can aid in identification of symptomatic OA in the knees.

CLINICAL RELEVANCE/APPLICATION
SUV measurement on FDG PET/CT may be helpful for assessment of symptomatic OA in the knees and hips, and pain in the shoulders.
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-enthesal unit with emphasis on the types of lesion that affect the region of the footprint, with emphasis on MR imaging.
Participants

RC408A  Abdomen (Solid Organs and Vessels)

Participants
Felipe Munera, MD, Miami, FL, (fmunera@med.miami.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1. Identify common pitfalls in interpretation of abdominal trauma CT studies - focus on solid organs and vascular structures.
2. Optimize CT acquisition techniques to reduce likelihood of missing potentially significant injuries.
3. Develop a search pattern that includes organs and structures where important lesions are commonly missed.
4. Describe strategies to improve detection of easily missed injuries.

RC408B  Diaphragm

Participants
Michael N. Patlas, MD, FRCPC, Hamilton, ON, (patlas@hhsc.ca) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To describe direct and indirect signs of blunt and penetrating diaphragmatic injury.
2) To highlight factors affecting detection of diaphragmatic injury.
3) To discuss pitfalls in diagnosis of diaphragmatic injury.

ABSTRACT
The traumatic diaphragmatic injury is an uncommon entity. Blunt diaphragmatic injury is undiagnosed at initial presentation in 7-66%. Penetrating diaphragmatic injury can be occult in 7% of cases. Diaphragmatic injury does not resolve spontaneously and can cause disastrous complications. The misinterpretation in patients with diaphragmatic injury may be caused by suboptimal technique, failure to review portion of examination e.g. MPRs, or satisfaction of search error. Potential pitfalls in interpretation include congenital diaphragmatic hernias and atraumatic defects simulating diaphragmatic injury.

RC408C  Bowel/Pelvis

Participants
Stephan W. Anderson, MD, Boston, MA (Presenter) Nothing to Disclose

RC408D  Extremities

Participants
O. C. West, MD, Houston, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Find upper extremity injuries that are difficult detect on screening radiographs.
2) Employ search patterns that may improve detection of easily missed injuries.

ABSTRACT
Summary of upper extremity pitfalls: Posterior shoulder dislocation; Supracondylar fracture (anterior humeral line); Monteggia fracture-dislocation (radio-captellar line); Proximal radius including vertical head fracture (external oblique view), impacted neck fracture, flipped radial head fracture-dislocation, Galeazzi fracture-dislocation - beware the lateral radiograph. Imaging joints requires 3 radiographic projections. The 3rd view varies: Axillary view of shoulder and External oblique of elbow. The wrist needs 4 views: PA, lateral, external oblique and "Scaphoid" view (ulnar deviated PA view). Words to live by: watch for the least obvious of multiple injuries.

Active Handout: O. Clark West
Nerve Ultrasound Based on a Regional Approach: Elbow to Hand (Hands-on)

Tuesday, Nov. 29 4:30PM - 6:00PM Room: E264

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

Participants
Carlo Martinoli, MD, Genova, Italy (Presenter) Nothing to Disclose
Etienne Cardinal, MD, Montreal, QC (Presenter) Nothing to Disclose
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Presenter) Consultant, Toshiba Medical Systems Corporation; Research Grant, Arthrex, Inc.;
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, Detroit, MI (Presenter) Nothing to Disclose
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.eu) (Presenter) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
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Kenneth S. Lee, MD, Madison, WI, (klee2@uwhealth.org) (Presenter) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose
Courtney E. Scher, DO, Detroit, MI (Presenter) Nothing to Disclose
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Ximena L. Wortsman, MD, Santiago, Chile, (xworts@yahoo.com) (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/

Michael A. Dipietro, MD - 2016 Honored Educator
Jon A. Jacobson, MD - 2012 Honored Educator
Participants
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Hillary W. Gamer, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Laura W. Bancroft, MD, Orlando, FL (Abstract Co-Author) Author with royalties, Wolters Kluwer nv
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Instructor, DFine, Inc
Kimberly Beavers, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
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Kurt F. Scherer, MD, Windermere, FL (Abstract Co-Author) Nothing to Disclose
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Edward Derrick, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
Raul Loya, MD, Orlando, FL (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.
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.

Abstract

URL
LEARNING OBJECTIVES
Topical lectures on pre- and post-operative imaging of shoulder, elbow, wrist and hand to familiarize the audience with concepts relevant to clinical practice. This session will also include oral presentation of scientific abstracts in shoulder, elbow and wrist.

ABSTRACT
Active Handout: Robert SD Campbell

LEARNING OBJECTIVES
1. Participants will be able to cite the important imaging features that a surgeon needs to know prior to operating on the rotator cuff, biceps tendon or the labrum.
2. Participants will comprehend the specific features of a rotator cuff tear that should be mentioned in the report.
3. Participants will be able to analyze the extent and features of labral tears so as to be able to communicate these to the surgeon.

PURPOSE
To compare the diagnostic performance of a 5-minute shoulder magnetic resonance imaging (MRI) protocol consisting of multiplanar 2-dimensional fast spin echo (2D FSE) sequences with parallel imaging to that of a standard shoulder MRI protocol.

METHOD AND MATERIALS
A HIPAA-compliant, IRB-approved retrospective review of 151 3T shoulder MRIs in 147 patients (mean age, 46.95 years; range, 18-80 years) and 50 1.5T shoulder MRIs in 50 patients (mean age, 53.74 years; range, 27-91 years) with 4 fast and 5 standard sequences from 2 academic centers between January 2014 and April 2015 was performed by 3 musculoskeletal radiologists. Interchangeability of fast and standard MRI was tested by comparing interprotocol (fast v standard) interreader agreement with that of standard MRI interreader agreement. Interreader agreement was also compared using kappa statistics. Frequency of major findings was compared using an adjusted McNemar test. Sensitivity and specificity were compared in patients who underwent surgery.

RESULTS
The interprotocol agreement was not significantly lower than agreement on standard MRI (mean ±1%; 95%CI [-3.8%, +3.9%]).
ranging from 61-96% across structures. Interset kappas (0.37–0.65) were similar to standard MRI kappas (0.32-0.73). Frequency of major findings on fast and standard MRI were similar (p>0.08), ranging from 0.7-19.6% across structures. Sensitivities of fast MRI for tendon and labral tears (33-92%) were equivalent or higher than that of standard MRI with similar specificities (77-98%).

CONCLUSION
A fast 5-minute shoulder MRI with multiplanar 2D FSE sequences using parallel imaging is interchangeable, with similar interreader agreement and accuracy, with a standard shoulder MRI for evaluating shoulder injuries.

CLINICAL RELEVANCE/APPLICATION
Use of a fast shoulder MR protocol would improve the efficiency and could lower the costs of shoulder MR imaging without sacrificing interpretative quality when compared to standard shoulder MR imaging. This fast protocol may also result in a more comfortable and tolerable examination.

RC504-03 The Glenoid Labral Articular Teardrop (GLAT) Lesion: A Novel Glenoid Articular Cartilage Injury Pattern on MRI

Wednesday, Nov. 30 9:00AM - 9:10AM Room: S406B

Participants
Pamela J. Lund, MD, Scottsdale, AZ (Presenter) Nothing to Disclose
Stephen Flores, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Damien Richardson, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Evan Lederman, MD, Phoenix, AZ (Abstract Co-Author) Consultant, Arthrex, Inc; Royalties, Arthrex, Inc; Fellowship funded, Arthrex, Inc; Fellowship funded, Wright Medical Technology, Inc; Fellowship funded, Smith & Nephew plc; Fellowship funded, Ossur HF; Research support, Arthrex, Inc

PURPOSE
The purpose of this study is to describe the arthroscopically correlated MRI features of a recently recognized glenoid rim articular cartilage pattern of injury associated with glenohumeral instability.

METHOD AND MATERIALS
Between December 2010 and September 2015, 31 shoulder MRI studies were identified by a single musculoskeletal radiologist at a group of outpatient imaging centers demonstrating typical features of the glenoid labral articular teardrop (GLAT) injury. All MRI studies were performed on 3T MRI equipment (GE or Siemens) using dedicated shoulder coils. GLAT lesion was identified if characteristic elliptical (teardrop) shaped fragment was present in inferior glenohumeral recess with thin stalk attached to glenoid margin on both standard and MR arthrogram studies. Three dimensional fragment size, location and clinical history were recorded for all images and correlated with arthroscopic findings.

RESULTS
31 patients (26 Male, 4 Female; Average age 30 years) with MRI findings of a GLAT lesion were included in the study. 17 (55%) were noted to have sustained an instability event or had physical exam findings of instability while 14 (45%) had no reported instability or physical exam findings. The lesion is described on MRI and arthroscopy as a chondral, elliptically-shaped articular cartilage fragment, displaced into the glenohumeral recess and rotated on an intact pedicle attached to the peripheral chondral articular surface. The displaced fragment varied in size from 5-20mm. Corresponding chondral defect donor sites were inconsistently identified. Associated injuries included: Hill Sachs (HS) lesions (71%), anterior labroligamentous periosteal sleeve avulsion (ALPSA) injuries (16%), labral tears (16%), osseous Bankart lesions (13%), and loose bodies (10%).

CONCLUSION
The GLAT lesion has a characteristic appearance and location on MRI and is often associated with glenohumeral instability. The distinct appearance should be recognized and included in the spectrum of glenoid labrochondral injuries.

CLINICAL RELEVANCE/APPLICATION
Glennon labral articular teardrop (GLAT) lesion is a characteristic, previously undescribed, glenoid rim chondral injury pattern on MRI often associated with glenohumeral instability.

RC504-04 Postoperative Evaluation of Shoulder

Wednesday, Nov. 30 9:10AM - 9:30AM Room: S406B

Participants
Laura W. Bancroft, MD, Orlando, FL, (laura.bancroft.md@flhosp.org) (Presenter) Author with royalties, Wolters Kluwer nv

LEARNING OBJECTIVES
1. Describe the expected postoperative MRI appearance of the shoulder after rotator cuff and labral repair, and their complications.
2. Review imaging findings of capsular shift, remplissage and Laterjet/Bristow procedures.

ABSTRACT

RC504-05 Cuff Tear Arthropathy Shoulder Hemiarthroplasty: A Radiographic Outcome Study

Participants
Laura W. Bancroft, MD, Orlando, FL, (laura.bancroft.md@flhosp.org) (Presenter) Author with royalties, Wolters Kluwer nv

LEARNING OBJECTIVES
1) Describe the MR imaging features of the postoperative rotator cuff. 2) Identify expected postsurgical change of the long head of the biceps tendon. 3) Classify normal and abnormal appearance of labral repair.

ABSTRACT
Electrodiagnostical testing is still the most sensitive and specific diagnostic test for detection of UNE. Nerve caliber measurements were assessed as diagnostic signs.

METHOD AND MATERIALS
In this retrospective study of CTA hemiarthroplasties over an 11 year period, two radiologists reviewed pre/post-operative radiographs and clinical data, including surgical reports, and reported pain levels. Rates of surgical revision and radiographic complications were determined using Kaplan-Meier curves. Occurrence of radiographic complications was correlated with subsequent surgery and preoperative radiographs using Cox regression and Weibull proportional hazard models, respectively.

RESULTS
98 CTA hemiarthroplasties were identified in 93 patients (5 bilateral) with mean patient age of 68.5 years. Mean radiographic follow-up was 12 months with a mean of 3.3 radiographs per prosthesis. 39 arthroplasties (39.8%) experienced at least one radiographic complication, including anterior-posterior subluxations (24.5%), acromion remodeling (19.4%), periprosthetic fractures (4.1%), glenoid remodeling (3.1%), superior-inferior humeral head subluxations (2.0%), perihardware lucencies (2.0%), and subsidence (1.0%). Most (42%) radiographic complications occurred by 3 months of initial surgery based on Kaplan-Meier curve analysis. Eight cases underwent revision surgery (8.2%). Risk of surgical revision increased 6.0 times (hazard ratio 95% CI: 1.2-28.9) when a radiographic complication was seen versus without (p = 0.026). Risk of radiographic complications increased 3.9 times with moderate to severe preoperative superior-inferior humeral head subluxation compared to without (hazard ratio 95% CI: 1.2-12.3).

CONCLUSION
Radiographic complications after CTA head hemiarthroplasty are common with most occurring by 3 months after surgery and are highly associated with subsequent surgical revision. Understanding normal from abnormal radiographic findings after CTA hemiarthroplasty will enable more efficacious and accurate interpretation of post-operative studies.

CLINICAL RELEVANCE/APPLICATION
Understanding normal and abnormal post-operative radiographic appearance of CTA hemiarthroplasty will enable more efficacious radiology interpretations.

Comparison of ElectroDiagnostic Testing, Neurosonography, MR-Neurography including DTI in Ulnar Neuropathy at the Elbow

PURPOSE
To compare diagnostic signs in electrophysiological testing, neurosonography, MR neurography and diffusion tensor imaging (DTI) in patients with clinical symptoms of ulnar neuropathy at the elbow (UNE).

METHOD AND MATERIALS
This prospective study was IRB approved and written informed consent was obtained from all participants. Electrodiagnostic studies, high-resolution ultrasonography at 15 MHz and high-field MR neurography at 3T were performed on both sides of 14 symptomatic patients and on both sides of 10 control subjects at standardized sites at the medial epicondyle as well as proximally of it - corresponding to the segments of ulnar short-segment nerve conduction studies. Nerve caliber in neurosonography and MR neurography, T2-weighted contrast-to-noise ratios of MR neurography and fractional anisotropy (FA) and mean diffusivity (MD) of DTI were assessed as diagnostic signs.

RESULTS
Diagnostic performance, as measured with area under the receiver operating characteristic curve (AUC), was excellent for nerve conduction latency in electrodiagnostic testing (AUC = 0.91; 95% confidence interval [CI]: 0.82, 1.00), nerve caliber in neurosonography (AUC = 0.84; 95% confidence interval [CI]: 0.82, 1.00), nerve caliber in MR neurography (AUC = 0.87; 95% confidence interval [CI]: 0.83, 1.00), nerve T2 weighted signal (AUC = 0.74; 95% confidence interval [CI]: 0.81, 1.00) and moderate for FA (AUC = 0.63; 95% confidence interval [CI]: 0.81, 1.00) and MD (AUC = 0.60; 95% confidence interval [CI]: 0.84, 1.00) in DTI to discriminate symptomatic from asymptomatic findings in patients with UNE.

CONCLUSION
Electrodiagnostical testing is still the most sensitive and specific diagnostic test for detection of UNE. Nerve caliber measurements...
in neurosonography and MR neurography as well as the T2-weighted signal in MR neurography might add information in unclear cases, when electrodiagnostic testing is inconsistent or not tolerated by the patient. DTI supports diagnostic findings of other tests, but is less sensitive and less specific.

**CLINICAL RELEVANCE/APPLICATION**

The results of this prospective study contribute to the understanding of different state-of-the-art diagnostic test in patients with UNE. Electrodiagnostic testing is still the most sensitive and specific test, but nerve calibre measurements in neurosonography and MR neurography and T2-weighted signal in MR neurography support the diagnosis of the former tests.

**RC504-07 Preoperative Evaluation of Elbow**

**Wednesday, Nov. 30 9:50AM - 10:10AM Room: S406B**

Participants
Bruce B. Forster, MD, Vancouver, BC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Demonstrate an understanding of the technical and procedure-related considerations in MR imaging of the elbow. 2) Identify the normal variants that can simulate pathology. 3) Diagnose common sports injuries of the elbow, using a four-compartmental approach.

**ABSTRACT**

This presentation will discuss technical considerations such as positioning, and protocol issues such as when to use arthrography, and optimal sequences for MR imaging of the elbow. Common sports injuries will be discussed, as well as normal variants that can simulate disease. Collateral ligament injuries, including partial tears of the UCL will be addressed, as will tears of the distal biceps, triceps and common flexor and extensor pathologies.

**RC504-08 Postoperative Evaluation of Elbow**

**Wednesday, Nov. 30 10:20AM - 10:40AM Room: S406B**

Participants
Martin Torriani, MD, Boston, MA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the MR imaging features of the postoperative elbow. 2) Identify expected postsurgical change of the ligaments, tendons and nerves. 3) Identify abnormal postsurgical findings of the elbow.

**ABSTRACT**

**RC504-09 Cost-Effectiveness of Utilizing 1.5T MRI, 3T MRI, and MR Arthrography in the Diagnosis of Scapholunate Interosseous Ligament Injury**

**Wednesday, Nov. 30 10:40AM - 10:50AM Room: S406B**

Participants
Sahar J. Farahani, MBBS, Baltimore, MD (Presenter) Nothing to Disclose
John Eng, MD, Cockeysville, MD (Abstract Co-Author) Nothing to Disclose
C. Craig Blackmore, MD, MPH, Seattle, WA (Abstract Co-Author) Author with royalties, Springer Science+Business Media Deutschland GmbH
John A. Carrino, MD, MPH, New York, NY (Abstract Co-Author) Research Consultant, BioClinica, Inc; Research Consultant, Pfizer Inc; Research Consultant, Carestream Health, Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc;
Nima Hafezi Nejad, MD, MPH, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Shadpour Demehri, MD, Baltimore, MD (Abstract Co-Author) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;

**PURPOSE**

To determine cost-effectiveness of applying 1.5T MRI, 3T MRI, and MR arthrography (MRA) prior to diagnostic arthroscopy (DA) in the patients with suspected scapholunate intersosseous ligament injury (SLILI)

**METHOD AND MATERIALS**

A Markov-cohort decision model was developed to project cost-effectiveness of the following diagnostic strategies: 1) Performing DA in all the patients, 2) 1.5T MRI and 3) and 3T MRI, and 4) MRA. In strategies 2-4, DA was performed in subjects with positive findings. The base-case analysis was conducted for a hypothetical cohort of 30-year old male patients. Outcome measures were lifetime costs, quality-adjusted-life (QALY) and incremental cost-effectiveness ratio (ICER). The model inputs and costs associated with each strategy were derived from literature and Medicare reimbursement data for 2016. The analysis was done from societal perspective. ICER threshold of $50,000 was considered as cost-effective.

**RESULTS**

Based on systematic literature review and met-analysis, using prevalence of SLILI at 25%, sensitivity and specificity of 1.5T MRI, 3T MRI, and MRA in detecting SLILI were considered as (46% and 80%), (76% and 97%), and (82% and 93%), respectively. The utility of wrist pain was considered as 0.8. The probability of major complication in DA and MRA was assumed 1% and 0.003%, respectively. The analysis calculated the QALY and costs ($) of DA, 1.5T MRI, 3T MRI, and MRA as (45.01, 16,850$), (44.88, 17,414$), and (44.98, 15,145$), respectively. 3T MRI was the least expensive and DA was the most effective strategies. 1.5T MRI was the most expensive and the least effective strategy.ICER of DA and MRA in comparison to 3T MRI was $32,200 and $542 per one QALY pain, respectively. Sensitivity analysis demonstrated that ICER of DA in comparison to 3T MRI exceeded threshold of $50,000 where utility of wrist pain was > 0.96, or probability of major DA complication >2%, or prevalence of SLILI < 12%. In SLILI prevalence> 28%, MRA was the least expensive strategy with higher effectiveness than 3T MRI, and DA
continued to be the most expensive and effective strategy.

**CONCLUSION**

3T MRI and MRA might be cost effective in comparison to DA in detection of SLILI where the patients experiencing less disutility due to wrist pain.

**CLINICAL RELEVANCE/APPLICATION**

In practice where the majority of the patients with wrist pain do not have substantial ligament injury or functional impairment, MRI and MRA could be cost-effective in avoiding unnecessary DA.

**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

**RC504-10** **Added Value of Dynamic Evaluation of Scapholunate Instability using Four Dimensional Computed Tomography in Association with Radiocarpal Osteoarthritis**

Wednesday, Nov. 30 10:50AM - 11:00AM Room: S406B

**Participants**

Nina Hafezi Nejad, MD, MPH, Baltimore, MD (Presenter) 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
John Eng, MD, Cockeysville, MD (Abstract Co-Author) Nothing to Disclose
Shadpour Demehri, MD, Baltimore, MD (Abstract Co-Author) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;

**PURPOSE**

To evaluate the added value of measurements obtained from dynamic computed tomography (CT) imaging in addition to static CT measurements in assessing the Scapholunate (SL) interval, and its association with radiocarpal osteoarthritis (OA).

**METHOD AND MATERIALS**

SL interval was measured in 55 wrists (31 subjects) with inconclusive plain radiographs (SL interval < 3mm) using: 1) Static CT in neutral position 2) Static CT in other positions: at rest, flexion, and radial deviation. 3) Dynamic CT: Changes from rest to clenched, from flexion to extension, and from radial to ulnar deviation. All subjects were examined by a hand surgeon and were suspected of having SL instability. 3 levels of statistical modeling were designed using CT measurements from 1) Static neutral position, 2) Static neutral position plus another static position, and 3) Static neutral position plus another static position plus dynamic change. Models were assessed for their ability to predict the presence radiocarpal OA. Radiocarpal OA was graded using Kellgren and Lawrence (KL) classification (with KL grade 2 as the threshold for OA diagnosis). Area Under the Curve (AUC) and discrimination slope of each modeling level was calculated and compared in association with radiocarpal OA.

**RESULTS**

All three modeling levels were in fair to moderate correlation with radiocarpal OA (correlation coefficients range: 0.356 – 0.457; P values<0.01). CT assessment of another static position in additional to neutral position, was associated with a positive trend of increased AUCs. Additional assessment of dynamic CT changes was associated with a significant increase in the AUC (AUC increase from 0.681 to: 0.731 (rest-clenched; P:0.07), 0.737 (flexion-extension; P:0.05), 0.774 (radial to ulnar deviation; P<0.01)).

**CONCLUSION**

Dynamic CT evaluations can significantly enhance the detection of SL instability in the prediction of radiocarpal OA, beyond the static CT measurements. Other static position CT images (in additional to neutral position) were associated with a positive trend of enhanced performance.

**CLINICAL RELEVANCE/APPLICATION**

Dynamic CT evaluations are of significant added value while performed in addition to static CT; when SL instability is suspected, radiographic findings are inconclusive and radiocarpal OA is of concern.

**RC504-11** **Preoperative Evaluation of Wrist and Hand**

Wednesday, Nov. 30 11:00AM - 11:20AM Room: S406B

**Participants**

Tetyana A. Gorbachova, MD, Huntingdon VY, PA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss current imaging techniques that can be used to evaluate painful wrist and hand. 2) Review pertinent anatomy and normal MRI appearance to avoid imaging pitfalls. 3) Identify common injuries and their clinical and surgical implications.

**ABSTRACT**

**RC504-12** **Variations of Wrist First Extensor Compartment MRI Anatomy and Association with DeQuervain’s Tenosynovitis**

Wednesday, Nov. 30 11:20AM - 11:30AM Room: S406B
Participants
Connie Y. Chang, MD, Boston, MA (Presenter) Nothing to Disclose
Arvin Kheterpal, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Timothy Meehan, MD, MS, Newark, NJ (Abstract Co-Author) Nothing to Disclose
Martin Torian, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ambrose J. Huang, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To study the correlation between variations of wrist first extensor compartment anatomy and DeQuervain tenosynovitis.

METHOD AND MATERIALS
A retrospective search of the imaging archive for “DeQuervain” was performed, which yielded 56 subjects (52±15 years, 23 F, 19 M). The control group contained 42 consecutive patients (43±16 years, 36 F, 10 M) with wrist MRI and a normal first extensor compartment. The studies were reviewed for: number of abductor pollicis longus (APL) tendon slips and their insertions, and tendon compartmentalization at the level of the radial styloid. A tendon slip was defined as a hypointense structure with normal caliber and signal intensity, with its own insertion. Groups were compared with Fisher exact test.

RESULTS
In the control vs subject groups, 12/42 (29%) vs 5/46 (11%) had 1, 23/42 (55%) vs 23/46 (50%) had 2, 6/42 (14%) vs 10/46 (22%) had 3, 1/42 (2%) vs 4/46 (9%) had 4, and 0/42 (0%) vs 4/46 (9%) had 5 tendon slips of the APL. There was a statistically significant difference between the controls and subjects when comparing the number of single versus multiple (>1) tendon slips of the APL (P = 0.03). In the control vs subject groups, 3/42 (7%) vs 0/46 (0%) had an absent EPB, 30/42 (71%) vs 18/46 (39%) had a normal configuration with a single compartment containing both EPB and APL, 7/42 (17%) vs 25/46 (54%) had a septation in the tendon sheath, and 2/42 (5%) vs 3/46 (7%) the EPB and APL were in separate compartments. There was a statistically significant difference between the compartmentalization of the EPB and APL between subjects and controls (0.0003). There was no statistically significant difference between the control and subject groups in terms of number of insertions on the thumb metacarpal (P = 0.6) or trapezium (P = 0.2), or having an insertion on both the metacarpal and the trapezium (P = 0.3).

CONCLUSION
Subjects with DeQuervain tenosynovitis are more likely to have multiple APL tendon slips, and are more likely to have a septation in the tendon sheath at the level of the radial styloid.

CLINICAL RELEVANCE/APPLICATION
Understanding the anatomy of the APL tendon, the multiplicity of the tendon sheaths, the differences in tendon compartmentalization, and their variant insertions is important to avoid falsely diagnosing tears of the tendon.

Diagnosing Carpal Tunnel Syndrome is As Easy As Diffusion Tensor Imaging, A Systematic Review

Wednesday, Nov. 30 11:30AM - 11:40AM Room: S406B

Awards
Student Travel Stipend Award

Participants
Hiren Rangunwala, MD, Detroit, MI (Presenter) Nothing to Disclose
Karan N. Patel, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Amr M. Daous, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Haiying Yu, MD, PhD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Mark Le, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Nicholas A. Lewis, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Kamran A. Shah, MD, Catonsville, MD (Abstract Co-Author) Nothing to Disclose

PURPOSE
Diffusion tensor imaging (DTI) is a highly sensitive MRI technique to detect pathological states in tissue microstructure. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) are used to measure the compactness of tissue. Both together can detect the structural architecture and integrity of normal versus pathological conditions. This is a systematic review to explore diagnosing carpal tunnel syndrome with DTI.

METHOD AND MATERIALS
A literature search on PubMed was carried out with major sub headings including carpal tunnel syndrome, diffusion tensor imaging and papers from 2007 to 2016 were included. Inclusion criteria included a trial of CTS patients compared to controls using FA and ADC from DTI. Data was extracted including: the number of patients and demographics, FA and ADC at a proximal and distal level. Proximal included the distal radioulnar joint whereas distal included the hook of the hamate and the pisiform. Inverse variance of weighted means was carried out by MedCalc under the random-effects model. An overall effect size with a standard difference of means was obtained. Heterogeneity was defined by I2. Additionally sensitivity and specificity were reported in six of the major studies, which were analyzed.

RESULTS
We calculated the standardized mean difference (SMD) of all the acceptable studies in the proximal and distal aspect of the carpal tunnel with FA and ADC using a random effects model. The proximal FA had a SMD of -1.271 with a confidence interval (CI) of -1.451 to -1.092 at 95%. The distal FA had a SMD of -0.887 with a CI of -1.061 to -0.712 at 95%. Study heterogeneity was of 79.75% for proximal ADC versus distal ADC of 81.06% Additionally the mean age for CTS patients was 49 years, with 78%-22% of women to men. For healthy control patients the mean age was 44 years, with 75%-25% ratio of women to men. Overall there was a mean sensitivity of 82.8% and mean specificity of 77.8% for FA.
CONCLUSION
Most studies performing DTI concluded that CTS has a significant lower FA and higher ADC compared to healthy controls.

CLINICAL RELEVANCE/APPLICATION
A systematic review can help standardize diffusion tensor imaging as a new method of diagnosing carpal tunnel syndrome.

RC504-14  Postoperative Evaluation of Wrist and Hand
Wednesday, Nov. 30 11:40AM - 12:00PM Room: S406B

Participants
Robert S. Campbell, MBCh, Liverpool, United Kingdom, (rob.campbell@rlbuht.nhs.uk) (Presenter) Royalties, Reed Elsevier

LEARNING OBJECTIVES
1) The common surgical procedures utilised in sports injuries of the hand and wrist. 2) The typical complications arising from surgical procedures of the hand and wrist. 3) The choice of imaging modality required to demonstrate complications of surgery of the hand and wrist. 4) The radiological appearances of the normal and abnormal post-operative hand and wrist.

ABSTRACT
This presentation will include discussion on the indications for surgical intervention, and surgical technique in sports injuries of the hand and wrist. Topics will include: TFC debridement and repair, ligament repair and reconstruction, tendon repair and stabilisation. The discussion will focus on post-operative complications, and the appearances of normal and abnormal post-operative radiological investigations.
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

RC531A Pre- and Post Biopsy Assessment

Participants
John L. Go, MD, Los Angeles, CA (Moderator) 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.

RC531B Equipment Used for Image-guided Biopsies of the Spine

Participants
Richard Silbergleit, MD, Royal Oak, MI (Presenter) Consultant, Relievant Medsystems, Inc

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.

RC531C 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

RC531D 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.

RC531E Disc Biopsy and Aspiration

Participants
Amish H. Doshi, MD, New York, NY, (amish.doshi@mountsinai.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the indications for spinal biopsies in the setting of discitis and osteomyelitis of the spine. 2) The various techniques and imaging modalities for these biopsies will be reviewed. 3) Sample collection and analysis as well as typical diagnostic yield will also be reviewed.

ABSTRACT
Techniques of Musculoskeletal Interventional Ultrasound (Hands-on)

Wednesday, Nov. 30 8:30AM - 10:00AM Room: E260

MK  IR  US

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

Participants
Veronica J. Rooks, MD, Honolulu, HI (Presenter) Nothing to Disclose
Stephen C. O’Connor, MD, Boston, MA (Presenter) Nothing to Disclose
Mabel Garcia-Hidalgo Alonso, MD, Majadahonda, Spain (Presenter) Nothing to Disclose
Patrick Warren, MD, Columbus, OH (Presenter) Nothing to Disclose
Carmen Gallego, MD, Madrid, Spain, (cgallego@salud.madrid.org) (Presenter) Nothing to Disclose
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 (Presenter) Nothing to Disclose
Nathalie J. Bureau, MD, MSc, Montreal, QC, (Nathalie.bureau@umontreal.ca) (Presenter) Equipment support, Siemens AG
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Paula B. Gordon, MD, Vancouver, BC (Presenter) Stockholder, OncoGenex Pharmaceuticals, Inc; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
Horacio M. Padua JR, MD, Boston, MA (Presenter) Nothing to Disclose
Peter L. Cooperberg, MD, Vancouver, BC (Presenter) Nothing to Disclose
Ebonee Carter, MD, Honolulu, HI (Presenter) Nothing to Disclose
Ulises Barajas, MD, Juarez, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 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, including core biopsy, small abscess drainage, cyst 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 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. 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%. 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, ages 9-73 years, by four radiologists. Parameters included; length 4 to 30 mm, retention 2 to 864 days, incision, 2 to 8 mm. Conclusion: USFBR is superior to non-guided surgical technique. The approach taught in simulation improves radiologist technique and outcomes.

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 A. Dipietro, MD - 2016 Honored Educator
LEARNING OBJECTIVES

1) Identify anatomic structures which can impinge or move abnormally in the upper extremity causing pain during normal range of motion. 2) Describe the ultrasound anatomy and scanning technique for a dynamic examination of these lesions. 3) Position patients optimally for the dynamic evaluation of the upper extremity respecting ergonomics.

ABSTRACT

This course will demonstrate standardized techniques of performing the dynamic examination of upper extremity conditions that are only or best demonstrated dynamically. These include shoulder impingement syndrome, long head of biceps dislocation, medial elbow joint instability, ulnar nerve/medial triceps dislocation, extensor carpi ulnaris dislocation, skier's thumb, median nerve movement, and trigger finger. In the first portion of the course, probe positioning will be demonstrated on a model patient with overhead projection during live scanning. In the second portion of the course, an international group of expert radiologists will assist participants in learning positioning and scanning of the shoulder, elbow, and wrist/finger lesions described. An emphasis on dynamic maneuvers and ergonomic documentation of tissue dynamics will be taught. Participants will be encouraged to directly scan model patients.

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
**SSK12-01 Mid-term Outcomes after Percutaneous Cryoablation of Venous Vascular Malformations**

**Participants**
Mark J. Kransdorf, MD, Phoenix, AZ (Moderator) Nothing to Disclose
Frank W. Roemer, MD, Boston, MA (Moderator) Chief Medical Officer, Boston Imaging Core Lab LLC; Research Director, Boston Imaging Core Lab LLC; Shareholder, Boston Imaging Core Lab LLC;

**Method and Materials**
In this mono-institutional retrospective study, 24 patients (6 were male and 18 female; mean age: 31 years, range: 12–64) presenting VVM in soft tissue and treated with PCA for symptomatic recurrences after sclerosis (N=16) or in case of non-indication of sclerosis (N=8) were consecutively included from 2011 to 2015. Eligibility criteria included initial radiological diagnosis of VVM and clinical and MR imaging follow-up of at least 6 months. The pain assessed by visual analogic scale and volume were 41.7mm (0-80) and 22.4cm³ (0.9-146) in mean, respectively. The safety was evaluated using the toxicity scale NCI-CTCAE. Disease-free survival (DFS) and local tumor progression (LTP) were calculated based on symptoms and volume evolution, respectively.

**Results**
The mean follow-up was 18.7 months (6-48). Three severe adverse effects occurred. Pain and volume decreased significantly to 20.3mm (0-80) (P=0.01) and 8.35cm³ (0-81.3) (P<0.001) in mean, respectively. Pain recurred in 9 patients and one lesion increased. The DFS and LTP rate were 54% [95%CI: 22.94-77.27] and 93.33% [61.26-99.03] at 24 months, respectively.

**Conclusion**
PCA appears to be safe and effective for local control of VVM.

**Clinical Relevance/Application**
As cryoablation seems to be safe and effective in treating symptoms related to venous vascular malformations, this minimally-invasive therapeutic option could contribute to the improvement of quality of life of patients.

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**SSK12-02 ADC Histogram Analysis of Whole Tumor Volume: Is It Helpful in the Differentiation of Malignant from Benign Soft Tissue Tumors over Single-slice Average ADC at 3 T?**

**Participants**
Junsung Kim, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Won-Hee Jee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Investigator, Bayer AG; Research support, Bayer AG;
Joon-Yong Jung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yohan Son, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Mun-Young Paek, Seoul, Korea, Republic Of (Abstract Co-Author) Employee, Siemens AG
Chan-Kwon Jung, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seung Han Shin, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yang-Guk Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**Purpose**
To evaluate the reliability and accuracy of apparent diffusion coefficient (ADC) histogram analysis of whole tumor volume and single-slice average ADC to differentiate malignant from benign soft tissue tumors at 3-T magnetic resonance (MR) imaging.

**Method and Materials**
This study was approved by the institutional review board and informed consent was waived. 3-T MR images including diffusion-weighted imaging in 72 patients with pathologically confirmed soft tissue tumors were retrospectively analyzed. There were 48 malignant and 24 benign soft tissue tumors. ADC histogram analysis of whole tumor volume was performed using Oncotreat software. Two independent readers measured average ADC within the solid portion on single slice. Interobserver agreement for ADC measurement was assessed using intraclass correlation coefficient (ICC). The receiver operating characteristic (ROC) curve...
and areas under the curve (AUC) were obtained with and without ten myxoid malignant soft tissue tumors.

**RESULTS**

In ADC histogram analysis of whole tumor volume, mean and 95th percentile of ADC of malignant tumors were significantly lower than those of benign tumors (P=.002 and P=.013): 1244 vs 1659 μm²/sec in mean ADC, 1659 vs 2060 μm²/sec in 95th percentile. Skewness was significantly higher in malignant tumors compared to benign tumors (P=.014): 0.4 vs 0.2. Single-slice average ADCs of malignant tumors were significantly lower than those of benign tumors (P<.001): 1089 vs 1664 μm²/sec and 1068 vs 1523 μm²/sec for two readers, respectively. Interobserver agreement was excellent (ICC=0.934). AUCs of single-slice average ADC in two readers were significantly higher than AUC of whole volume ADC: 0.815 and 0.782 vs 0.689 (P=.014 and P=.039) and when excluding myxoid malignant tumors, 0.876 and 0.859 vs 0.761 (P=.029 and P=.041). With cutoff value of 1379 μm²/sec, sensitivity, specificity, and accuracy were all 75% in single-slice average ADC, while in cases without myxoid malignant tumors those were 84%, 88% and 86% with cutoff value of 1233 μm²/sec.

**CONCLUSION**

Single-slice average ADC is more reliable and accurate in differentiating malignant from benign soft tissue tumors than ADC histogram analysis of whole tumor volume at 3T MR imaging.

**CLINICAL RELEVANCE/APPLICATION**

Single-slice average ADC within solid portion should be used in differentiating malignant from benign soft tissue tumors instead of ADC histogram analysis of whole tumor volume at 3T MR imaging.

**SSK12-03 Value of Diffusion-weighted MR Imaging in Evaluation of Peritumoral Contrast Enhancement in Patients with Soft Tissue Sarcoma at 3 T: Initial Observation for Preoperative Evaluation**

**Wednesday, Nov. 30 10:50AM - 11:00AM Room: E353C**

Participants

Seo Yeon Youn, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

Won-Hee Jee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Investigator, Bayer AG; Research support, Bayer AG

Ji Hyun Hong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Joon-Yong Jung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Chan-Kwon Jung, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Seung Han Shin, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Yang-Guk Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To determine the value of diffusion-weighted imaging (DWI) in the preoperative evaluation of peritumoral contrast enhancement on standard magnetic resonance (MR) imaging in patients with soft tissue sarcoma at 3 T.

**METHOD AND MATERIALS**

The institutional review board approved this retrospective study and informed consent was waived. Twelve patients who underwent 3-T MR imaging including DWI and had soft tissue sarcoma with circumscribed margin at pathology were included in this study. Two independent musculoskeletal radiologists retrospectively reviewed standard MR imaging. Then, they assessed a combination of standard MR imaging and DWI.

**RESULTS**

Among 12 soft tissue sarcomas with circumscribed margin at pathology, peritumoral contrast enhancement was observed in 83% (10/12) and 75% (9/12) of circumscribed soft tissue sarcoma on standard MR imaging for each reader, respectively. Among cases that showed peritumoral contrast enhancement on standard MR imaging, 10% (1/10) and 22% (2/9) cases showed impeded water diffusivity (diffusion restriction) on DWI. Overall, impeded water diffusivity that could suspect the peritumoral invasion was observed in 8% (1/12) and 17% (2/12) of patients at DWI, respectively. Specificity of peritumoral invasion was increased with addition of DWI to standard MR imaging: 17% vs 92% and 25% vs 83% for each reader, respectively.

**CONCLUSION**

The addition of DWI to standard MR imaging improves the preoperative determination of peritumoral invasion in patients with soft tissue sarcoma at 3 T.

**CLINICAL RELEVANCE/APPLICATION**

Diffusion-weighted MR imaging should be added to standard MR imaging protocols to help determine the peritumoral invasion in patients with soft tissue sarcoma for preoperative evaluation.

**SSK12-04 Are the Fibromatoses a Homogeneous Group? Can MR and DW Imaging Characteristics be Used as a Prognostic Indicator in Patients with Extra-Abdominal Fibromatoses?**

**Wednesday, Nov. 30 11:00AM - 11:10AM Room: E353C**

Participants

Joo Yeon Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

Hye Won Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Jeong Hyun Lee, MD, PhD, 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

**PURPOSE**

To determine the prognostic factors of extra-abdominal fibromatoses among the MR and DW imaging features.
METHOD AND MATERIALS

Among the 233 patients (pts) with pathologically proven extra-abdominal fibromatoses, we selected the 29 pts with conventional MRI and DWI (b-factors: 0, 400, and 800 s/mm²). One radiologist blinded to clinical information measured the apparent diffusion coefficient (ADC) value of whole-volume region of interest (ROI) within the solid tumor as well as the sizes, signal intensity, locations, margins, contours, extra-compartment extension, bone involvement, and neurovascular involvement of the tumors. The whole-volume ROI was manually placed on the ADC map and the areas with internal dark signal intensity component on T2-weighted image was excluded. The MR imaging findings and mean ADC of fibromatoses were compared between 2 groups: group 1 with recurrence or progression, and group 2 with no recurrence or stable without treatment.

RESULTS

The mean ADC of group 1 of recurred or progressed fibromatoses was lower than that of group 2 with marginal statistical significance ($P = 0.054$). Group 1 revealed higher rate of ill-defined margin ($P = 0.0004$), irregular or spiculated contour ($P = 0.037$), neurovascular involvement ($P = 0.035$), extra-compartment extension ($p = 0.005$), and higher percent of internal dark signal intensity (SI) component within the tumor on T2-weighted images ($P = 0.042$).

CONCLUSION

MRI features including ill-defined margin, irregular or spiculated contour, and higher percent of internal dark SI could be used as poor prognostic factors warning recurrence or progression. The lower mean ADC value of whole-volume of the tumor also could suggest high probability of recurrence or progression.

CLINICAL RELEVANCE/APPLICATION

MR and DW imaging features regarding margin, contour, internal dark signal intensity component, extra-compartment extension as well as ADC value could imply biological activity of fibromatoses.

SSK12-05 The White Toe Finding (WTF) on Forefoot MRI: Incidence and Potential Significance

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E353C

Awards
Student Travel Stipend Award

Participants
Ian Hayden, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Jordan Gold, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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

PURPOSE

Anecdotally, we noticed abnormal bone marrow signal within the distal phalanges on forefoot MRI. We sought to determine the incidence, associations, and clinical significance of this previously unreported finding.

METHOD AND MATERIALS

We searched our radiology information system (RIS) for MRI forefoot reports containing the keywords "phalanx" and "edema". We found 16 studies with T2 hyperintensity in the distal phalanges of the foot. Artifact was excluded based on corresponding low T1 marrow signal and lack of heterogeneous fat suppression in the distal forefoot. We reviewed patient records and MRI questionnaire for symptoms, location of pain, demographic factors, injury, metabolic diseases, and other conditions to determine whether there was a common association. We then developed a questionnaire to further assess the patient's pertinent history. Lastly, we invited patients back for a limited MRI of the forefoot to evaluate for resolution of the abnormal signal.

RESULTS

16 examinations were found, with 3 male and 13 female patients. Average age was 35. All 5 toes were involved in 75% of cases, and the great toe was involved in 94% of cases. There was no associated adjacent tendon, ligament, capsular, or articular abnormalities. 3 studies had associated nailbed abnormalities. According to the MRI questionnaires provided at the time of scanning, 25% patients had pain localized to the toes. 31% of patients reported history of recent or remote foot injury. 69% of patients reported a history of exercise. Of the 16 patients, 4 responded to the follow-up questionnaire. All of the patients' foot pain had resolved. 1 patient had an inflamed ingrown toenail which improved after treatment. 2 patients described subsequent diagnoses of Raynaud's phenomenon. As part of our study, 1 patient chose to undergo a follow-up MRI 3 years after initial MRI. 4 other patients had follow up imaging (range 1 - 7 months after their initial encounter). All 5 demonstrated residual abnormal signal in the distal phalanges. 1 patient also demonstrated abnormal signal in the contralateral, unaffected foot.

CONCLUSION

We have reported an unusual finding in the distal phalanges of the foot with a low incidence. The etiology and significance of this finding remains unclear, but it does not appear to result in specific symptoms.

CLINICAL RELEVANCE/APPLICATION

The white toe finding may indicate underlying local or systemic pathology; further clinical workup may be warranted.

SSK12-06 Assessing Myeloma Focal Lesion Conspicuity on Dixon Images

Wednesday, Nov. 30 11:20AM - 11:30AM Room: E353C

Awards
Student Travel Stipend Award

Participants
EXTRA-SKELETAL OSTEOsarCIMA ARE RARE AND TYPICALLY HIGH-GRADE MALIGNANCIES THAT COMMONLY METASTASIZE TO LUNG AND BONES. LOW-
grade tumors and those without metastases have good prognosis. MRI appearance is non-specific with T2-hyperintense signal and heterogeneous enhancement. In contrast to conventional osteosarcoma, mineralization is rare.

**CLINICAL RELEVANCE/APPLICATION**

A soft tissue tumor without any mineralization can be consistent with extra-skeletal osteosarcoma. Identification of central necrosis on CT, MRI, or pathology portends poorer prognosis.

**SSK12-08**  
**F-18 FDG PET Differentiation of Benign and Low-Grade Chondroid Neoplasms from Intermediate/High-Grade Chondrosarcoma: A Meta-Analysis**

**PURPOSE**

Discriminating benign and low-grade chondroid lesions managed either with observation or intralesional procedures, respectively from grade 2/3 chondrosarcoma that requires wide local resection is critically important and frequently difficult to achieve with standard imaging modalities, and core needle biopsies are prone to sampling error. The role of PET-CT in making this distinction has only been explored previously in smaller series.

**METHOD AND MATERIALS**

We identified 256 PubMed- and Embase-indexed articles containing combinations of “chondrosarcoma,” “enchondroma,” “chondroid,” “cartilage,” and “PET/CT,” “PET,” “positron,” in the title or abstract; 13 articles comprising 194 lesions were included after excluding case reports, opinions, editorials, and other reviews. Demographic data, tumor size, histologic grade, and SUV max were extracted for individual lesions when possible, and otherwise recorded as aggregated data. Comparisons in SUV among benign, low-grade, and intermediate/high-grade chondroid neoplasms were made.

**RESULTS**

Individual SUVs were available for 100 lesions; 94 additional lesions were reported as aggregated data. There were 115 malignant (grade 1, 2, or 3) and 79 benign (grade 0) tumors; when specified there were 28 grade 1, 44 grade 2/3 tumors. Malignancy was associated with older age [49.2 vs 39.3 years, p = 0.026, t-test], and larger size [9.35 cm vs 3.21 cm, p = 0.004, t-test]. SUV for Grade 0 (1.59 +/- 0.78) was lower than Grade 1, 2, or 3 (4.56 +/- 2.9), p<0.0001, t-test; threshold SUV of 2.2 yielded a sensitivity/specificity of 85/92%, with area under ROC curve 0.93. SUV for Grade 0/1 (1.67 +/- 0.94) was lower than grade 2/3 (5.59 +/- 3.1), p <0.0001, t-test; threshold SUV of 3.1 yielded a sensitivity/specificity of 79/85% for identifying grade 2/3 chondrosarcoma, with area under ROC curve 0.91. Grade 0/1 tumor SUV never exceeded 4.1.

**CONCLUSION**

PET/CT shows excellent discriminatory ability in distinguishing benign and low-grade chondroid neoplasms from intermediate/high-grade chondrosarcoma, and could play an important role in the management of these tumors.

**CLINICAL RELEVANCE/APPLICATION**

High SUV values (> 4) in chondroid lesions are highly suggestive of grade 2 or 3 chondrosarcoma, and should compel appropriate surgical planning for wide local excision rather than intralesional treatment regardless of grade on prior biopsy due to potential sampling error.

**SSK12-09**  
**Compressed Sensing-Accelerated SEMAC Metal Artifact Reduction MRI for the Evaluation of Periprosthetic Tumor Recurrence following Complex Oncologic Limb Salvage Reconstructions**

**PURPOSE**

Effective imaging is important for surveillance of complex oncologic limb salvage reconstructions; however, metal artifacts of conventional MRI and CT often obscure areas of concern around tumor prostheses. SEMAC MRI affords powerful metal suppression, but is time consuming. Sparsity-driven compressed sensing (CS) based data sampling; however, affords 8-fold accelerated SEMAC acquisition with reduction of scan time by 50-70%. Thus, we assessed an accelerated SEMAC MRI prototype protocol for the evaluation of oncologic limb salvage implant reconstructions.

**METHOD AND MATERIALS**

Following IRB approval and written informed consent, 15 consecutive patients [8 female, 7 male; age, 39 (18-72) years] underwent CS-SEMAC MRI at 1.5T for evaluation of bone and soft tissues adjacent to oncologic limb salvage reconstructions with metallic implants. The protocol included PD-weighted, STIR as well as pre- and post-contrast T1-weighted axial and sagittal or coronal sequences with 15-19 SEMAC encoding steps. Outcome variables included the ability to evaluate the area of interest as compared to other imaging modalities utilized, accuracy of diagnosis and change in oncologic management or operative plan.
RESULTS

All 15 patients had at least a CT or conventional MRI, which was unable to fully evaluate the area of interest. In all cases CS-SEMAC MRI resulted in improved visibility and confidence of the area of interest around the metallic implants. In 8/9 (89%) patients, CS-SEMAC MRI was able to entirely replace CT. In 9/15 (60%) cases, CS-SEMAC MRI demonstrated findings that were not visualized on CT or conventional MRI. CS-SEMAC MRI findings were accurate in 14/15 (93%) patients and altered management and operative plan for 7/15 (47%) patients.

CONCLUSION

Compressed sensing-accelerated SEMAC MRI has the potential for more accurate and efficient evaluation of areas of concern around oncologic reconstructions. The high degree of metal artifact suppression improved our ability to detect local recurrence and diagnose alternative conditions.

CLINICAL RELEVANCE/APPLICATION

Our initial experience shows a higher degree of accuracy and efficiency of CS-SEMAC MRI when compared to CT and conventional MRI. Although continued prospective investigation is necessary, our initial results have already begun to change our clinical practice for these complex limb salvage patients toward using CS-SEMAC MRI as the principle modality for surveillance.
Pre- and Post-operative Imaging Evaluation of the Peroneal Tendons

Wednesday, Nov. 30 12:15PM - 12:45PM Room: MK Community, Learning Center Station #9

Participants
Ali Alian, MD, Dallas, TX (Presenter) Nothing to Disclose
Lulu Tenorio, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Mohammad Toliyat, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Michael Vanpelt, Dallas, TX (Abstract Co-Author) Nothing to Disclose
George Liu, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

TEACHING POINTS
- Learn the normal anatomy and variations of the peroneal tendons
- To review the high-resolution US and optimized MR protocol with kinematics for evaluation of the peroneal tendons
- To illustrate the US and MR imaging findings of the spectrum of variants and abnormalities involving the peroneal tendons and retinacula
- Learn the imaging findings of normal and abnormal post-operative appearances and role of kinematic imaging in that setting.

TABLE OF CONTENTS/OUTLINE
(a) Normal anatomy with drawing illustrations of peroneal tendons, superior and inferior peroneal retinaculae and anatomic variations.
(b) Imaging technical considerations of high-resolution ultrasound and MR with kinematics.
(c) Imaging findings of normal variants, including bifid tendon, low lying peroneus belly, fibular groove variations and os peroneum.
(d) US and MR imaging appearances of peroneal tendinosis, tears and related retinacular abnormalities including role of US and MR kinematic imaging.
(e) Normal and abnormal post-operative appearances, including peroneal groove refashioning, tendon and retinacular repairs, and reoperation of failed peroneal tendon surgery with relevant case examples.
The Relationship between Disease Activity and Joint Involvement Evaluated by MRI in Patients with Rheumatoid Arthritis

PURPOSE
To assess the relationship between disease activity measured by the Disease Activity Score (DAS28) and joint involvement evaluated by magnetic resonance imaging (MRI) in patients with rheumatoid arthritis (RA).

METHOD AND MATERIALS
We conducted a cross-sectional descriptive study of fifty-five patients diagnosed with RA between February and December 2014. The patients' clinically dominant foot were assessed by MRI and clinical and laboratory data were collected to measure the DAS28.

RESULTS
The majority of patients classified as in clinical remission showed some inflammatory activity on MRI (67.5% synovitis or bone marrow edema, 53.6% just synovitis and 53.6% just bone marrow edema). The statistical analysis demonstrated no linear relationship between disease activity measured by the Disease Activity Score (DAS28) and RAMRIS even when its variables were analyzed separately.

CONCLUSION
Despite clinical remission assessed by DAS28, MRI evaluation can document a state of persistently active disease.

Simplified CT Therapy Response Monitoring Criteria in Multiple Myeloma Undergoing Therapy

PURPOSE
To test for correlation between the course of size and CT-attenuation values of medullary lesions in the axial skeleton and that of established hematological myeloma-specific parameters for accurate monitoring multiple myeloma during bortezomib- or lenalidomide-based treatment.

METHOD AND MATERIALS
Reduced-dose whole-body CT examinations of 78 consecutive patients (43 male, 35 female, mean age 63.69±9.2 years) with stage III multiple myeloma were re-evaluated in retrospect. Either one medullary lesion located in the bone marrow cavities of the appendicular skeleton (right/left upper humerus, right/left femur) was defined as "target lesion" by 2 readers in consensus and length diameter, transverse diameter, and average CT-attenuation values both at baseline and follow-up were measured. The course of myeloma specific haematological biomarkers (M-gradient, light-chains and ß2-microglobulin) was used for validation. Sensitivity and specificity were calculated after ROC-curve analysis. Multivariate analysis including primary component analysis was performed to test for patient-wise covariance and correlation.

RESULTS
The lesion-based sensitivity/specificity values of length diameter vs. transverse diameter vs. CT attenuation were 94.4%/95.7%
MK332-SD-WEA5
MR Imaging and Clinical Findings of Lateral Epicondylitis: Comparison in Patients Treated with and without Arthroscopic Surgery and Factors Associated with Management Plans
Station #5

Participants
Ji Young Jeon, Incheon, Korea, Republic Of (Presenter) Nothing to Disclose
Min Hee Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
In Ho Jeon, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyung Won Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Ho 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

PURPOSE
We compared MR imaging and clinical findings of lateral epicondylitis in patients treated conservatively and with arthroscopic surgery to identify factors associated with management plans.

METHOD AND MATERIALS
60 patients with lateral epicondylitis who treated conservatively (n = 38) and with arthroscopic surgery (n = 22) were included. Two radiologists reviewed elbow MR images independently as follows: grade of common extensor tendon (CET) abnormality and size of tear which were measured as a maximum length on axial and coronal planes—grade 1, tendinosis or ≤ 2mm partial tear (PT); grade 2, 2 mm < 6 mm or complete tear, presence of increased signal in adjacent muscles, injury of RCL complex, synovitis/effusion, synovial fringe, increased signal of ulnar nerve, radiocapitellar joint space widening, chondral lesions. Clinical data recorded were frequency (intermittent/persistent), duration, NRS (numerical rating scale) of pain, trauma history, range of motion. MR imaging and clinical findings in both groups were compared and analyzed with univariate analysis and multivariable logistic regression models.

RESULTS
All MR imaging findings except a chondral lesions, frequency and NRS of pain were significantly different between both groups (p<0.05). Among them, factors with significant association (p<0.01) which were grade of CET abnormality and size of tear on axial and coronal planes, presence of increased signal in muscles, frequency of pain were tested with multivariable models. Grade of CET abnormality on coronal plane (grade 2, OR 3.43, p = 0.021; grade 3, OR 29.22, p = 0.015, respectively), increased signal in muscles (one muscle, OR 1.56, p = 0.022; multifocal muscles, OR 11.6, p = 0.019) and persistent pain (OR 6.8, p = 0.006) were significant factors associated with surgical treatment.

CONCLUSION
In patients with lateral epicondylitis, MR imaging, along with pain characteristics, provided features of different severity between conservative and operative managements, and can assist in treatment planning by predicting conditions may require operative management.

CLINICAL RELEVANCE/APPLICATION
In lateral epicondylitis, grade of CET abnormality on longitudinal plane, increased signal in muscles on MR imaging and persistent pain were associated with conditions may require surgical treatment.
measured ankle joint space widths and semi-quantitatively graded contrast material dispersion between the opposing cartilage surfaces, and articular cartilage and osteochondral visibility allowing these parameters to be compared before and after traction. Patient were instructed to report on pain and complications.

RESULTS

The width of talotibial joint spaces (bone-bone distance and cartilage-cartilage distance, $\Delta= 0.47-0.69\text{mm}$, all $p <0.05$) was significantly greater in the traction than non traction. The amount of contrast and cartilage visibility of talotibial joint spaces significantly improved after traction (all $p<0.05$). Traction also significantly improved the visibility of cartilage part of the talar dome osteochondral lesion ($p<0.05$). No patient asked for termination of examination. There were no cases of neuropraxia.

CONCLUSION

Traction MRI ankle is safe and technically feasible. This is the first study to evaluate the effect of traction on the MRI of ankle joint using finger coil for assessment of osteochondral lesion. There is beneficial effect of ankle traction on joint space widening, cartilage and talar dome osteochondral lesion visibility.

CLINICAL RELEVANCE/APPLICATION

Better assessment of cartilage using traction in MR ankle is beneficial in detecting potential osteochondral lesion.

MK119-ED-WEA7  
Toes: Anatomy, Pathology and Common Surgical Procedures

Station #7

Participants

Adam D. Singer, MD, Atlanta, GA (Presenter) Nothing to Disclose
Jason Bariteau, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Yara Younan, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Walter A. Carpenter, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Jean Jose, MS, DO, Miami Beach, FL (Abstract Co-Author) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Monica B. Umpierrez, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. The complex anatomy of the toes can make their imaging evaluation challenging2. A thorough knowledge of the toe anatomy helps to understand function and to detect developing pathological states3. In combination with physical examination, good multimodality imaging techniques can assist in diagnosing toe pathology and can help guide treatment4. Toe pathology is common and it is important for the radiologist to be familiar with commonly performed surgeries when interpreting post-operative imaging

MK181-ED-WEA8  
A Review of Athletic Pubalgia: Synthesis at the Pubic Symphysis

Station #8

Awards

Certificate of Merit

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

By the end of this educational exhibit, the participant should be able to: Define the anatomy of the tendinous origins and insertions at the symphysis pubis Describe the underlying biomechanics of injuries surrounding the symphysis pubis Develop a differential diagnosis for etiologies of groin pain in athletes

MK283-ED-WEA10  
Mechanisms and Patterns of Elbow Fracture: It is Not Tricky Anymore

Station #10

Participants

Eun Hae Park, Jeon Ju, Korea, Republic Of (Presenter) Nothing to Disclose
Jung Hee Byun, Jeon Ju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin Hee You, MD, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
TEACHING POINTS

1. Introduce detail mechanism of elbow fracture (supracondylar, lateral condylar, medial epicondylar, radial head, coronoid, radial head).
2. Introduce cases of tricky elbow fractures: once you know the mechanism, it is not tricky anymore.

TABLE OF CONTENTS/OUTLINE

1. Introduction of elbow joint and reason why radiologist needs to understand the mechanism
2. Supracondylar fracture - mechanism, case, complications
3. Lateral condylar fracture - mechanism, displacement stage, case, complications
4. Medial epicondyle fracture - mechanism, case, complications - importance of ossification center - importance of right positioning when obtaining the radiograph
5. Radial head and coronoid process fracture - mechanism, case, complications - introduce posterolateral rotatory instability
Musculoskeletal Wednesday Poster Discussions

Wednesday, Nov. 30 12:45PM - 1:15PM Room: MK Community, Learning Center

PURPOSE
To determine the computed tomographic prevalence of sacroiliitis (SI) in a large inflammatory bowel disease (IBD) population and identify risk factors associated with the development of SI.

METHOD AND MATERIALS
1,247 consecutive patients from our IBD clinic, 350 with ulcerative colitis (UC), and 897 with Crohn’s disease (CD) were investigated as long as they had a pre-existing computed tomography (CT) of the abdomen and pelvis for symptoms unrelated to SI joint pain (GE Lightspeed 64-slice VCT scanner, 2.5-5mm slice acquisition, KVp 100-140, automated mA-s). These CTs were re-interpreted for evidence of sacroiliac joint disease. Each sacroiliac joint was graded based on the modified New York Criteria. Each patient was classified as having no disease, suspected disease or definite disease. Gender, age, type of IBD, HLA-B27 status, and IBD serologies (ASCA, anti-CBir1, anti-OMPc, ANCA) were also analyzed.

RESULTS
Prevalence of definite and suspected SI was found in 16.1% and 19.4% in CD and UC, respectively. The prevalence of definite SI was 8.7% and 8.1% in CD and UC, respectively. In patients with SI (definite and suspicious), 57% were male and 43% were female. When looking only at the definite group, there were 68% males and 32% females (p=0.002). Of significance, 16% of patients in the definite SI group were positive for HLA-B27 (OR 4.36, p=0.006). In the suspicious group, 8% of patients were positive for HLAB27. Definite SI was associated with: anti-Cbri1 (p=0.002) in CD, and ASCA (p=0.05) in UC.

CONCLUSION
In this study, we observed an overall SI prevalence of 17% in our IBD cohort. Historically, UC and CD occur evenly between genders. However, when gender and SI in IBD were compared, there were more males in the definite group. Significant associations with clinically relevant subsets of IBD defined by serological markers were observed. The findings suggest that SI and spondylitis in the IBD population are different pathologic entities, with unique genetic risks, compared with the pure ankylosing spondylitis population.

CLINICAL RELEVANCE/APPLICATION
Radiographic interpretation of the true prevalence has allowed further insight into the pathogenesis of the association between IBD and ankylosing spondylitis. Early identification and treatment of these musculoskeletal manifestations can potentially improve quality of life and prevent debility.
The aim of this study is to evaluate the diagnostic performance of Contrast Enhanced Ultrasound (CEUS) compared with Magnetic Resonance Imaging (MRI), in the soft tissue malignant tumors recurrences identification, considering the histological diagnosis as reference standard.

**METHOD AND MATERIALS**

An analysis of patients treated for extravisceral malignant soft tissue tumors in a national reference center between January 2012 and December 2015 was performed. Forty patients were identified (men/women 22:18; age range 22-94 years) with following inclusions criteria: age over 18; pathologic report of soft tissue malignant tumors at diagnosis; complete follow-up with CEUS and MRI. We excluded those patients with CEUS or MRI not assessable and the absence of a definitive histologic report at biopsy or at resected surgical specimen. We have calculated sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), likelihood ratio for positive value (LR+), likelihood ratio for negative values (LR-), and CEUS and MRI diagnostic accuracy.

**RESULTS**

The sensitivity and specificity of CEUS are respectively 1 and 0.67 with VPP = 0.97; VPN = 1; LR+ = 3; LR- = 0 and diagnostic accuracy = 0.98. MRI shows sensitivity = 0.97; specificity = 0.67; VPP = 0.97; VPN = 0.67; LR+ = 2.9; LR- = 0.04 and diagnostic accuracy = 0.95.

**CONCLUSION**

The CEUS diagnostic accuracy is significantly high, and is superior to MRI in locoregional recurrences detection in patients in follow-up to extravisceral soft tissue malignant tumors. Negativity at CEUS significantly excludes the absence of local recurrences.

**CLINICAL RELEVANCE/APPLICATION**

The European Society of Oncology (ESMO) clinical practice guidelines published in 2014 found that there are a few published data to indicate the optimal routine follow-up. The use of MRI to detect local recurrences has not been demonstrated that is beneficial or cost effective compared clinical assessment of the primary site. There are actually no data concerning the role of CEUS in local recurrences detection compared with MRI. Considering the CEUS feasibility and cost effectiveness, the purpose of this study is to evaluate the diagnostic performance of CEUS to propose its application in soft tissue malignant tumors follow-up.

**MK337-SD-WEB4**  
**Posterior Decentering of the Humeral Head on Shoulder MR Arthrography: Significant Association with Posterior Synovial Proliferation**

**Station #4**

**Awards**

**Student Travel Stipend Award**

**Participants**

Gabin Yun, MD, Seongnam-si, Korea, Republic Of (Presenter) Nothing to Disclose  
Joo Han, MD, PhD, Sungnamsi, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Yusuh Kang, MD, Seoul, 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, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Joo Han Oh, MD, Seongnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To retrospectively evaluate MR imaging findings associated with posterior decentering of the humeral head on shoulder MR arthrography.

**METHOD AND MATERIALS**

A total of 255 shoulder MR arthograms (MRAs) were obtained during a 10-month period. MRAs in patients with posterior decentering of the humeral head (n = 27) were reviewed and compared with those of randomly selected control group without posterior decentering (n = 54). MRA was evaluated for posterior factors (glenohumeral joint space narrowing, posterior synovial proliferation), fatty degeneration of rotator cuff, anterior factors (subcoracoid bursa effusion, rotator interval tear), posterior labral abnormality, by two experienced observers who reached in consensus. The Fisher exact test, linear by linear association was used for comparison of categorical data, and multivariate stepwise logistic regression analysis, pooled kappa coefficient was performed.

**RESULTS**

Posterior decentering of the humeral head was found in 27 (14%) patients. At univariate analysis, posterior synovial proliferation (29.6% [8/27] in posterior decentering group vs 7.4% [4/54] in control group; p = .008), fatty infiltration of supraspinatus, infraspinatus and teres minor (linear by linear association 8.090, 6.797 and 5.608, respectively; p = .004, .009 and .018, respectively), rotator interval tear (55.6% [15/27] vs 31.5% [17/54]; p < .037) were more frequently found in posterior decentering group with a statistical significance. At multivariate analysis, only the posterior synovial proliferation was significantly associated with posterior decentering of the humeral head (Odds ratio, 5.263; 95% CI, 1.418 – 19.532).

**CONCLUSION**

Posterior decentering of the humeral head is most significantly associated with posterior synovial proliferation. In addition, rotator cuff interval abnormality as well as rotator cuff atrophy is associated with posterior decentering to a lesser extent.

**CLINICAL RELEVANCE/APPLICATION**

Awareness of the association of the posterior decentering of the humeral head with the described MR findings above will facilitate an effective interpretation of shoulder MRA.
Purpose
When soft tissue sarcomas (STS) are treated with neoadjuvant chemotherapy (NC), the number of cycles of NC is usually
dependent on the tumor's initial response. Popular methods to assess tumor response include RECIST criteria which relies solely on
tumor size, and maximum SUV reduction in PET which requires an expensive and high radiation test. We hypothesized that
contrast-enhanced MRI may offer a good alternative by providing additional information beyond tumor size.

Method and Materials
Following IRB approval, a retrospective review identified patients with STS who underwent both PET and MRI before and after two
cycles of NC. Five readers independently examined the MR exams for: changes in size, T2 or T1 signal, necrosis and degree of
enhancement. Readers then made a subjective binary assessment of tumor response to therapy. Each reader repeated the
anonymized randomized reading at least 2 weeks apart. 18 F-FDG PET exams were interpreted by a single nuclear medicine
specialist. The maximum standardized uptake values (SUVmax) for pre and post-chemotherapy exams were compared with greater
than 35% reduction defined as “response” for this study. Intra- and inter-reader agreement was assessed using Cohen’s kappa and
Light’s kappa, respectively.

Results
Twenty cases were identified, of which 9 (45%) were responders and 11 were non-responders by SUVmax. Using all MRI criteria, 
43% were classified as responders based on MRI findings and 1.5% as responders by RECIST criteria alone (30% decrease in
longest dimension). Using PET as the reference, the sensitivity and specificity of the MRI diagnosis for response using all findings
was 50% and 63%, respectively. There was fair to moderate intra- (kappa = 0.37) and inter-reader agreement (kappa = 0.48) for
the MRI diagnosis of response. None of the individual MRI findings were significantly different between the PET responders and non-
responders.

Conclusion
By our assessment, there is poor correlation between tumor response by RECIST criteria versus PET SUVmax. In addition, varying
MR features did not help in diagnosing tumor response. Imaging of tumor response remains a challenging area that requires further
research.

Clinical Relevance/Application
Accurate assessment of post treatment response on imaging is crucial in soft tissue sarcoma treatment.

18F-Fluorodeoxyglucose (FDG) Positron Emission Tomography (PET)-Computed Tomography (CT) 
Appearance of Benign Musculoskeletal Lesions

Station #7

Awards
Identified for RadioGraphics

Teaching Points
Benign musculoskeletal lesions are frequently encountered on FDG PET-CT, often with FDG avidity, and may lead the radiologist to
favor a malignant lesion. Some benign lesions encountered on FDG PET-CT have typical imaging findings, and do not require imaging
follow up or biopsy. In addition, brown fat and arthritis are frequently metabolically active. Moreover, attenuation correction
artifacts may simulate metabolic activity. The aim of this exhibit is to review imaging features of commonly encountered
musculoskeletal lesions on FDG PET-CT. An understanding of these imaging features can help improve diagnostic accuracy and
prevent unnecessary biopsy or surgery.

Table of Contents/Outline
- Review the FDG PET-CT appearance of benign musculoskeletal lesions, including fibrous dysplasia, aneurysmal bone cyst,
Paget disease, benign cartilaginous neoplasms, osteonecrosis, osteomyelitis, bone island, heterotopic ossification/myositis
ossificans, and other lesions.
- Discuss the limitations of FDG PET in the evaluation of osseous lesions. Create an awareness that benign musculoskeletal lesions are frequently FDG avid.
- Review the FDG appearance of musculoskeletal findings that may simulate neoplasm including arthritis and brown fat.
- Discuss attenuation correction artifacts and other technical considerations.

Role of MRI in the Postoperative Assessment of Meniscus

Station #8

Participants
MK010-EB-WEB

Acute Trauma of the Knee Ligaments: Following the Contusion Pattern

Hardcopy Backboard

Participants
Takeshi Wada, MD, Tokyo, Japan (Presenter) Nothing to Disclose
Taiki Nozaki, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Saya Horuchi, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Jay Starkey, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Midori Enokido, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Tomoki Kyosaka, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Takahisa Kurosaki, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Masaki Matsusako, MD, PhD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Kurihara, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to demonstrate indications and techniques used in meniscal surgeries to understand the normal MRI findings of the postoperative meniscus. To teach MRI findings of major complications of the postoperative meniscus. To show new treatments for meniscal tears, including arthroscopic centralization of extruded meniscus for restoring the load bearing function of the lateral meniscus.

TABLE OF CONTENTS/OUTLINE

1. Anatomy of meniscus as relates to meniscal surgery, especially the vascular supply of the meniscus.
2. Normal MRI findings of the postoperative meniscus.
   - Post partial meniscectomy, post meniscal repair.
3. MRI findings of complications of postoperative meniscus.
   - Residual meniscal tear, recurrent meniscal tear, subchondral insufficiency fracture of knee after arthroscopic meniscectomy and development of osteoarthritis as a chronic complication.
4. Arthroscopic centralization: indication, procedure details, post-operative MRI findings and prognosis.

MK135-ED-WEB10

Dissecting the Sacroiliac Joint: Beyond Pain and Arthropathy - A Detailed Look at the Anatomy, Physiology, and Biokinetics

Station #9

Participants
David C. Gimarc, MD, Denver, CO (Presenter) Nothing to Disclose
Mary Kristen Jesse, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The sacroiliac joint is a unique articulation that provides an important window to numerous disease processes and age-related changes. After viewing this presentation, readers will have a better understanding of the exact anatomy of the joint including the unique osseous characteristics, cartilage composition, and fibromuscular stabilizing structures. This more-specific knowledge will then be applied to the physiology and movement of the joint with respect to biokinetics and demographic factors, with the goal of better understanding disease processes such as arthropathy.

TABLE OF CONTENTS/OUTLINE

SI Joint overview Osseous details - 3D included Ligamentous and muscular structures Articulating Cartilage - hyaline and fibrocartilage Synovium and Capsule Variations in anatomy Demographic differences: gender, age Joint shape types (1-3) Accessory SI Joint Imaging modality variations: Radiographs, CT, MRI Physiology Biokinetcs: axial loading Motion: Nutation and Counter-nutation Disease Process Examples Degenerative - OA Inflammatory - Psoriatic, Rheumatoid, IBD-related, Seronegative, Reactive Infectious
### SSM14-01  Musculoskeletal Keynote Speaker: Cartilage Imaging—One View of the Future

**Wednesday, Nov. 30 3:00PM - 3:20PM Room: E353C**

**Participants**
- Michael P. Recht, MD, New York, NY *(Moderator)* Nothing to Disclose
- Michael J. Tuite, MD, Madison, WI *(Moderator)* Nothing to Disclose

### SSM14-03  Does Cartilage Composition Change after Joint Preserving Hip Surgery for FAI - Preliminary Data of a Prospective Comparative Longitudinal Study Using Delayed Gadolinium Enhanced MRI of Cartilage (dGMERIC) at 3 T

**Wednesday, Nov. 30 3:20PM - 3:30PM Room: E353C**

**Participants**
- Florian Schmaranzer, Bern, Switzerland *(Presenter)* Nothing to Disclose
- Pascal Haefeli, Bern, Switzerland *(Abstract Co-Author)* Nothing to Disclose
- Markus Hanke, Bern, Switzerland *(Abstract Co-Author)* Nothing to Disclose
- Stefan Werlen, MD, Bern, Switzerland *(Abstract Co-Author)* Nothing to Disclose
- Moritz Tannast, MD, Bern, Switzerland *(Abstract Co-Author)* Nothing to Disclose
- Klaus A. Siebenrock, MD, PhD, Bern, Switzerland *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**

Delayed gadolinium enhanced MRI of cartilage (dGMERIC) allows a 'monitoring' of glycosaminoglycan depletion of cartilage and can be used as biomarker for osteoarthritis. Longitudinal data on the change in hip cartilage composition in patients with femoroacetabular impingement (FAI) is lacking. We aimed to assess whether changes in T1 values occur 1 year after FAI surgery compared to patients with non-operative treatment and if changes correlate with clinical short-term outcome.

**METHOD AND MATERIALS**

IRB-approved prospective, comparative, longitudinal study of two groups (61 hips, 55 patients). After exclusion 17, 18 hips were assigned to the ‘operative’ (open/arthroscopic correction) respectively to the ‘non-operative’ (conservative treatment) group. At baseline, groups were comparable regarding radiographic osteoarthritis (Tönnis score), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and T1 values. Patients had baseline and 1-year follow-up i.v. dGEMRIC scans with the same 3 T magnet (0.4 ml/kg, 0.2 mmol gadopentate dimenglumine /kg). Radial T1 maps were reformed from a 3D dual flip-angle volume interpolated breath hold examination (VIBE). Central, peripheral femoral (12 ‘hour’ positions) and acetabular (10 ‘hour’ positions) T1 values were manually measured separately from each other with the help of 2D radial high-resolution PD-w images. Baseline and 1-year follow-up WOMAC scores were obtained. Statistical analysis included paired/unpaired Student’s t-Tests (p<0.05).

**RESULTS**

Acetabular T1 values decreased significantly (p<0.05) in 17/20 (85%) zones and in 21/24 (88%) of femoral zones in the operated group. In the non-operative group, no acetabular zone and 2/24 (8%) femoral zones presented with a significant drop. After 1 year the WOMAC significantly improved (58±42 to 33±42; p= 0.007) for the operative group, while there was no significant change (55±43 to 48±50; p= 0.825) for the non-operative group.

**CONCLUSION**

FAI surgery led to a decline in cartilage composition on MRI after 1 year despite significant clinical improvement. This decline may result from postoperative inflammation and/or may reflect altered biomechanic stress within the cartilage and requires longer follow-up.

**CLINICAL RELEVANCE/APPLICATION**

DGMERIC may improve our understanding of hip osteoarthritis and has great potential to improve surgical treatment planning for FAI.

### SSM14-04  Quantitative Measurement of Medial Femoral Knee Cartilage Volume - Analysis of The OA Biomarkers Consortium FNIH Project Cohort

**Wednesday, Nov. 30 3:30PM - 3:40PM Room: E353C**

**Participants**
- Lena Schaefer, Boston, MA *(Abstract Co-Author)* Nothing to Disclose
- Ming Yin, Boston, MA *(Abstract Co-Author)* Nothing to Disclose
- Meera Sury, Boston, MA *(Abstract Co-Author)* Nothing to Disclose
- Scott Jamieson, Boston, MA *(Abstract Co-Author)* Nothing to Disclose
PURPOSE

Objective and efficient methods to determine knee cartilage volume are useful for large osteoarthritis (OA) trials. We previously developed and validated a fast and responsive quantitative software tool to measure cartilage volume on MRI scans. The purpose of the present study is to further validate this method in a larger patient cohort and to assess predictive validity in a case-control study.

METHOD AND MATERIALS

The OA Biomarkers Consortium FNIH Project is a case-control study of knee OA progression nested within the Osteoarthritis Initiative (OAI), including 600 subjects in four subgroups based on radiographic and pain progression over 48 months in knees with OA. We used logistic regression to assess the association of change in cartilage volume with progression status. Our software tool measured cartilage volume in the central weight-bearing portion of the medial femur. We evaluated different sized areas of cartilage segmentation and their ability to differentiate the case control status of the cohort. The readings were performed on sagittal double echo steady state (DESS) MRI scans at the baseline and 24-month visits.

RESULTS

Change in medial femoral cartilage volume was associated with radiographic progression (OR=4.47; 95% CI=2.75-7.25). This correlation was significant but less prominent with combined radiographic and pain progression (OR=1.84; 95% CI=1.50-2.25). Smaller areas of cartilage segmentation were also able to predict the case-control status with similar results. The average reader time for the largest area was less than 20 minutes per scan. Smaller areas could be assessed with substantially less reader time, since smaller regions require fewer slices to be segmented.

CONCLUSION

We demonstrated that our software tool to measure cartilage volume in focal regions of the medial femur is ideal for existing and future large studies of knee OA and showed its clinical validity in a case-control setting. Smaller areas of segmented cartilage deliver the same associations with similar ORs as larger regions. This implies that comparable performance can be achieved with substantially less reader time, and that the method could be used for studies requiring assessment of several thousand MRI scans.

CLINICAL RELEVANCE/APPLICATION

By showing its clinical validity in a case-control setting we demonstrated that our tool to measure cartilage volume is fast and responsive and useful for future clinical studies of OA therapies.

SSM14-05 Presence and Severity of Type 2 Diabetes Mellitus are Associated With Cartilage Matrix Degeneration Measured With 3T MRI T2 Relaxation Time: Data from the Osteoarthritis Initiative

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E353C

Awards

Student Travel Stipend Award

Participants

Alexandra S. Gersing, MD, Munich, Germany (Presenter) Nothing to Disclose
Nattagan Chancheck, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Benedikt J. Schweiger, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Gabby B. Joseph, 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) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (Abstract Co-Author) Research Grant, General Electric Company; Research Consultant, General Electric Company; Research Consultant, InSightec, Ltd; Research Grant, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Consultant, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

TOPOGRAPHY

To assess the cross-sectional association of presence and severity of type 2 diabetes mellitus (DM) with cartilage degeneration, measured using 3T MRI-based T2-values.

METHOD AND MATERIALS

In this study, 100 subjects with DM (age 60.6±8.5y; 57 females) and risk factors for osteoarthritis (OA) or mild radiographic OA (Kellgren-Lawrence (KL) score ≤2) were frequency-matched to 200 subjects without DM (age 60.9±8.1y; 114 females) on age, sex, BMI and KL score. For a subgroup analysis, DM subjects with severe disease were defined as subjects with present diabetes-related renal and ophthalmological complications at any time point until 48 months (N=28). Knee MRI examinations were assessed for structural joint abnormalities using the Whole-Organ Magnetic Resonance Imaging Score (WORMS). Our outcomes at baseline were presence and radiographic severity of OA. We used logistic regression to assess the association of change in cartilage volume with progression status. Our software tool measured cartilage volume in the central weight-bearing portion of the medial femur. We evaluated different sized areas of cartilage segmentation and their ability to differentiate the case control status of the cohort. The readings were performed on sagittal double echo steady state (DESS) MRI scans at the baseline and 24-month visits.

RESULTS

Cartilage T2 values of the patella were significantly higher in subjects with DM in comparison to subjects without DM (mean diff. 1.1msec [95% confidence interval (CI) 0.6, 1.5]; P=0.023) and cartilage T2 of the bone layer of the medial tibia and patella (mean diff. 1.2msec [95% CI 0.5, 1.9]; P=0.003) was significantly different from controls (bone layer averaged: over all compartments, mean diff. 1.1msec [95% CI 0.2, 2.0], P=0.022, respectively). Subjects with more severe DM overall showed significantly higher T2 values compared to controls (bone layer averaged: over all compartments, mean diff. 2.2 [95% CI 0.3, 3.4], P=0.044; medial tibia, mean diff. 1.4msec [95% CI 0.3, 2.6], P=0.001). However, no significant differences in structural knee abnormalities (WORMS of cartilage, meniscus and bone marrow) were found between controls and DM subjects with various disease severity (P>0.05 in all cases).
CONCLUSION

Compared to controls, subjects with DM showed significantly higher cartilage T2 values with even higher T2 values in subjects with more severe disease. These results suggest more advanced biochemical cartilage degradation in DM patients.

CLINICAL RELEVANCE/APPLICATION

MR-based knee cartilage T2 measurements allow monitoring of the effect of DM on joint health and underline the need for preventative treatment of patients with DM in order to slow or prevent cartilage deterioration.

SSM14-06  **T1-rho MRI Detects Cartilage Improvement Following Surgical Treatment for Cam-Type FAI**

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E353C

Participants

Kawan S. Rakhra, MD, Ottawa, ON (Presenter) Nothing to Disclose
Helen Anwander, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Gerd Melkus, PhD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Paul E. Beaule, MD, Ottawa, ON (Abstract Co-Author) Consultant, Wright Medical Technology, Inc Consultant, Getinge AB Consultant, MEDACTA International SA Consultant, MicroPort Scientific Corporation

PURPOSE

The goal of this study was to determine if the T1-rho MRI profile of hip hyaline cartilage improves in patients with cam-type femoroacetabular impingement following surgical osteochondroplasty.

METHOD AND MATERIALS

The study included 17 subjects with cam-type FAI diagnosed clinically and radiologically by MRI. T1-rho MRI(1.5T) of the symptomatic hip, pre- and post-operatively(2 years), was performed. Each subject underwent arthroscopic osteochondroplasty. The superior hip hyaline cartilage was segmented as a bilayer. The cartilage was subsequently divided into 2 zones(anterosuperior, posterosuperior) and further into equal thirds(medial, middle, lateral) zones in the transverse plane, generating 6 sub zones. The mean T1-rho relaxation value for the entire bilayer, and for the anterosuperior and posterosuperior zones, with and without further division into thirds, was performed and compared between the pre- and post-operative scans using a paired t-test.

RESULTS

The global mean T1-rho relaxation value(msec) postoperatively(30.62 ± 3.77) was significantly lower than pre-operatively(33.04 ± 2.99), p=0.0467. For the anterosuperior zone, the mean T1-rho relaxation value(msec) postoperatively(29.62) was significantly lower than pre-operatively(34.01), p=0.008. For the posterosuperior zone, the mean T1-rho relaxation value(msec) postoperatively(32.47) was not significantly different from pre-operatively(32.80), p=0.823. Further subdivision of the anterosuperior zone into thirds, found that the T1-rho relaxation values(msec) were significantly lower post-operatively than pre-operatively in both the lateral(27.61 vs 31.57, p=0.006) and middle(29.41 vs 33.46, p=0.021) subzones. None of the subzones posterosuperiorly demonstrated any significant difference between pre- and post-operative states.

CONCLUSION

There is significant reduction in the T1-rho relaxation values following osteochondroplasty, namely in the anterosuperior zone where cam-FAI is known to preferentially cause chondral disease. The change in T1-rho suggests an increase in proteoglycan content, equating with improved cartilage health.

CLINICAL RELEVANCE/APPLICATION

T1-rho MRI cartilage mapping can monitor biochemical changes in hyaline cartilage and be used to evaluate the impact of joint preserving surgical treatments.
Participants
Neety Panu, MD, FRCPC, Thunder Bay, ON (Presenter) Nothing to Disclose
Gregory L. Katzman, MD, Chicago, IL (Presenter) Nothing to Disclose
Omer A. Awan, MD, Philadelphia, PA (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.

ABSTRACT

URL
Participants
Jennifer L. Demertzis, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Stephen A. Currie, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jason W. Stephenson, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Eric B. England, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Hillary W. Garner, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Laura W. Bancroft, MD, Orlando, FL (Abstract Co-Author) Author with royalties, Wolters Kluwer nv
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Instructor, DFine, Inc
Kimberly Beavers, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
Kaitlin M. Peterson, BS, Madison, WI (Abstract Co-Author) Nothing to Disclose
Michael V. Friedman, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Matthew G. Pipho, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Jeffrey M. Youngquist, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Michael Burch, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Kurt F. Scherer, MD, Windermere, FL (Abstract Co-Author) Nothing to Disclose
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Edward Derrick, MD, Orlando, FL (Abstract Co-Author) Nothing to Disclose
Raul Loya, MD, Orlando, FL (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.
LEARNING OBJECTIVES

1) Identify a variety of common sports injuries utilizing MRI. 2) Review clinical presentations of sports injuries that present to orthopedic clinics and how these presentations can assist in the diagnosis when correlated with imaging. 3) Review a variety of typical and atypical musculoskeletal injuries that present to the Emergency Department. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT

URL
Case-based Review of Musculoskeletal Radiology (An Interactive Session)

Thursday, Dec. 1 8:30AM - 10:00AM Room: S406A

AMAPRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Stacy E. Smith, MD, Weston, MA (Director) Nothing to Disclose

Sub-Events

MSCS51A Muscle

Participants
Robert D. Boutin, MD, Davis, CA (Presenter) Nothing to Disclose

MSCS51B Shoulder

Participants
Kirkland W. Davis, MD, Madison, WI, (kdavis@uwhealth.org) (Presenter) Author with royalties, Reed Elsevier; Editor with royalties, Reed Elsevier

LEARNING OBJECTIVES
1) Differentiate types of tears of the glenoid labrum. 2) Distinguish radiographic findings of shoulder arthritides. 3) Describe the common types of calcifications that present about the shoulder.

ABSTRACT

MSCS51C Ankle and Foot

Participants
Stacy E. Smith, MD, Weston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review several disorders of the ankle using CR, CT, MR and US delineating advantages of each 2) Assess common tendon and ligament abnormalities of the ankle. 3) Describe types of internal derangement of the ankle and foot.

ABSTRACT

Imaging features of ankle and foot abnormalities will be reviewed using several modalities with key features presented that will help further delineate a differential or specific diagnosis

MSCS51D Wrist and Hand

Participants
Martin Torriani, MD, Boston, MA, (mtorriani@mgh.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe ligamentous abnormalities of the wrist and hand. 2) Describe common tendon abnormalities of the wrist and hand. 3) Describe common types of wrist internal derangement.

ABSTRACT
RC604

Musculoskeletal Series: Tumors

Thursday, Dec. 1 8:30AM - 12:00PM Room: E451B

Participants
Mark D. Murphey, MD, Silver Spring, MD, (mmurphey@acr.org) (Moderator) Nothing to Disclose
Benjamin M. Howe, MD, Rochester, MN, (howe.benjamin@mayo.edu) (Moderator) Nothing to Disclose
Mark Davies, MBCHB, Birmingham, United Kingdom (Moderator) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (Moderator) Nothing to Disclose
Hakan Ilaslan, MD, Pepper Pike, OH (Moderator) Nothing to Disclose

Sub-Events

RC604-01  Workup of Incidental Soft Tissue Lesions

Thursday, Dec. 1 8:30AM - 8:55AM Room: E451B

Participants
Mark J. Kransdorf, MD, Phoenix, AZ, (kransdorf.mark@mayo.edu) (Presenter) Nothing to Disclose

Active Handout:Mark J. Kransdorf

RC604-02  Radiography, Ultrasound and MRI Features of Soft Tissue Tumours: Can a Simple Checklist of Imaging Features Identify Malignancy?

Thursday, Dec. 1 8:55AM - 9:05AM Room: E451B

Participants
Leonhard Gruber, Innsbruck, Austria (Presenter) Nothing to Disclose
Anna Luger, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Bernhard Godny, MD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Benjamin Henninger, MD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Hannes Gruber, MD, PhD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Alexander Loizides, MD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose

PURPOSE

To statistically quantify the diagnostic value of imaging features in soft tissue masses (STMs) and derive a focused checklist of imaging features.

METHOD AND MATERIALS

Diagnostic properties of a comprehensive set of 26 imaging features in 260 cases of STMs with known histology were assessed via Fisher’s exact test/chi-square test and a random forest analysis: diagnostic values including sensitivity, specificity, positive and negative predictive values, likelihood/odds ratios (OR) and normalised variance (NV) were determined. The diagnostic value of an 8-item checklist consisting of the highest-ranked features was assessed as the area under the curve (AUC) in a receiver-operator-characteristics (ROC) analysis.

RESULTS

The most predictive features were inhomogeneous contrast-enhancement in ultrasound (297.9 NV/15.1 OR) and MRI (197.3 NV/11.9 OR), lesion roundness (209.8 NV/5.5 OR), diffusion restriction (175.8 NV/9.3 OR), cystic intraläsional areas (167.1 NV/8.3 OR), higher patient age (159.0 NV/2.6), surrounding edema (155.4/6.5) and intraläsional Doppler hypervascularity (134.4/5.1). Patient gender (-18.6 NV /1.1 OR), affected compartment (-16.7 NV /1.2 OR), fascial relationship (-2.7 NV /1.4 OR), T1- (19.7 NV /2.8 OR) or T2-weighted signal intensity (5.0 NV /2.1 OR), surrounding capsule (10.9 NV /0.4 OR), diffuse margins (28.1 NV /0.97 OR), lesion size (46.4 NV /2.8 OR), and localization (56.3 NV /2.2 OR) showed little diagnostic value. A simple 8-item checklist was highly predictive of malignancy in cases with at least 75% positive features (0.90 ROC AUC, 0.87 sensitivity, 0.84 specificity, 0.59 positive and 0.96 negative predictive value, 36.5 odds ratio). The method proved robust even in cases with missing information.

CONCLUSION

Features vary widely in their diagnostic value in STMs; a simple checklist based on the eight most decisive features can provide a reliable tool for the assessment of likelihood for malignancy in unknown STMs.

CLINICAL RELEVANCE/APPLICATION

A simple combined score based on the eight most decisive patient and imaging features can reliably identify low-risk and high-risk soft tissue masses.

RC604-03  Radiogenomics in Desmoid Tumors: Association of Semantic and Computational MR Image Features with CTNNB1 Mutation Status

Thursday, Dec. 1 9:05AM - 9:15AM Room: E451B
PURPOSE

Clinical outcomes of desmoid tumors are known to vary depending on mutations of the CTNBB1 gene. The purpose of this study was to identify prognostic image features in desmoid tumors by associating semantic and computational magnetic resonance (MR) imaging features with CTNNB1 mutation status.

METHOD AND MATERIALS

177 patients diagnosed with a desmoid tumor from 2003 until 2016 were evaluated for the availability of CTNNB1 molecular data and presurgical MR imaging data from the hospital Electronic Medical Record and the digital Picture Archiving Communication System (PACS). Patients who had undergone treatment for the desmoid tumor prior to MR imaging were excluded. Semantic and computational data of 18 patients were extracted from MR imaging using quantitative imaging extraction software after annotation by experienced musculoskeletal (MSK) radiologists who were blinded to the CTNNB1 mutation status to avoid bias. Univariate analyses were performed to assess correlations between semantic image features and CTNNB1 mutation status, using a Fisher exact test. A Random Forest using 20 trees was used as a multivariate model for prediction of CTNNB1 mutation status in terms of semantic image features.

RESULTS

Eight patients (44.4%) had no CTNNB1 gene mutation, 5 patients (27.8%) had a p.T41A mutation, 3 patients (16.6%) a p.S45F mutation, 1 patient (5.6%) a p.S45P mutation and 1 patient (5.6%) a p.S33L mutation. Univariate analysis showed desmoid tumors with CTNNB1 mutation were significantly associated with an intra-abdominal or upper extremity location (p=0.039). For the p.S45F mutation there was a trend towards significance for the association between tumor location (p=0.15) and neurovascular encasement (p=0.16). Semantic image features predicted the p.S45F mutation using a multivariate model with an accuracy of 77.8%.

CONCLUSION

In desmoid tumors, CTNNB1 mutation is significantly associated with an intra-abdominal or upper extremity location. Computational data analyses are in progress and may identify additional prognostic image features.

CLINICAL RELEVANCE/APPLICATION

Identifying image features correlated with specific CTNNB1 mutation status can accelerate the diagnostic process and predict clinical course noninvasively.

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 L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

RCG04-04  Common Errors in Soft Tissue Tumor Evaluation

Thursday, Dec. 1 9:15AM - 9:40AM Room: E451B

Participants

Mark D. Murphey, MD, Silver Spring, MD, (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 hematoma from hemorrhagic neoplasm. 3) Identify the imaging characteristic of myositis ossificans. 4) Improve recognition of the distinction of intramuscular tendon injury from neoplasm.

ABSTRACT

Radiologists are frequently requested to evaluate a soft tissue mass by imaging. Common diagnostic dilemmas in imaging assessment of soft masses include differentiation of a cystic lesion from myxoid neoplasm, distinction of hematoma from hemorrhagic neoplasm, misdiagnosis of myositis ossification on MR imaging and recognition intramuscular tendon injury simulating a neoplastic process. This lecture emphasizes imaging features that usually allow differentiation of these diagnostic dilemmas in evaluation of a soft tissue tumor.

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
**PURPOSE**

To investigate the prevalence of lipid-rich myxoid liposarcoma and describe its MRI appearance.

**METHOD AND MATERIALS**

Retrospective review of 100 histologically proven myxoid liposarcoma cases from 60 patients archived in the Cleveland Clinic Anatomic Pathology database from January 1, 1980 to September 16, 2015. Recurrent and metastatic lesions, and cases where MRIs are not available for review were excluded. MRIs were reviewed independently by both a fellowship-trained MSK radiologist and an MSK fellow. Disagreements were resolved by consensus. Each MRI case was reviewed for intralesional fat content, fat pattern (lacy, linear, amorphous, nodular), T2 hyperintense component, enhancement and necrosis (if post-contrast image available). Pathology slides were reviewed by at least 1 pathologist with expertise in soft tissue pathology.

**RESULTS**

36 MRI examinations from 34 patients met the criteria for review. Quantification of intralesional fat by visual inspection of MRI found that 58.3% (21/36) of cases had negligible fat; 19.4% (7/36) had fat content of <5%; 11.1% (4/36) had 5-10% fat; 0% had 10-25% fat; 5.6% (2/36) had fat content of 25-50%; 5.6% (2/36) had fat content of more than 50%. Two cases had fat content approaching 80%.

**CONCLUSION**

A small percentage of lipid-rich myxoid liposarcomas can have high fat content, with an MRI appearance mimicking that of an atypical lipomatous tumor.

**CLINICAL RELEVANCE/APPLICATION**

Differentiation of lipid-rich myxoid liposarcoma from atypical lipomatous tumors can significantly affect patient treatment.

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**PURPOSE**

To determine the added value of diffusion-weighted imaging (DWI) to standard magnetic resonance (MR) imaging to assess tumor margin infiltration in soft tissue sarcoma at 3 T.

**METHOD AND MATERIALS**

The institutional review board approved this retrospective study and informed consent was waived. Forty-five patients who underwent 3-T MR imaging including DWI and were pathologically confirmed as soft tissue sarcoma after surgery were included in this study. One experienced musculoskeletal radiologist and one musculoskeletal fellow retrospectively scored standard MR imaging. Then, they assessed a combination of standard MR imaging and DWI. Margin infiltration on pathology were retrospectively reviewed by one experienced pathologist blinded to MR findings. The receiver operating characteristic curve with areas under the curve (AUC) was obtained for diagnostic performance. Interobserver agreement for scoring of tumor margin infiltration of soft tissue sarcoma was assessed using kappa statistics.

**RESULTS**

Among 45 patients with soft tissue sarcoma, 33 soft tissue sarcomas had tumor margin infiltrations at pathology. Sensitivity, specificity, and accuracy of each reader were 100%, 17%, and 78%; 97%, 25%, and 78% on standard MR imaging alone and 94%, 67%, and 87%; 88%, 42%, and 76% on standard MR imaging combined with DWI. Specificity of standard MR imaging combined with DWI was significantly higher than that of standard MR imaging alone for reader 1 (P = .0313). AUCs of a combination of standard MR imaging and DWI were significantly higher than those of standard MR imaging alone: 0.890 vs 0.678 (P = .0123), and 0.780 vs 0.645 (P = .1252) for each reader, respectively. Interobserver agreements of standard MRI alone and standard MR imaging combined DWI were fair to good (k = 0.646, k = 0.533, respectively)

**CONCLUSION**

The addition of DWI to standard MR imaging improves the assessment of tumor margin infiltration in soft tissue sarcoma at 3 T.

**CLINICAL RELEVANCE/APPLICATION**

DWI should be added to standard MR imaging protocol to help assess the tumor margin infiltration of soft tissue sarcoma in preoperative imaging.
**RC604-07 Workup of Incidental Bone Lesions**

Thursday, Dec. 1 10:00AM - 10:25AM Room: E451B

Participants
Stephanie A. Bernard, MD, Hershey, PA, (sbernard@hmc.psu.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1. Be able to recognize features that indicate bone lesion benignity.
2. Be able to apply appropriate imaging to the work up of chondroid, osteolytic, osteoblastic and focal marrow replacing lesions.

**ABSTRACT**

Unexpected bone lesions are a common diagnostic dilemma. When faced with an unexpected bone lesion, the goal is to be able to accurately assess which lesions can be safely ignored from those requiring additional workup or biopsy. As part of this process, understanding the strengths and limitations of the various imaging tests when applied to the commonly encountered scenarios for unexpected bone lesions is essential for selecting the most cost-effective and expeditious work up. This lecture will review imaging options, including helpful supplemental MR sequences and an generalized approach to the work up of unexpected bone lesions in 4 frequently encountered scenarios; 1) chondroid lesions, (2) sclerotic bone lesions, (3) osteolytic lesions and (4) areas of focal marrow replacement on MRI.

**RC604-08 Common Errors in Bone Tumor Evaluation**

Thursday, Dec. 1 10:30AM - 10:55AM Room: E451B

Participants
Mark Davies, MBChB, Birmingham, United Kingdom (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize clinical features that stratify the risk of malignancy in bone lesions.
2) Understand the imaging features that raise a concern of chondrosarcomatous transformation in cartilage lesions.
3) Be able to select the appropriate next imaging for the work up of unexpected osteolytic bone lesions, osteosclerotic bone lesions and isolated marrow abnormalities.

**ABSTRACT**

PURPOSE
To evaluate the diagnostic performance of a novel CT post-processing software that generates subtraction maps of baseline and follow-up examinations in the course of myeloma bone lesions.

**METHOD AND MATERIALS**

This study included 61 consecutive myeloma patients who underwent repeated whole-body reduced-dose MDCT at our institution between November 2013 and June 2015. CT subtraction maps were compared with hematological markers and classified as a progressive disease (PD) vs. stable (SD)/remission. Bone lesions were categorized as new, enlarging osteolyses or sclerosis. Bone subtraction maps (BSM) only and in combination with 1 mm (BSM+) source images were compared with 5 mm axial and 2 mm MPR-scans. Statements of 1 mm axial CT images were considered the standard of reference if they were confirmed by CT-follow-up. For statistical purposes, we sub-grouped hematological response categories similarly to those applied for CT-imaging (progression vs. stable/response).

**RESULTS**

Hematological response categories at follow-up were: [complete remission-CRh(n=9), very good partial remission-VGPRh(n=2), partial remission-PRh (n=17), SDrh(n=19) vs. PDrh(n=14)]. 5mm CT-scan yielded PDrh(n=14) and SDrh/remissionrh(n=47) whereas bone subtraction + 1mm axial scans (BSM+) reading resulted in PDrh(n=18) and SDrh/remissionrh(n=43). Sensitivity/ specificity/accuracy for 5mm/1mm/BSM+ vs. lesion-by-lesion was 89.4%/98.9%/98.3%/99.5%; 69.1%/96.9%/72%/92.1% and 83.8%/98.4%/92.1%/98.3%, respectively. The use of BSM+ resulted in a change of response classification in 9.8 % patients (3). Bone sclerosis lesions was detected in 39/61 patients.

**CONCLUSION**
BSM reading is more accurate for monitoring myeloma compared to axial scans whereas BSM+ yields similar results with 1mm reading (gold standard) but by significantly reduced reading time.

**CLINICAL RELEVANCE/APPLICATION**

The use of longitudinal bone subtraction maps can improve radiologists’ accuracy of the therapy response diagnosis in patients with myeloma bone disease through improved and more efficient detection.

**RC604-10 The Natural Course of Incidental Enchondromas on Knee MRI in a Large Population-based Cohort of Middle-aged Females**

**Participants**
- Stephan J. Breda, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose
- J. H. J. M. Bessens, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
- Dieuwke Schiphof, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
- Abida Z. Ginal, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
- Jan Heeringa, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
- Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Consultant, Bracco Group; Scientific Advisor, Zebra Medical Vision Ltd; Advisory Board, Quantib BV
- Meike W. Vernooij, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
- Sita Bierma-Zeinstra, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
- Edwin H. Oei, MD, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

Although it is important to distinguish benign enchondromas from low-grade chondrosarcomas, no established criteria exist for the management of incidental enchondromas on knee MRI, partly due to lacking information on natural course. We therefore investigated the natural course of incidentally found enchondromas on knee MRI in females of a large population-based study of middle-aged and elderly.

**METHOD AND MATERIALS**

Of 891 female participants aged 45-60 (mean 55) from the Rotterdam Study who underwent non-contrast bilateral knee MRI (1.5 T) at baseline, 700 (79%) participants were re-scanned at 5 years follow-up and included in the analysis. All participants gave written informed consent, including a section on incidental findings. At baseline, incidentally found enchondromas were categorized into those that did not require referral (< 1cm, central metadiaphysial location, and no endosteal scalloping) and those that required referral to an orthopaedic surgeon for further investigation with dynamic contrast-enhanced MRI (DCE-MRI) (all other). Of each enchondroma we determined the presence of interval progression (size increase, endosteal scalloping, or cortical disruption).

**RESULTS**

In 1782 MRI scans, we identified 52 incidental enchondromas (2.9%) at baseline, of which 15 were referred (28.8%) and 37 were not. In the absence of malignant features on clinical DCE-MRI, none of the referred enchondromas were treated. Mean follow-up duration was 4.6 years (SD 0.6, range 4-6). At follow-up, two enchondromas (4.3%), both of which had been referred, showed progression only in terms of increased size. None of the non-referred enchondromas demonstrated progression. One referred participant and 5 non-referred participants were lost to follow-up.

**CONCLUSION**

In a population of middle-aged women, incidental enchondromas are present on 2.9% of knee MR scans, and show size increase in 4.3% of cases over a period of 5 years. Our pre-defined criteria (< 1cm, central metadiaphysial location, and no endosteal scalloping) appear to be applicable for classifying incidental enchondromas as not requiring referral, since none of these demonstrated progression.

**CLINICAL RELEVANCE/APPLICATION**

Incidental enchondromas on knee MRI of middle-aged females < 1 cm, located in the metadiaphysis without endosteal scalloping don't require referral since they don't progress over a period of 5 years.

**RC604-11 The Single Energy Metal Artifact Reduction Algorithm with a 320-MDCT Volume Scanner Improves the Quality of Images in Patients with Custom-made Tumor Prosthesis of Knee Joint**

**Participants**
- Lei Ding, Guangzhou, China (*Presenter*) Nothing to Disclose
- Ling Ma, MD, Canton, China (*Abstract Co-Author*) Nothing to Disclose
- Fang-Ling Zhang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

To evaluate the effect of single energy metal artifact reduction (SEMAR) algorithm with 320-MDCT volume scanners in patients with custom-made tumor prostheses of knee joint.

**METHOD AND MATERIALS**

23 consecutive patients with a custom-made tumor prosthesis of knee joint underwent a 320-MDCT scan. And the images were reconstructed using two different methods: iterative reconstruction (IR) alone and IR associated with SEMAR. 10 periarticular structures at different orientations were selected at two planes (5 at each plane): the articular plane and osteotomy plane. Objective assessment including CT number and SD value was performed with paired sample t test. Two radiologists visually graded the influence of metallic artifacts on a 6-point scale from 0 (completely obscured) to 5 (recognition with high confidence), and paired sample t test and kappa analysis were used for the subjective scores of image quality.
RESULTS

Visualization of periprosthetic structures was significantly improved by the SEMAR algorithm \((p<0.05)\). Objectively, SD values of the osteotomy plane decreased 44.8\%~74.1\% and that of the articular plane decreased 73\%~95\%. Subjectively, the scores of image quality of two planes increased 0.45\~2.0 scores and 0.78\~3.4 scores respectively. In the images with SEMAR, we found periprosthetic effusion in 4 patients, periprosthetic fracture in 2 patients, and tumor recurrence in 2 patients, which were partly or completely obscured by metallic artifacts in the images without SEMAR.

CONCLUSION

The SEMAR significantly improved the quality of images and diagnostic confidence in patients with custom-made tumor prosthesis of knee joint.

CLINICAL RELEVANCE/APPLICATION

The SEMAR significantly improved the quality of images and diagnostic confidence in patients with custom-made tumor prosthesis of knee joint.

RC604-12 **Treatment of Aneurysmal Bone Cysts by Percutaneous CT-guided Injection of Calcitonin and Steroid**

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, New York, NY (Abstract Co-Author) Nothing to Disclose
Frank J. Simeone, MD, 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

To determine the efficacy and safety of percutaneous calcitonin and steroid injection in the treatment of aneurysmal bone cysts (ABCs).

METHOD AND MATERIALS

Our study was IRB-approved and HIPAA-compliant. We reviewed pre- and post-procedural imaging studies and medical records of all CT-guided percutaneous injections of ABCs with calcitonin and steroid performed at our institution between 2003-2015. Treatment success based on imaging was categorized as complete/near complete (>80% filled-in), significant partial (50\~80% filled-in), partial (20\~49% filled-in), and little-to-no (<20% filled-in).

RESULTS

Our study group comprised eight patients (7 F, 1 M; mean age 19\±5 (range12-25) years). ABCs were located in the pubis (n=3), femur (n=2), and humerus /ilium/sacrum (n=1 for each). Clinical and imaging follow-up ranged from 0.7 to 93 months (mean 16\±29 months). One patient had two injections, and one patient had three injections. 6/8 patients (75\%) had complete symptomatic relief and 2 (25\%) patients had partial symptomatic relief after initial injection. Short-term imaging follow-up revealed complete/near complete imaging response in 2 (25\%) patients and significant partial response in 2 (25\%) patients. There was partial response in 2 (25\%) patients and little-to-no response in 2 (25\%) patients, and all four of these patients had local recurrence. The other four patients did not have local recurrence. There were no complications.

CONCLUSION

Percutaneous CT-guided injection of ABCs with calcitonin and steroid is a safe and effective alternative to surgery. Lack of imaging response may necessitate more aggressive treatment to minimize local recurrence.

CLINICAL RELEVANCE/APPLICATION

Calcitonin/steroid sclerotherapy is safe, effective, alternative, minimally invasive treatment for treatment of aneurysmal bone cysts and should be considered in the forefront of treatment options.

RC604-13 **Pearls and Pitfalls of Bone and Soft Tissue Biopsies**

Participants

Travis J. Hillen, MD, Saint Louis, MO (Presenter) Consultant, Biomedical Systems; Instructor, DFine, Inc

LEARNING OBJECTIVES

1) Indications and relative contraindications to MSK biopsy. 2) Importance of compartmental anatomy and your referring surgical oncologist in biopsy planning. 3) Tricks to make the difficult biopsy relatively easy using case illustrations.

ABSTRACT

Musculoskeletal biopsies are commonly performed in the diagnosis and staging of malignancy or to evaluate for infection. Preprocedural planning is tantamount to a successful biopsy. As radiologists we must remember that we are physicians and not just technicians. In the biopsy of primary MSK malignancies, discussion of the biopsy with a surgical/orthopedic oncologist is very important as there are potential changes in morbidity related to biopsy of these primary lesions. The majority of MSK biopsies are straightforward. Occasionally challenging biopsies will arise and having some tricks up your sleeves to get the biopsy performed can make a big difference in patient management.

Active Handout: Travis J. Hillen

LEARNING OBJECTIVES

1) Indications and relative contraindications to MSK biopsy. 2) Importance of compartmental anatomy and your referring surgical oncologist in biopsy planning. 3) Tricks to make the difficult biopsy relatively easy using case illustrations.

ABSTRACT

Musculoskeletal biopsies are commonly performed in the diagnosis and staging of malignancy or to evaluate for infection. Preprocedural planning is tantamount to a successful biopsy. As radiologists we must remember that we are physicians and not just technicians. In the biopsy of primary MSK malignancies, discussion of the biopsy with a surgical/orthopedic oncologist is very important as there are potential changes in morbidity related to biopsy of these primary lesions. The majority of MSK biopsies are straightforward. Occasionally challenging biopsies will arise and having some tricks up your sleeves to get the biopsy performed can make a big difference in patient management.
Participants

Sub-Events

**RC613A Imaging of Musculoskeletal Soft Tissue Masses**

Participants
Michele M. Walters, MD, Boston, MA (*Presenter*) Nothing to Disclose

**RC613B Imaging of Pediatric Vascular Anomalies**

Participants
Oscar M. Navarro, MD, Toronto, ON, (oscar.navarro@sickkids.ca) (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Classify vascular malformations and hemangiomas. 2) Explain the importance of clinical information in the diagnosis of pediatric vascular anomalies. 3) Describe most relevant sonographic and MR imaging features of pediatric vascular anomalies.

**RC613C Imaging of SCFE**

Participants
Delma Y. Jarrett, MD, Boston, MA (*Presenter*) Nothing to Disclose

**RC613D Imaging of Pediatric Scoliosis**

Participants
Nancy A. Chauvin, MD, Philadelphia, PA, (chauvinn@email.chop.edu) (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the types and patterns of scoliosis in children. 2) Develop an evidence based approach to imaging scoliosis in children. 3) Identify key imaging findings in pediatric scoliosis.

**ABSTRACT**
**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)* Nothing to Disclose  
Todd S. Miller, MD, Bronx, NY, (tmiller@montfiore.org) *(Presenter)* Nothing to Disclose  
Afshin Gangi, MD, PhD, Strasbourg, France *(Presenter)* Proctor, Galil Medical Ltd

### LEARNING OBJECTIVES

1. Discuss appropriate algorithms for patient selection.  
2. Review anatomic and technical considerations for vertebral augmentation.  
3. Present an update of the recent advances in vertebral augmentation including sacroplasty.  
4. Emphasize safety issues and how to avoid complications.  
5. Understand the applications of vertebral augmentation in osteoporotic and neoplastic spine pathology.  
6. Update participants with respect to advances in equipment and biomaterials.

### ABSTRACT

1. Patient selection for vertebral augmentation  
2. Indications and Contraindications  
3. New devices and techniques in vertebral augmentation  
4. Vertebral augmentation for osteoporotic and pathologic vertebral compression fractures  
5. Complications avoidance  
6. Efficacy  

Vertebral augmentation is an image-guided (fluoroscopy or CT) percutaneous procedure in which a bone needle is inserted into a painful osteoporotic or pathologic fracture within the spinal axis. Biopsy, cavity creation or lesion ablation may then be performed under imaging guidance depending on the nature of the pathology that is being treated. Subsequently a radioopaque implant, usually an acrylic bone cement, is carefully injected into the vertebra or sacral ala under imaging guidance. These procedures have been shown to provide pain relief by stabilizing the fractured vertebra or sacrum. As with any other invasive procedure, they carry a small risk (<1%) of complication including bleeding, infection, neurovascular injury, or cement 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.
LEARNING OBJECTIVES
1) Recognize the patterns of arthritides and differentiate them from other entities. 2) Learn the features that help differentiate types of arthritides. 3) Select imaging modalities appropriate for specific clinical questions.

ABSTRACT
Inflammatory arthritides can have varied clinical presentations that simulate other diseases. Through the recognition of these image patterns, the radiologist can play an important role in diagnosis and management of these patients. Through case presentations, we will review the appearances of various arthritides and demonstrate the importance of imaging for these diseases.

Active Handout: Carl Scherman Winalski

LEARNING OBJECTIVES
1) Learn to recognize normal developmental patterns, age-dependent physiologic findings, and congenital lesions within the pediatric musculoskeleton. Some of which persist into adulthood. Key features which differentiate these entities from pathology will be reviewed.

ABSTRACT
Important imaging appearances of normal, physiologic development within the pediatric musculoskeleton will be reviewed with an emphasis on epiphyseal and physeal cartilage, bone marrow, and vascular variation.

LEARNING OBJECTIVES
1) Review several disorders of the knee utilizing conventional radiography, CT scanning, and MR imaging. 2) Delineate important points that allow accurate diagnosis of these disorders.

ABSTRACT
The knee is commonly involved in many different disease processes, some localized to this joint (such as a variety of internal derangements and posttraumatic alterations) and others affecting other parts of the skeleton as well. In this presentation, several important derangements or disorders affecting the knee will be presented using conventional radiography, CT scanning, and MR imaging.

LEARNING OBJECTIVES
1) To recognize imaging appearances of common soft tissue neoplasms. 2) To identify imaging features that suggest an aggressive
bone neoplasm. 3) To apply the imaging appearance of a musculoskeletal neoplasm to help guide biopsy and improve diagnostic performance.

**ABSTRACT**

Important imaging features in evaluation of both bone and soft tissue tumors will be reviewed with key features that may allow diagnostic differentiation emphasized.

**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
PURPOSE

Injuries to the thoracic and lumbar (TL) spine due to blunt trauma are a common cause for presentation to emergency departments (ED). In 2015, the American Association for the Surgery of Trauma (AAST) published a prospectively derived clinical decision rule for thoracolumbar spine evaluation after blunt trauma. The purpose of this study was to evaluate the accuracy of this decision rule and determine how many TL spine reformats would have been unnecessary had the rule been prospectively applied.

METHOD AND MATERIALS

1000 consecutive patients who underwent CT Chest, Abdomen, Pelvis (CT CAP) with TL spine reformatted images following blunt trauma were retrospectively reviewed. Patients with penetrating injury, age < 15 yrs, injury > 48 hrs prior to presentation, known TL spine fracture, and those not evaluated by an ED physician were excluded. Clinical and imaging records of the patients were reviewed to identify all AAST decision rule criteria (alert and evaluable, physical exam, high risk mechanism, age > 60 yrs) and determine the presence of TL spine fracture.

RESULTS

Of the 1000 patients, 900 met study inclusion criteria, of which 66 (7.3%) had TL spine fractures. Of the 900, 535 patients were not evaluable by the AAST decision rule (i.e., not alert and evaluable, C-spine or other distracting injury)(Fig 1). Of the remaining 365 patients, 20 (5.5%) had TL spine fractures. The decision rule correctly identified 17 of these 20 patients with fractures for a sensitivity of 85%, but with a 100% sensitivity for fractures requiring surgical management or bracing. Of the 365 patients evaluable by the AAST decision rule, 102 (27.9%) would have met the criteria for not requiring imaging, of which 3 had fractures detected (Fig 2).

CONCLUSION

The AAST clinical decision rule for TL spine evaluation after blunt trauma identified all fractures of the TL spine requiring surgical management or bracing and would have resulted in a 27.9% reduction in the number of required TL spine reformats. However, the performance of the decision rule in detecting fractures not requiring surgical management or bracing was suboptimal for a screening tool and further evaluation of its accuracy is necessary prior to widespread implementation.

CLINICAL RELEVANCE/APPLICATION

Fractures not requiring surgical management or bracing can still alter patient management and clinicians utilizing this clinical decision rule must take this into consideration when forgoing imaging.
PURPOSE
Midfoot fractures are missed in 20% of initial visits. Missing midfoot fractures can cause pain, pseudoarthrosis, arthritis, deformity and amputation. Our aim is to analyze Lisfranc and Chopart fractures and to provide an evidence-based flowchart to reduce missed fractures.

METHOD AND MATERIALS
This is a HIPAA compliant, IRB approved, retrospective study conducted between 2010 and 2014. PACS system of our institution was searched for Lisfranc and Chopart fractures. Diagnosis was made based on imaging modalities. Patients were divided into 2 categories: high-energy (motor vehicle accidents, fall from height) and low-energy trauma (slips and twisting, simple fall, blunt trauma) based on medical records.

RESULTS
400 patients were analyzed (mean 46.5 years; 54.3% male). Lisfranc fracture was diagnosed in 65.0% (260/400), Chopart in 33.3% (133/400) and 1.8% (7/400) had both. The most common associated fracture was fibular diaphysis (8.5%; 34/400). CT had the highest overall sensitivity (98.5%; 203/206), followed by MRI (98.3%; 58/59), weight bearing radiography (81.3%; 65/80) and plain radiography (79.7%; 286/359). Overall, CT and MRI were significantly more sensitive than plain radiography and weight bearing radiography (all p < 0.001). Fractures were missed in 19.2% (77/400) of first visits. In missed cases, MRI and CT were significantly more sensitive (97.7% and 92.9% respectively) compared to weight bearing radiography (42.9%) and plain radiography (18.1%) (all p < 0.05). Most common trauma history was low-energy (66.0%; 264/400). Low-energy trauma cases were significantly missed more than high-energy trauma (p = 0.04). In low-energy trauma, plain radiography and weight bearing radiography had the sensitivity of 77.5% and 80.3% respectively. CT and MRI are next steps and significantly more sensitive (99.1% and 98.0% respectively; both p < 0.001). In high-energy trauma, first step is plain radiography (82.9% sensitive) followed by CT which is significantly more sensitive (97.9%; p < 0.001).

CONCLUSION
Lisfranc and Chopart fractures were missed in the first presentation in 19.2% of patients. Overall, CT and MRI were more sensitive to detect these fractures. If radiographs are negative in the first visit and clinical suspicion remains for midfoot fracture, CT or MRI are both equally efficient for the diagnosis of midfoot fractures.

CLINICAL RELEVANCE/APPLICATION
This study provides an opportunity to reassess imaging appropriateness of acute midfoot fractures to reduce delayed diagnosis that negatively impact patient care.

SSQ05-03 The (Lack of) Impact of Published Guidelines on Appropriate Imaging for Low Back Pain in the Emergency Department

Awards
Student Travel Stipend Award

Participants
Sarvenaz Pourjabbar, MD, New Haven, CT (Presenter) Nothing to Disclose
Ali Raja, MD, MBA, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ivan Ip, MD, MPH, Brookline, MA (Abstract Co-Author) Nothing to Disclose
Ramin Khorasani, MD, Boston, MA (Abstract Co-Author) Consultant, Medicalis Corp

PURPOSE
To quantify the impact of a Clinical Practice Guideline for imaging of patients with low back pain (LBP) (published by the American College of Physicians and the American Pain Society in 2007) on imaging practices in the emergency department (ED).

METHOD AND MATERIALS
Informed consent was waived for this IRB-approved retrospective observational study. ICD-9 diagnosis codes were used to fetch ED visits related to low back pain in patients 18-64 years old in two 2-year periods: 2005/2006 (just before the guideline was published) and 2013/2014 (5 years after the guideline was published). Imaging performed within 24 hours of the ED admission was considered related to that visit. As per the guideline, each imaging indication was linked to specific diagnosis and procedure codes (ICD-9/CPT) which was used to confirm appropriateness of the imaging. In order to verify the accuracy of ICD-9/CPT method, 160 charts were randomly selected from the study cohort and manually reviewed. The primary outcome was the overall utility of imaging and the secondary outcome was the proportion of inappropriate imaging. Chi-square test was used to compare the pre and post guideline publication groups.

RESULTS
In 2005/2006, 3,221 unique ED visits (age: 40.4 ± 10, F:M 1235:1986) were due to low back pain, compared to 3,766 in 2013/2014 (age: 42.5 ± 12, F:M 1621:2145). Chart review of 160 charts showed a sensitivity and specificity of 89% & 96% using the ICD-9/CPT codes. The use of cross-sectional imaging for these patients increased from 46% to 58% over the two time periods (p = 0.0001), however, the proportion of imaging not adherent to the guidelines remained the same (61%, p-value = 0.6). In patients with imaging indicated by the guideline, 29.8% (337/960) in 2005-2006 and 42% (412/986) in 2013-2014 had imaging performed (p = 0.002).

CONCLUSION
The implementation of the guideline resulted in an overall increase in imaging, primarily due to an increase in the amount of imaging of patients who met appropriate guideline criteria. Inappropriate imaging did not decrease; suggesting that guideline publication alone is unlikely to change image-ordering behavior.

CLINICAL RELEVANCE/APPLICATION
This study provides an opportunity to reassess imaging appropriateness of acute midfoot fractures to reduce delayed diagnosis that negatively impact patient care.
SSQ05-04  Is MR of the C-spine in Acute Trauma Patients Indicated?

Thursday, Dec. 1 11:00AM - 11:10AM Room: S405AB

Participants
Marlen Pajcini, MD, San Jose, CA (Presenter) Nothing to Disclose
Mahesh R. Patel, MD, San Jose, CA (Abstract Co-Author) Nothing to Disclose
Rajul P. Pandit, MD, San Jose, CA (Abstract Co-Author) Nothing to Disclose
John Sherck, MD, San Jose, CA (Abstract Co-Author) Nothing to Disclose
Adella Garland, San Jose, CA (Abstract Co-Author) Nothing to Disclose
Young S. Kang, MD, San Jose, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
In recent years, MR of the cervical spine has become part of the routine imaging protocol for selected indications in many trauma centers. Because of the expense and complex operational requirements of MR, it is imperative to establish its effectiveness. While there is ample anecdotal evidence and some clinical series demonstrating the utility of MR, we set out to examine the spectrum and frequency of findings in MR performed on patients presenting to our Level I trauma center.

METHOD AND MATERIALS
A retrospective review of consecutive C-spine MR imaging studies over a two-year period ordered in the context of an acute trauma was performed. Each study was assessed for the presence of the following findings: cord injury, ligamentous injury, soft tissue/muscle injury, marrow/disc injury, and/or vascular injury. If none of these acute findings were present or if the MR study demonstrated only findings that were seen on prior imaging studies, the study was categorized as negative for the purposes of the analysis.

RESULTS
241 studies were identified. Indications included neurologic deficit or inability to perform clinical assessment. Cord injury was noted in 17% (41/241), ligamentous injury in 43% (104/241), soft tissue/muscle injury in 29% (69/241), marrow/disc injury in 28% (67/241), and vascular injury in 12% (28/241). 36% (86/241) of the analyzed studies were negative for acute findings or only demonstrated findings that were previously known from prior imaging.

CONCLUSION
Ligamentous injury is the most common pathological finding in MR. Cord injury, which can have the most severe clinical repercussions, was the least frequent finding at 17%. Slightly over one-third of analyzed cases were negative for any acute findings or demonstrated findings that had been previously described. This indicates that in the majority of trauma patients for which a C-spine MR study is ordered, an acute finding is generally present. While there may be variations in treatment protocols among trauma centers in response to specific findings on MR, the overall high frequency of positive findings found in our study validates the general concept of the use of MR in acutely injured patients who demonstrate neurologic deficit or cannot be assessed clinically.

CLINICAL RELEVANCE/APPLICATION
Understanding the frequency of findings on C-spine MR imaging studies on acute trauma patients can allow radiologists to guide ordering physicians in appropriate utilization.

SSQ05-05  The Impact of Total Spine MRI on Targeted Patient Selection for Surgical Therapy of Geriatric Vertebral Fractures

Thursday, Dec. 1 11:10AM - 11:20AM Room: S405AB

Participants
Christoph Weber, MD, Hamburg, Germany (Presenter) Nothing to Disclose
Corinna Ossadnik, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Theo Abel, Ljungburg, Germany (Abstract Co-Author) Nothing to Disclose
Jonas Hafner, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Hannah Hentschel, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Peter Bannas, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the diagnostic accuracy of total spine MRI in the diagnosis of vertebral fractures in comparison to conventional radiographs (CR) and to evaluate its effect on surgical therapy (vertebro-/kyphoplasty, spondylodesis etc.) in geriatric patients.

METHOD AND MATERIALS
The vertebral bodies (n=2736) of 114 “geriatric” patients, average age 84y (75-96y) were measured by the method of Genant on total spine MRI and CR performed on average within 2d (0-17d) before to determine morphology (normal, wedge, biconcave, crush) and to graduate deformity. “Geriatric” was defined as age >75y. All patients suffered from back pain after mild trauma. Two radiologists independently evaluated the images (T1/T2/STIR sequences). Interobserver agreement was assessed by kappa statistics. Surgical treatment was indicated, when the fracture was fresh (fluid sign on edema sensitive STIR sequence, fracture line), the patient had <5 total fractures and the posterior border was involved.

RESULTS
Qualitative analysis revealed n=520/2736 vertebral bodies fractured, quantitative analysis by the method of Genant increased the amount of vertebral fractures/deformities to n=1062/2736. The presence of a fluid sign on STIR sequences and a fracture line indicated the recentness of the vertebral fracture in 7% (n=202/2736) of vertebral bodies measured. 38 % (n=78/202) of these recent fractures were missed on CR (p=0.019), 7 % (n=14/202) were distant from the location of pain and not imaged by CR. The method of Genant revealed a reduction of heights in deformed vertebral bodies of ~3 mm, either on CR and MRI. Surgical therapy was indicated in 53% (n=60/114) patients, 55% (n=33/60) rejected the recommended surgical intervention, 18% underwent
vertebro-/kphoplasty, 6% spondylodesis. Surgical therapy was predominantly indicated based on MRI data. \( \kappa \)-scores for interobserver agreement for existing fractures were as follows: MRI, \( \kappa = 0.754 \); CR, \( \kappa = 0.488 \); for posterior border involvement, respectively: MRI, \( \kappa = 0.718 \); CR, \( \kappa = 0.567 \).

CONCLUSION
Interobserver agreements were much better for MRI than for CR. For an accurate selection of patients with vertebral fractures for surgical therapy after mild trauma total spine MRI represents a significant improvement to detect recent vertebral fractures in geriatric patients.

CLINICAL RELEVANCE/APPLICATION
Total spine MRI is the method of choice to detect vertebral fractures and to select vertebral fractures for surgical therapy in geriatric patients.

SSQ05-07 140 kVp Spectral Filtration CT of the Lumbar Spine: Reduced Radiation Dose in the Emergency Setting

Thursday, Dec. 1 11:30AM - 11:40AM Room: S405AB

Awards
Student Travel Stipend Award

Participants
Sheldon J. Clark, MD, Vancouver, BC (Presenter) Nothing to Disclose
Bo Gong, MSc, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Patrick J. Slipp, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Michael E. O'Keeffe, MBCh, Vancouver, BC (Abstract Co-Author) Speaker, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (Abstract Co-Author) Institutional research agreement, Siemens AG
Patrick D. McLaughlin, FFRRCSI, Vancouver, BC (Abstract Co-Author) Speaker, Siemens AG

PURPOSE
Imaging of the lumbar spine is often indicated in symptomatic patients who have undergone low velocity trauma. The purpose of this study is to compare image quality and diagnostic accuracy of a conventional 120 kVp CT with a 140 kVp CT with tin filter in acute trauma patients. A 140 kVp with tin filter CT can be obtained at 1/3 of the dose of a conventional 120 kVp CT.

METHOD AND MATERIALS
Institutional review board approval was obtained, with no informed consent required, for this retrospective analysis. 97 consecutive trauma patients underwent abdominal scans using a dual source, dual energy 128-slice CT system (Definition FLASH; Siemens Healthcare, Forchheim, Germany). Image noise, spatial resolution, contrast resolution, diagnostic acceptability, and diagnostic accuracy for fractures/soft tissue injuries were compared between the conventional 120 kVp CT (mixed data set) and the 140 kVp with tin filter CT (single data set) using a 10 point scoring system (1=unacceptable, 5=acceptable, 10=excellent). These parameters were reviewed by two radiologists. Analysis between the two CT data sets were analyzed using one-way paired-t-tests.

RESULTS
The average radiation dose for the conventional 120 kVp CT was 6.1 +/- 2.3 mSv. The 140 kVp with tin filter CT is approximately 1/3 of the dose, and would be 2 mSv. Image noise, spatial resolution, contrast resolution, diagnostic acceptability, and diagnostic accuracy were well matched between the two readers. There were statistically significant \((p<0.05)\) decreases in image noise \((9.7+/-0.5 \text{ vs. } 8.4+/-0.9)\), spatial resolution \((9.6+/-0.6 \text{ vs. } 8.4+/-1.0)\), contrast resolution \((9.3+/-0.8 \text{ vs. } 8.0+/-1.0)\), and diagnostic acceptability \((9.97+/-0.17 \text{ vs. } 9.91+/-0.29)\). No fractures or soft tissue injuries were missed in either data sets.

CONCLUSION
No fractures or soft tissue injuries were missed on the 140 kVp with tin filter CT when compared with the conventional 120 kVp CT. While image quality was statistically decreased, all parameters were within the range of acceptability. These results suggest that in specific cases, an ultra low dose lumbar spine imaging protocol can be performed at 1/3 of the conventional dose.

CLINICAL RELEVANCE/APPLICATION
The ability to acquire a CT examination of the lumbar spine at approximately 1/3 of the conventional dose with no degradation in image quality or reduction in diagnostic accuracy for vertebral body fracture or soft tissue injury is a substantial benefit.

SSQ05-08 Is Tomosynthesis More Accurate than Radiography in Detecting Subtle Hip Fractures?

Thursday, Dec. 1 11:40AM - 11:50AM Room: S405AB

Participants
Naveen Parasu, MBBS, Hamilton, ON (Presenter) Nothing to Disclose
Jane Castells, Hamilton, ON (Abstract Co-Author) Nothing to Disclose
Sandra Monteiro, PhD, Hamilton, ON (Abstract Co-Author) Nothing to Disclose
David A. Koff, MD,FRCPc, Hamilton, ON (Abstract Co-Author) Stockholder, Real Time Medical, Inc Spouse, President, Real Time Medical, Inc
Katelyn Nye, Waukesha, WI (Abstract Co-Author) Employee, General Electric Company
John M. Sabol, PhD, Waukesha, WI (Abstract Co-Author) Employee, General Electric Company

PURPOSE
Digital tomosynthesis with flat-panel detector radiography is a novel application that allows easy, swift volume data acquisition of any anatomical site of interest with arbitrary patient posture. A single sweep of the X-ray tube provides multiple tomographic images of high resolution giving superior anatomical detail, potentially demonstrating fractures not identified on radiographs. The purpose of this study is to demonstrate that using digital tomosynthesis, in conjunction with radiographs, is better at detecting subtle and occult hip fractures than radiographs alone.
METHOD AND MATERIALS

This was a prospective 8-month study that assessed adult patients presenting to ER with a suspected hip fracture following a fall. For study purposes, a hip fracture was defined as involving either proximal femur or pelvis. Patients with prior hip fractures or surgery were excluded from study. 62 patients (M=24; F=38; average age=79 yrs) without an obvious hip fracture on radiographs (as determined by the technologist) proceeded immediately to tomosynthesis. Images were reviewed by musculoskeletal radiologists.

RESULTS

Of the 62 patients, 15 had hip fractures confirmed by either surgery or medical treatment. CT confirmed fracture in 3 patients. The fracture location and corresponding patient numbers were as follows: Femoral neck/intertrochanteric region (5); acetabulum (5); pubic rami (4); sacral ala (1). 6 patients (5 femoral and 1 acetabular fracture) had surgical management. Radiographs showed fracture in 8 of the 15 patients with no false positive cases (sensitivity=53%; specificity=100%). Tomosynthesis detected all 15 fractures with no false positive cases (sensitivity and specificity were both 100%). Among the 47 patients with no fractures, 3 had CT while 2 had MRI, which confirmed no evidence of bony trauma. The remaining 42 patients had their medical records reviewed 30 days following their initial ER visit and discharge, which confirmed no further admissions from the initial hip injury.

CONCLUSION

The study shows that tomosynthesis is an accurate imaging modality in detecting subtle, nondisplaced hip fractures which may not be readily apparent on initial radiographs.

CLINICAL RELEVANCE/APPLICATION

Digital tomosynthesis provides an early and accurate diagnosis of hip fractures, particularly in centers where CT or MRI is not readily available and is also significantly less expensive.

SSQ05-09 Systematic Radiation Dose Reduction in Cervical Spine Computed Tomography of Human Cadaveric Specimens - How Low Can We Go?

Thursday, Dec. 1 11:50AM - 12:00PM Room: S405AB

Participants
Anna Hirschmann, MD, Basel, Switzerland (Presenter) Nothing to Disclose
Dorothee Harder, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Clemens Reisinger, MD, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Johanna Lieb, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Zsolt Szucs-Farkas, MD, PhD, Berne, Switzerland (Abstract Co-Author) Nothing to Disclose
Sebastian T. Schindera, MD, Basel, Switzerland (Abstract Co-Author) Research Grant, Siemens AG; Research Grant, Ulrich GmbH & Co KG; Research Grant, Bayer AG; Speakers Bureau, Bayer AG
Magdalini Tozakidou, MD, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE

To compare image quality of computed tomography (CT) images of the cervical spine of cadaveric specimens at different radiation dose levels reconstructed with a filtered back projection (FBP) and an iterative reconstruction (IR) algorithm.

METHOD AND MATERIALS

The cervical spine of four human formalin-fixed cadavers (mean BMI; 30.5 kg/m2± 5.2; range 24-36) was examined using a 128-MDCT scanner (DefinitionAS/Siemens) at nine different reference tube current-time products (45/75/105/135/150/165/195/275/355 mAs) and a tube voltage of 120 kVp. Automatic tube current modulation was applied (CareDose 4D). Data were reconstructed using both FBP and IR (SAFIRE/Siemens; strength 3). Morphological characteristics (vertebral cortex, anterior/posterior vertebral integrity, conspicuity of trabecular bone, posterior vertebral alignment, facet joint alignment) were quantified on a Likert-scale for each cervical segment by four independent and blinded radiologists. Subjective image noise was evaluated on a three-point scale. Signal-to-noise ratio (SNR) was measured. Statistical analysis included analysis of variance and Tukey’s-test.

RESULTS

IR provided significantly better image quality than FBP (P<0.001); noise increased as radiation dose decreased. Subjective image noise at levels C1-C4 was rated as either “no noise” or as “acceptable noise” in all scans. At lower spine levels subjective image noise was not acceptable, even at 355 mAs. Shoulder position of all human cadaveric specimens was found to be at level C5. Analyzing all spinal levels, scores for morphological characteristics revealed no significant differences between 105 and 355 mAs (P=0.555), but were significantly worse in scans at lower 45 (P < 0.001) and 75 mAs (P=0.025).

CONCLUSION

Clinically acceptable image quality of the cervical spine of cadaveric specimens with different body habitus can be achieved with reference mAs of 105. High position of the shoulders is a limiting factor even with high radiation doses; therefore pulldown of both shoulders during acquisition is fundamental.

CLINICAL RELEVANCE/APPLICATION

Radiation dose for cervical spine CT may be significantly reduced in patients with a low shoulder position.
Distribution of Subchondral Travecular Bone Density: Effects of Meniscal Integrity

PURPOSE
The purpose of this study is to describe the appearance and density of the cadaveric tibial subchondral trabecular bone in the knees with normal and torn menisci.

METHOD AND MATERIALS
3D-high resolution PD CUBE MRI exams of the 6 cadaveric knees were acquired in the axial plane at 0.25 mm resolution. Images were reformatted in the coronal and sagittal plane and reviewed by two musculoskeletal radiologists. Menisci were evaluated in each compartment as normal, intrasubstance degeneration or tear in the anterior horn, mid-body, and posterior horn. At each meniscal compartmental designation, the tibial subchondral (within 5 mm) trabecular pattern was evaluated, and subchondral trabecular bone density was determined in meniscal covered- vs. -uncovered regions using a Matlab routine.

RESULTS
In the samples, 2 exams showed normal medial menisci while the remaining four exams demonstrated medial meniscal tear in consensus. In normal samples (A,B), region of high trabecular bone density was found centrally in axial images. In contrast, in samples with meniscal tear (C,D,E,F), there was a tendency of the shift of the region of high bone density towards the location of the meniscal tear. Tear-associated bone changes were also observable in other planes (E,F). Trabecular bone density of normal samples in meniscal-covered and –uncovered regions were 30 ± 4.6% (mean ± std. dev.) and 40 ± 3.4%, respectively, while those of torn samples were 36 ± 5.3% and 47 ± 3.8%, suggesting a slightly higher (p=0.17) values in torn samples, and a significantly higher (p=0.001) values in uncovered regions.

CONCLUSION
Changes in subchondral trabecular density are identified in the setting of meniscal pathology.

CLINICAL RELEVANCE/APPLICATION
Quantitative evaluation of trabecular response to meniscal pathology may offer insight into bone adaptation as a surrogate for meniscal mechanical axis, and offer insight into "inside-out" theories of osteoarthritis.

MR Properties of the Posterior Root Ligaments of the Knee in Cadaveric Specimens and Healthy Volunteers: Morphology and Relaxation Patterns with a Focus on Adjacent Cartilage

PURPOSE
To explore the relationship of root ligament morphology and quantitative MR properties in cadaveric specimens and asymptomatic volunteers.

Awards
Student Travel Stipend Award

Participants
Alessandro Vidoni, MD, San Diego, CA (Presenter) Nothing to Disclose
Tineke De Coninck, MD, Ghent, Belgium (Abstract Co-Author) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Renii Biswas, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Betty Tran, La Jolla, 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
METHOD AND MATERIALS

7 fresh cadaveric knees (64 to 92 years) (screened for degrees of degeneration with CT) and 6 healthy volunteers (25 to 42 years) were imaged at 3T. Morphologic (PD, T1 SE, PD CUBE), and quantitative standard (T2 CUBE) and ultra-short TE (T2*) MR sequences were performed. The study took place under the approval of the institutional review board (IRB). 3 anatomical regions were considered for morphologic: 1. root ligaments posterior horns medial and lateral menisci grade I = intrasubstance signal intensity increase not touching the articular surface; grade II = partial discontinuity; grade III = full-thickness tear; 2. articular cartilage of femur in contact with root ligaments 3. articular cartilage of tibia in contact with root ligaments both evaluated with modified ICRS grading system. In addition, qMRI values of those regions were extrapolated with mono-exponential fitting and T2 maps (when ICRS grade 2 or less).

RESULTS

In cadaveric knees, pathology of root ligament included grade 1 (n=4 PLRL; n=1 PMRL) degeneration. In all cases, apposing articular cartilage was abnormal: femur (grade I n=3; grade II n=2) and tibia (grade I n=1; grade II n=2; grade III n=2). T2 relaxation values obtained in degenerated RL (average: T2 CUBE= 37.18; UTE T2*=19.913) and adjacent cartilage of femur (average: T2 CUBE= 54.84; UTE T2*= 28.38) and tibia (average: T2 CUBE= 52.69; UTE T2*=17.87). Reference values obtained in healthy volunteers: root ligament (average: T2 CUBE= 19.33; UTE T2*=9.02), femoral (average: T2 CUBE= 26.98; UTE T2*= 16.54) and tibial (average: T2 CUBE= 22.53; UTE T2*= 13.17) cartilage. Values of femoral cartilage at the level of the curved posterior aspect of the condyle were increased due to magic angle effect.

CONCLUSION

Morphologic and quantitative MR evaluation of the posterior horn meniscal root ligaments can identify structural change that is associated with chondral degeneration. The morphologic alterations of posterior root ligaments as well as of adjacent cartilaginous surfaces of tibia and femur suggest an interdependence between root ligament structural alteration and chondral integrity that may be mechanical in nature.

CLINICAL RELEVANCE/APPLICATION

Quantitative MRI values of root ligament and related cartilage are good predictors for degeneration.

SSQ12-03 The Association of Superolateral Hoffa’s Fat Pad Edema and Synovitis with Structural Changes in the Patellofemoral and Tibiofemoral Joints: The MOST Study

Thursday, Dec. 1 10:50AM - 11:00AM Room: E451A

Participants

Mohamed Jarraja, MD, Boston, MA (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
David T. Felson, MD, MPH, Boston, MA (Abstract Co-Author) Consultant, Zimmer Biomet Holdings, Inc
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;
Michael C. Nevitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Joshua J. Stefanik, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine the relation of superolateral Hoffa’s fat pad (SHFP) edema and Hoffa-synovitis to cartilage damage and bone marrow lesions (BMLs) in the patellofemoral (PF) and tibiofemoral (TF) joints.

METHOD AND MATERIALS

The Multicenter Osteoarthritis (MOST) study is a NIH-funded longitudinal cohort study of older individuals with or at risk for knee OA. We used data from the 60-month study visit where all eligible subjects had knee MRI assessed for other structural features of knee OA. SHFP edema and Hoffa-synovitis (infrapatellar and/or intercondylar) were assessed on sagittal proton density-weighted fat-suppressed MRI images by two musculoskeletal radiologists and dichotomized into presence (>1) and absence (=0). Cartilage damage and BMLs were scored in the PF and TF joints. We used three definitions of structural damage: 1) any cartilage damage (WORMS score of ≥2), 2) full-thickness cartilage damage (WORMS score 2.5, 5-6) and 3) any BML (WORMS score of ≥1). We further defined the location of PF and TF joint damage in the lateral and medial compartments. Separate logistic regression models were used to determine the relation of SHFP edema to our three definitions of structural damage in the medial and lateral PF and TF joints, adjusting for age, sex, and BMI. The same models were used with Hoffa’s synovitis as the exposure instead of SHFP edema.

RESULTS

1041 knees were included; Mean (sd) age and BMI were 66.8 (7.5) and 29.6 (4.8), respectively; 65% were female. SHFP edema and Hoffa-synovitis was present in 12.7% and 59.3% of knees, respectively. Compared with knees without SHFP edema, knees with SHFP edema showed statistically significant increase in odds of any and full-thickness cartilage damage, and any BML in the lateral PF joint only. Compared with knees without synovitis, knees with Hoffa-synovitis showed statistically significant odds of any and full thickness damage, and BMLs in all 4 compartments (table).

CONCLUSION

While synovitis is a marker of whole-joint disease, SHFP edema is a surrogate of local lateral PF joint disease only. SHFP edema is likely the result of mechanical impingement and maltracking leading to local structural abnormalities like cartilage and osseous changes.

CLINICAL RELEVANCE/APPLICATION

Unlike synovitis, SHFP edema is a surrogate of local lateral PF joint disease only, independent from structural changes in the TF joint.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying
METHOD AND MATERIALS

Institutional review board approval was obtained. Retrospective review of lateral knee radiographs and CE knee MR examinations (time interval, 0–7 days) from 79 patients (male:female, 37:42; mean age, 60.1 years) was performed by two radiologists independently. They evaluated the following grades: (1) IPFP opacity alteration grade (CR-IPFP grade 0–3) and joint effusion grade (CR-EFF grade 1–3) on lateral knee radiograph, (2) IPFP signal alteration grade (MR-IPFP grade 0–3) and grade of joint effusion amount (MR-EFF grade 1–3) on CE MR images, (3) individual synovitis grade (MR-SYN grade 1–3) at 11 divided sites on CE MR images, and (4) compartments (parapatellar, periligamenous, perimeniscal) MR-SYN grade (grade 1–3) and whole-knee MR-SYN grade (grade 1–4) by adding individual MR-SYN grade. For statistical analysis, the Spearman correlation test and weighted kappa (κ) values were used.

RESULTS

The CR-IPFP grade was strongly correlated with the MR-IPFP grade (p=0.906), and also with the whole-knee MR-SYN (p=0.740), suprapatellar MR-SYN (p=0.708), infrapatellar MR-SYN (p=0.726), and the parapatellar MR-SYN grades (p=0.718). The CR-IPFP grade was moderately correlated with MR-SYN grades of the other 9 sites and 2 compartments (p=0.502–0.687). The MR-IPFP grade was strongly correlated with the whole-knee MR-SYN (p=0.748) and the parapatellar MR-SYN grades (p=0.739). For CR-IPFP grade and MR-IPFP grade, interobserver reliability were 0.830 and 0.844, respectively. For MR-SYN grades of each site and whole-knee, interobserver reliability were 0.730–1.000 and 0.803, respectively.

CONCLUSION

CR-IPFP grade enabled reliable evaluation and reporting of the knee synovitis. Especially, both CR-IPFP and MR-IPFP grades were well correlated with the MR-SYN grade of the whole-knee and the parapatellar compartment.

Clinical Relevance/Application

Grading of IPFP opacity alteration on lateral knee radiograph is a potentially screening and an easy tool to evaluate the severity of knee synovitis.

SSQ12-05 Quantitative Assessment of Meniscal Degeneration with Ultrashort Echo Time-T2* and Standard T2 Mapping MRI

Thursday, Dec. 1 11:00AM - 11:10AM Room: E451A

Participants

Soo Yeon Choi, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Sang Hoon 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
Hye Won Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung Jin Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

Purpose

To evaluate the feasibility of standard T2 mapping and ultrashort echo time-T2 star (UTE-T2*) mapping to detect the meniscal degeneration of the knee.

Method and Materials

Standard T2 map and UTE-T2* map were acquired on two hundred eight menisci of ninety nine patients, medial or lateral meniscus after the routine MR sequences. UTE-T2* mapping images were acquired at seven echo times (TE=1.0, 2.5, 4.8, 7.2, 9.5, 11.8, 14.2ms) with TR=20.2ms. Standard T2 mapping images were acquired at 6 echo times (TE=13.0, 26.0, 39.0, 52.0, 65.0, 78.0ms) with TR=2600ms. Images were graded the meniscal degeneration according to the morphologic criteria on intermediate-weighted sequences. [Grade 0, normal, no abnormal hyperintensity within meniscus; Grade 1, small focal area of hyperintensity within meniscus; Grade 2, linear areas of hyperintensity without extension to articular surface; Grade 3, abnormal hyperintensity extending to the articular surface, indicated tear]. Regions of interest were manually drawn on each meniscus and abnormal hyperintensity portion within meniscus to calculated the mean T2* and T2 values.
RESULTS

Grade 0, 1, 2 and 3 were diagnosed in 50, 52, 50 and 56 menisci, respectively. Both mean T2 and T2* values of menisci were found to significantly differ between the all grades and tended to be higher in more severely degraded meniscus. (P <0.001 for both) The mean T2 values of the menisci were 10.76, 15.81, 20.26 and 30.80ms, and the mean UTE-T2* values of the menisci were 7.10, 9.64, 12.01 and 18.98ms for grade 0, 1, 2 and 3, respectively. Mean T2 and T2* values of hyperintensity portion within menisci (Grade 1-3) were significantly higher than the values of menisci (P <0.001 for both) and also increased with the grade of meniscal degeneration (P=0.002 between grade 1 and 2 in mean T2 value, others P <0.001). Mean T2 values of hyperintensity were 20.05, 24.39 and 39.92ms and mean UTE-T2* values of hyperintensity were 10.94, 13.67 and 22.36ms at T2* values for grade 1, 2 and 3, respectively.

CONCLUSION

Standard T2 mapping and UTE-T2* mapping are both sensitive to detect degenerative changes in meniscus and can be used to quantitatively characterize meniscus degeneration in patients.

CLINICAL RELEVANCE/APPLICATION

Standard T2 mapping and UTE-T2* mapping are novel tool for the detection and quantification of meniscal degeneration that may predict progression of meniscal degeneration and development of meniscal tear.

SSQ12-07 Association of MRI-Based Tibial Slope Measurements with Mucoid Degeneration of the Anterior Cruciate Ligament; A Case - Control Study

Thursday, Dec. 1 11:20AM - 11:30AM Room: E451A

Participants
Nima Hafezi Nejad, MD, MPH, Baltimore, MD (Presenter) Nothing to Disclose
Bashir Zikria, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Alex Johnson, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Yalda Siddiqui, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Robert M. Kwee, Heerlen, Netherlands (Abstract Co-Author) Nothing to Disclose
Shivani Ablawat, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
John N. Morelli, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Shadpour Memehr, MD, Baltimore, MD (Abstract Co-Author) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation;

PURPOSE

To investigate whether medial (MTS) and lateral tibial slope (LTS) measurements are associated with the presence of ACL mucoid degeneration (MD) independent of age, gender, BMI and Medial Tibiofemoral Compartment (MTFC) damage.

METHOD AND MATERIALS

Following IRB approval for this retrospective study, four musculoskeletal radiologists interpreted 471 consecutive knee MRI examinations obtained by consensus. ACL MD cases had intact ACL from origin to insertion, and MR pulse sequence with increased signal intensity and easily distinguishable bundles on fat-saturated Proton Density (PD) images (but not on PD images). A sample of 108 examinations including 36 knees with ACL MD and 72 age and gender matched controls with normal ACLs were included in the analysis.

Whole Organ MR Imaging Score (WORMS) was used to assess the severity of meniscal and cartilage damage (MTFC damage). Tibial slope measurements were done by defining the tibial proximal anatomic axis (TPAA). Tangent lines were drawn and the angles between the TPAA and the medial and lateral tibial plateaus were measured on fat saturated PD images, blinded to ACL MD determination. Analysis was performed using generalized estimating equations with stepwise adjustments.

RESULTS

Knees with ACL MD had significantly higher values of LTS, but not MTS measurements (7.20º (95%CI: 4.36–9.07) vs. 5.28º (2.72–7.89); P-value: 0.04). In the adjusted models, there was a significant linear association between MTS and LTS measurements and ACL MD. Every one degree higher, MTS and LTS values were associated with 3.4 % (0.2–6.5; P-value: 0.03) and 4.3 % (1.8–6.7; P-value<0.01) higher probability of having ACL MD, respectively.

CONCLUSION

We found a trend of linear association between the MTS and LTS with the presence of ACL mucoid degeneration (MD) independent of age, gender, BMI and Medial Tibiofemoral Compartment (MTFC) damage.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that similar to the known association between increased MTS and LTS measurements and ACL rupture, re-injury and graft failure, these increased measurements are also associated with the presence of ACL MD.
Purpose
To study association between non-traumatic lateral patellar instability and degenerative pathology of the posteromedial corner (PMC) of knee and to investigate if severity of the patellar instability correlates with medial meniscal extrusion.

Method and Materials
Retrospective review of 101 consecutive knee MRIs (age range 11-80 years; 66% female) with exclusion of traumatic knee injuries was performed. Patellar instability was evaluated using 8 parameters: Insall-Salvati ratio, patellar tilt, patellofemoral cartilage loss, patellar subluxation, patellofemoral cartilage loss, and superolateral Hoffa’s fat pad edema. Patellar instability was defined (and scored 0-8) by abnormality of these indices. PMC of the knee was evaluated for tear and/or degeneration of the medial meniscus, postero-medial capsule and muscular complex (semimembranosus and medial head of gastrocnemius). Medial meniscal extrusion was also quantified.

Results
The prevalence of patellar instability and PMC pathology was 78% (79/101) and 93% (94/101) respectively. 79% with patellofemoral cartilage degeneration had meniscal extrusion vs 43% with no degeneration (p<0.001). Also, cartilage degeneration was significantly associated (p<0.05) with tear/degeneration of medial head of gastrocnemius as well as that of the posterior capsule. Other patellar instability factors showed significant associations with PMC pathology: Abnormal patellar tilt and sulcus angle with meniscal tear/degeneration and abnormal patellofemoral index with semimembranosus degeneration were significant (p<0.05). Severity of patellar instability (0/8 to observed maximum 6/8) was significantly associated with prevalence of meniscal extrusion (p=0.001). The prevalence of extrusion for those with 0, 1-2 and 3-6 abnormalities was 33%, 64% and 79% respectively. Also, the degree of extrusion (in mm) significantly increased with increasing patellar instability; the mean (SD) was 0.6 (1.1), 1.1 (1.2), and 1.4 (1.2) for 0, 1-2, and 3-6 abnormalities (p=0.030).

Conclusion
Patellar instability is associated with PMC pathology and the severity of patellar instability can be a predictor of worsening medial meniscal extrusion.

Clinical Relevance/Application
The association between PMC pathology and patellar instability suggests a coup-countercoup mechanism. Hence pathology in PMC region should alert towards patellar instability and vice versa.

SSQ12-08 Spontaneous Osteonecrosis of the Knee (SONK): The Role of MR Imaging in Predicting Clinical Outcome

Thursday, Dec. 1 11:40AM - 11:50AM Room: E451A

Awards
Student Travel Stipend Award

Participants
Jared Nesbitt, MD, Stony Brook, NY (Presenter) Nothing to Disclose
Dharmesh Tank, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Marco A. Orulondo Verastegui, MD, Lima, Peru (Abstract Co-Author) Nothing to Disclose
Elaine S. Gould, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Mingqian Huang, MD, Syosset, NY (Abstract Co-Author) Nothing to Disclose

Purpose
To assess the potential associations between MR imaging patterns and findings in patients with diagnosis of subchondral fracture around the knee, formerly known as SONK, and their clinical outcome.

Method and Materials
We evaluated 43 knees of 37 patients (28 male, 15 female), who had diagnosis of subchondral fractures around the knee. The mean age is 56 years old (range 17-83). Musculoskeletal fellowship trained radiologists evaluated all 43 knee MRI for: 1) location of marrow edema; 2) periosseous edema; 3) subchondral fracture; 4) subchondral articular surface contour; 5) meniscal tear and extrusion; 6) adjacent soft tissue edema; 7) joint effusion. Independent clinical chart review was performed for clinical outcomes with follow up time average of 13.3 months (range 0 - 88 month). Poor outcome was defined as progression to articular surface collapse, continued complaints leading to surgical knee replacement or another episode of SONK. Chi-square analysis and Student’s t tests were conducted to test the statistical significance of association between MR findings and outcomes. Statistical significance were set at p=0.05 level.

Results
Of 43 knees, 6 patients had another episode of SONK (14%), 11 patients were not improving or needed injection vs arthroscopy (26%), 4 patients required arthroplasty (9%), 22 patients had no negative outcome (51%). Age (P=0.62), gender (P=0.84), diabetic status (P=0.73) and location of marrow edema (P=0.30) show no influence on outcome. The poor outcome group had a significantly higher average BMI (31.7 vs. 28.0, P=0.02). Positive change of subchondral articular surface contour was the only imaging finding in isolation associated with poor outcome (80% vs. 39.9%, P=0.02). The presence of multiple imaging findings of above 3), 4), 5) and 6) had a higher percentage of poor outcomes (77.8%) compared to those with less positive findings (47.2%).

Conclusion
MR imaging findings may help at identifying SONK patients with risk of developing unfavorable clinical outcomes.

Clinical Relevance/Application
There is potential of MR Imaging at helping prognosticate subchondral fractures around the knee. Careful and close follow up with more aggressive treatment can help certain group of patients to minimize their risk.

SSQ12-09 Imaging Features of iBalance, New High Tibial Osteotomy: What the Radiologist Needs to Know
PURPOSE
iBalance high tibial osteotomy, (iHTO, Arthrex Inc, Naples Florida), is a recently introduced surgical procedure for correction of knee genu varus malalignment. iHTO, utilizing a polyetheretherketone (PEEK) implant and osteoinductive compounds (OIC), presents challenging post operative radiographs which can easily be misinterpreted as infection. Our purpose is to report, based on review of 24 cases, the previously undescribed to the best of our knowledge, radiographic features of iHTO and its complications.

METHOD AND MATERIALS
Retrospective query of our digital database was performed to identify iHTO cases. The clinical and post-surgical images in all cases with > 1-month follow up imaging, were reviewed with attention to 1. Correction of varus malalignment, 2. Healing at the osteotomy site, 3. Changes in the OIC, and 4. Complications.

RESULTS
There were 24 iHTOs in 23 patients (17 men, 6 women, ages 21-59, mean 44, median 46), imaged 2 to 29 months post-surgery, with angle of correction, when available, ranging from 5-14 degrees. Immediate post-surgical correction of genu varum deformity was seen in 100% of patients. 100% depicted oval radiolucencies, at bone PEEK interface simulating erosions and infection. Four, often overlapping, signs of healing were noted: 1. Blurring of bony margins at the osteotomy site, noted within 2 weeks post surgery, 2. Blurring of sharp interface between OIC and host bone, 3. Anterior, posterior and less commonly medial bridging callus, 4. Resorption of OIC, noted as early as 4 months. Complications, seen in 8 cases (33%), included genu varum recurrence (n=2), painful exuberant bone formation, (n=1), persistent pain requiring knee arthroplasty, (n=1), and propagation of the osteotomy through the lateral tibial cortex (n=5). In patients with >6 months follow-up, nonunion and possible infection was seen in 1 patient.

CONCLUSION
iHTO typically depicts oval radioluencies at the PEEK bone interface not to be mistaken for infection. Familiarity with this features, as well as with other signs of healing, should aid the radiologist in accurate interpretation of post operative films of iHTO patients.

CLINICAL RELEVANCE/APPLICATION
Radiologists should be aware of potential complications and the normal radiographic appearance of healing after iHTO, which may mimic infection to the inexperienced reader.

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
Participants
John Cathcart, Newtownabbey, United Kingdom, (j.cathcart@ulster.ac.uk) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Introduce the concept of applying Imaging to non routine diagnostic applications. 2) Report on Pilot work on Multi planar MR on imaging the Ischial Tuberosity anatomical area whilst sitting. 3) Highlight why understanding this anatomical variation is of relevance in the development of cushions for wheelchair users.

ABSTRACT
Purpose
The purpose of this work was to determine the capability of seated magnetic resonance imaging to visualise anatomy around the ischial tuberosity involved in sitting. Clear visualisation of anatomy enabled understanding of the anatomical variation across normal and spinal cord injury subjects.

Methods
Multiplanar T1 weighted thin slice magnetic resonance imaging was carried out in 3 subjects with spinal cord injury and 4 people without spinal cord injuries, seated in a FONAR 0.6T system. The images were scored for anatomical visualisation, anatomical variation between subjects, and percentage of fat voxels within the gluteus maximus.

Results
Seated magnetic resonance imaging was able to visualise the majority of anatomy around the ischial tuberosity, however, there was significant anatomical variation between all subjects regardless of their spinal cord injury status. It was also shown that mechanical support for sitting is provided by a variety of soft tissues, including gluteus maximus, subcutaneous fat and skin, although the amount and type varied significantly.

Conclusion
Magnetic resonance imaging was shown to be capable of producing high resolution anatomical data of the anatomy involved in sitting. This data may be used to inform clinicians of pressure ulcer risk.

Handout: John Cathcart
MK340-SD-THA1

The Relationship between MRI and Histology in a Porcine Model of Intervertebral Disc Degeneration: A 24 week in Vivo Study

Station #1

Participants
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Moderator) Consultant, Toshiba Medical Systems Corporation; Research Grant, Arthrex, Inc; 

Sub-Events

PURPOSE
To investigate a slowly progressive, reproducible porcine model of disc degeneration, and the relationship between MRI and histology in the long-term progression of disc degeneration.

METHOD AND MATERIALS
The L4/L5 and L5/L6 intervertebral discs of lumber spine in miniature pigs with a weight of 10-15kg were punctured after anterior surgery, using 20-gauge sterile needles, 0.75 cm depth from annulus fibrosus to the middle of nucleus pulposus, controlled by the handmade stopper. Degeneration of the lumber discs was analyzed before surgery and at 4, 8, 12, and 24 weeks post-surgery by in vivo MRI and histological analysis.

RESULTS
Based on the histological grading system, the discs of two groups were all categorized as normal, moderately degenerated, and severely degenerated, and the histologic score of puncture discs was significantly correlated with the time post-stab. Meanwhile, MRI measurements showed a progressive decrease in T2 signal intensity and MRI index starting at 4 weeks post-puncture. Furthermore, the degenerated discs did not recover spontaneously, shown by decrease in T2 signal intensity and MRI index and histological analysis. The apparent relativity was found between the content of sulfated glycosaminoglycan and MRI measurements.

CONCLUSION
This study demonstrates that needle puncture into a lumber disc in the miniature pig induces a slow and progressive disc degeneration process without spontaneous recovery in 24 weeks. The apparent correlation was found among histological score, content of sulfated glycosaminoglycan and MRI measurements. In conclusion, MRI is a convenient, less invasive, and reproducible option to assess the progression of disc degeneration.

CLINICAL RELEVANCE/APPLICATION
To investigate a porcine model and the relationship between MRI and histology in the long-term progression for further in vivo study of disc degeneration.

MK341-SD-THA2

The MR Quantitative Research of the Vertebral Microvascular Permeability in Alloxan-induced Diabetic Rabbits

Station #2

Participants
Jianming Hua, MD, Hangzhou, China (Presenter) Nothing to Disclose

PURPOSE
To estimate the variation of the vertebral microvascular permeability in alloxan-induced diabetic rabbits using DCE-MRI.

METHOD AND MATERIALS
Twelve young New Zealand White rabbits were randomly assigned to alloxan-induced diabetic group (n=6) and control group (n=6). All rabbits underwent sagittal magnetic resonance imaging (DCE-MRI) of lumbar on a 3.0T scanner (GE Discovery 750 Plus) with an 8 channel knee coil at fixed time points (0, 4, 8, 12, 16 week). The contrast agent with a concentration of 0.2 mmol/kg was injected after one pre-contrast frame was acquired. L7 was chosen to measure DCE-MRI parameters. The Extended Tofts model was used to estimate the quantitative parameters including Ktrans, kep, ve, and vp. The AIF was determined from a circular ROI in the center of abdominal aorta at the plane of L7. At the week 16, all rabbits were sacrificed, after which L7 sampling, HE staining and immunoperoxidase CD31 labeling. To count microvessel density (MVD), a quantitative estimation was performed. Repetitive measure analysis of variance (ANOVA) was applied in analyzing DCE-MRI parameters at different time points. Pearson correlations of
RESULTS

DCE-MRI parameters with MVD were analyzed, respectively. All of the thresholds of statistical significance were set at $P<0.05$.

CONCLUSION

The results of this study demonstrated diabetes mellitus could cause the variation of the vertebral microvascular permeability.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI can evaluate quantitatively the variation trends of the vertebral microvascular permeability in alloxan-induced diabetic rabbits.

MK343-SD-THA4

Knee Arthroplasty in Knees with Early Osteoarthritis - MRI-Based Analysis from the Osteoarthritis Initiative

Station #4

Participants

Frank W. Roemer, MD, Boston, MA (Presenter) Chief Medical Officer, Boston Imaging Core Lab LLC; Research Director, Boston Imaging Core Lab LLC; Shareholder, Boston Imaging Core Lab LLC; ;
Kent C. Kwoh, MD, Pittsburgh, PA (Abstract Co-Author) Advisory Panel, Pfizer Inc Data Safety Monitoring Board, Novartis AG
Tomoko Fuji, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Michael Hannon, Oakland, PA (Abstract Co-Author) Nothing to Disclose
Robert Boudreau, PhD, Pittsburgh, PA (Abstract Co-Author) 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

PURPOSE

Knee replacement (KR) is commonly considered the therapy of choice in advanced osteoarthritis (OA) with severe symptoms. However, the proportion of knees that underwent KR from the 12 month visit through the 48 month visit in the Osteoarthritis Initiative (OAI) with no or only mild radiographic disease at baseline (BL) is high (~30%). Aims are to assess 1.) whether structural damage seen on MRI that is potentially associated with pain differed at BL and the time point prior to reported KR (“T0”) between those with mild OA and those with severe OA and 2.) whether change in pain levels from BL to T0 differed between those with mild OA vs. severe OA.

METHOD AND MATERIALS

Participants who underwent KR were drawn from the OAI, a longitudinal observational study that includes 4,796 participants with or at risk of knee OA. MRIs were assessed for bone marrow lesions (BMLs), Hoffa-synovitis, and effusion-synovitis at BL and T0. Logistic regression was used to compare number of subregions affected by any BMLs per compartment, and presence of any Hoffa-synovitis and effusion-synovitis at BL and T0. MVD showed negative correlation with Tkrans and kep and positive correlation with ve and vp (Ktrans: $r=-0.901$, $P<0.05$; kep: $r=-0.731$, $P<0.05$; ve: $r=0.741$, $P<0.05$; vp: $r=0.593$, $P<0.05$).

RESULTS

Of 181 knees that underwent KR during the 4 years of observation, 130 knees had severe OA while 51 knees had mild OA at BL. Compared to those with severe OA at BL, mild OA knees that later underwent KR were more strongly associated with presence of BMLs in two or more subregions in the PFJ (crude OR 9.44 95%CI [3.45,18.16]) but not the TFJ. Similar findings were observed for the time point prior to KR, with mild OA being associated with two or more subregions with BMLs in the PFJ (crude OR 9.44 95%CI [4.00, 22.28]) but not in the TFJ. Mild OA knees showed an increased odds for change from “no pain” to “pain presence” from BL to T0 (aOR 5.48, 95%CI [1.25, 24.00]) for “pain within the last 12 months”.

CONCLUSION

BMLs in the PFJ were more often seen among knees that had mild OA at baseline. Worsening pain status seems to contribute to KR during a time frame of 4 years particularly in knees with mild OA at BL.

CLINICAL RELEVANCE/APPLICATION

The findings support the role of structural damage in the PFJ in the decision for KR. Worsening pain is an important predictor of KR despite only mild structural radiographic changes.

MK344-SD-THA5

Effect of Autologous Stem Cell Transplant on Bone Mineral Density and Bone Strength in Patients with Multiple Myeloma
PURPOSE
An increase in effective therapies including autologous stem cell transplantation (ASCT) for patients with multiple myeloma (MM) has led to an improvements in overall survival. Osteoporosis and osteoporotic fractures are long-term complications of allogeneic SCT. This study evaluated the overall bone quality and bone strength after ASCT in MM patients using multidetector computed tomography (CT).

METHOD AND MATERIALS
Spinal microarchitecture was examined by 64-detector CT and quantitative data (SUVmax) of 18F-fluorodeoxyglucose uptake of PET/CT were obtained in 72 MM patients who were classified into the following 3 groups: patients with newly diagnosed MM (control, n = 18); patients who received bortezomib-based regimen (BD, n = 35); and patients who underwent ASCT with bortezomib-based regimen (n = 19). Using a 3-dimensional image analysis system and finite element modeling (FEM), the bone mineral content per tissue volume (tissue BMD), trabecular parameters, failure load, and SUVmax of the third lumbar vertebrae without any focal lesion were calculated. The trabecular parameters and SUVmax were compared among the three groups using the Kruskal-Wallis test.

RESULTS
No significant differences were seen in trabecular indices, failure load, or SUVmax among the 3 groups. Tissue BMD was significantly higher in the BD group than in the control group (P < 0.05).

CONCLUSION
Multidetector CT demonstrated that bone strength and bone mass were not significantly reduced in patients who underwent ASCT compared with the BD group. Patients after chemotherapy with BD showed significantly higher BMD than in control patients.

CLINICAL RELEVANCE/APPLICATION
Myeloma patients who had undergone ASCT were not found to have less BMD compared to patients after standard chemotherapy. Osteoporosis does not appear to be a long-term complications of ASCT.

MK3455-S5D-THA6
The Effect of Sonication Duration on Ablation Size in MR Guided Focused Ultrasound (MRgFUS) Ablation of Bone

PURPOSE
One challenge in MRgFUS ablation of bone tumors is extending the depth of ablation beyond the cortical surface, which rapidly attenuates sound. Anecdotally, providers will lower ultrasound frequency or increase sonication duration, in order to achieve better penetration. The purpose of this study was to evaluate the effect of longer versus shorter sonication durations on the size of the post-ablation appearance in a swine model of MR guided focused ultrasound ablation of bone, for a given total energy.

METHOD AND MATERIALS
Experimental procedures received approval from the institutional committee on animal research. MRgFUS was used to create two ablation foci (distal and proximal) in the left femoral diaphysis of 6 pigs. The spacing of sonications was equivalent between the two foci. Both targets were subjected to six sonications with 400 J of energy each: the distal targets were dosed with 20 W for 20 seconds (standard time) and the proximal targets were dosed with 10 W for 40 seconds (long duration). The hypoenhanced ablation zone was then measured on post-contrast MRI sequences in three dimensions.

RESULTS
MRgFUS created focal hypoenhanced lesions at the distal and proximal targets. Interestingly, the use of the conventional 20 second duration sonication resulted in the largest depth of the transverse intramedullary hypoenhanced zone and the craniocaudal dimension of the ablations, which on average measured 7.3 mm and 26.7 mm, respectively. By comparison, the mean ablation measurements for the 40 second long duration sonication group were 4.5 mm and 21.0 mm: these differences reached statistical significance (paired t-test, p = 0.026 and 0.006). There was no significant difference in the anteroposterior measurements between the two groups.

CONCLUSION
While different techniques can and should be used to maximize the size of the ablation zone in MRgFUS of bone lesions, these results suggest that increasing the sonication duration, while concomitantly decreasing the acoustic power to maintain a given...
total energy, is not an effective technique and may be counterproductive.

**CLINICAL RELEVANCE/APPLICATION**

These results can be used to help clinicians perform more complete MRgFUS ablations of bone lesions. They suggest that in order to maximize bone ablation size, if sonication duration is extended, then acoustic power should be either maintained, or decreased only partially, for a net increase in the total amount of energy delivered.

**MK130-ED-THA7**  
**Metal Artefact Reduction Using Standard Sequences in MRI: Our Experience with Hip Prostheses**

Participants  
Jaime Isem, MD, Barcelona, Spain (Presenter) Nothing to Disclose  
Ferran Pifarre, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose  
Alexandras Banguero, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose  
Nuria Mayolas Sr, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose  
Cristobal Segura, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose  
inmaculada ormazabal, barcelona, Spain (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

1. To expose the method of reducing metal artifacts with standard sequences in 1.5 MRI.  
2. To describe the utility of each sequence: T1 SE, DP y T2 TSE y STIR.  
3. To assess the importance of intravenous contrast administration for an appropriate diagnosis of complications.  
4. To demonstrate the difficulty of reducing artifacts dependent on the type of prosthesis.  
5. To show the expected range of normal and pathological findings following hip arthroplasty.

**TABLE OF CONTENTS/OUTLINE**

- MR Imaging around Metal Hip Prostheses.  
  - Method to reduce metal artifacts with standard sequences.  
  - Pathological findings following hip arthroplasty.  
  - Importance of intravenous contrast administration.

**MK190-ED-THA8**  
**Why do Nerves Bright on DWI and Other FAQ about Functional MR-Neurography for Beginners**

Participants  
Teodoro Martin, MD, Jaen, Spain (Presenter) Nothing to Disclose  
Antonio Luna SR, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose  
Marta Gomez Cabrera, MD, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

Describe the physiological aspects of functional MR-Neurography (MR-N) studies from peripheral nerve structure and basic DWI sequence design to more complex MRI-DTI based techniques. Explain, using a similar frequently asked questions (FAQ) guide, the main concepts to understand, perform and approach to a functional MR-N study. Show the utility of functional MR-Neurography in different clinical scenarios.

**TABLE OF CONTENTS/OUTLINE**

- Introduction: Physical basis of DWI and DTI focused in peripheral nerve evaluation.  
  - FAQ guide about functional MR-N for beginners.  
    - Why do nerves bright on DWI?  
    - How it influences the structure of the nerves for a DTI based approach?  
    - What is the biological meaning of ADC, FA or other derived parameters? Can they be considered as neural biomarkers?  
    - 1.5T or 3T magnet?  
    - DWI or DTI approach?  
    - When do I have to perform a functional MR-N study?  
    - Is necessary to integrate functional MR-N in routine protocols?  
    - How it should be read a functional MR-N study?  
    - Clinical applications of functional MR-N evaluation.  
      - Brachial and lumbosacral plexus.  
      - Carpal tunnel syndrome.  
      - Sciatic nerve assessment.  
      - Tumor and tumor-like conditions.  
      - Other neuropathies.

**MK239-ED-THA9**  
**Pain in the Neck: Postoperative Appearance of the Cervical Spine**

Participants  
Philip K. Wong, MD, Atlanta, GA (Presenter) Nothing to Disclose  
Matthew L. Unell, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose  
Steven Prescutti, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose  
Douglas D. Robertson, MD, PhD, Decatur, GA (Abstract Co-Author) Nothing to Disclose  
Monica B. Umpierrez, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose  
Walter A. Carpenter, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose  
Adam D. Singer, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

Teaching Points:  
1. Radiologists should be familiar with the various surgical techniques when interpreting post-operative imaging of the cervical spine.  
2. Factors such as number of stenotic levels, sagittal alignment of the spine, degree of existing motion, and medical comorbidities impact the optimal surgical approach.  
3. Postoperative complications can be divided into early and late complications.  
4. Early instrumentation-related complication such as instrument malpositioning can lead to major neurovascular and soft tissue related injuries.  
5. Long term sequelae of fusion surgery often affects the adjacent nonfused levels.  
6. Infection can even manifest in the late post-operative period.

**TABLE OF CONTENTS/OUTLINE**

- Overview of cervical spine postoperative imaging modalities.  
- Review common indications for cervical spine surgery in the.
1. Overview of cervical spine anatomy on different imaging modalities.
2. Review common indications for cervical spine surgery in the non-traumatic setting.
3. Discuss and illustrate imaging features of common cervical spinal surgical techniques and hardware in the non-traumatic setting.
4. Present examples of postoperative complications and their imaging appearance.
Quantification of Fat Contents in Vertebral Marrow using Modified DIXON Sequence to Differentiate Benign from Malignant Processes

PURPOSE
To determine whether fat-signal fraction (FF) map using modified DIXON (mDIXON) sequence could help differentiate benign from malignant bone lesions.

METHOD AND MATERIALS
Spine MRI of 134 consecutive patients were studied by using 3.0 T MR scanner with standard T1-weighted (T1WI) and 3D gradient-echo sequence with flexible echoes and T2* correction (mDIXON) sequences. Control group consisted of 51 normal vertebrae. Benign group consisted of 40 benign focal bone lesions including endplate degenerations, Schmorl nodes, focal red-marrow depositions, and benign fractures. Malignant group consisted of 29 spinal malignancies. Three parameters were measured on T1WI and automatically reconstructed FF map images by two radiologists independently: T1 signal intensity (SI), T1 SI of normal disc (SId), and FF. The Lesion-to-Disc ratio (LDR) was calculated by dividing SI of the lesion to SId. The FF ratio was obtained by dividing FF of the lesion to FF of the normal marrow. The mean values of parameters were compared among the groups. Diagnostic performance of the parameters was analyzed by ROC analysis. A binary logistic regression method was used to determine the best predictors of differential diagnosis between malignancy and benign focal lesions.

RESULTS
FF (2.8%) and FF ratio (0.082) of malignancy were lower than other benign focal lesions (P<0.001, both). There was no difference of LDR between malignancy (0.87) and Schmorl node (0.87, P = 0.795), or benign fracture (0.90, P = 0.866). The areas under ROC curves of FF and FF ratio were 93% and 87%, which were higher than that of other parameters for differentiation between malignancy and benign lesions (P <0.001). In binary logistic regression analysis, FF remained significant variable that could be used to independently differentiate benign from malignant lesions, with odds ratio of 1.9.

CONCLUSION
FF and FF ratio obtained from automatically reconstructed FF map using mDIXON sequence could be used to allow distinction between benign and malignant causes of focal bone marrow abnormalities.

Magnetic Resonance Imaging for the Diagnosis of Knee Pathology: A Comparison of Academic and Community Centers

PURPOSE
Determining the best use of magnetic resonance imaging (MRI) for the evaluation of intra-articular knee pathology requires understanding of factors determining its effectiveness. Factors impacting diagnostic quality may include subspecialty expertise of the radiologist. Academic radiologists (AR) tend to be musculoskeletal fellowship trained and read in their specialty. The converse tends to be true for community radiologists (CR). The goal of this study was to examine the diagnostic MRI sensitivity and specificity of AR and CR for various intra-articular knee pathologies.
METHOD AND MATERIALS
Over a six year period of April 2008 to May 2014, the records of 535 consecutive patients who underwent diagnostic arthroscopy for intra-articular knee pathology were retrospectively reviewed. MRI reports were generated by either AR at a single institution with subspecialty expertise in MSK radiology or by general CR. Diagnostic parameters, including sensitivity and specificity, were determined for MRI reports utilizing a standard comparative grading scale and arthroscopic findings as the gold standard. Only MRI’s performed at 1.5T or less were included to eliminate field strength bias at academic centers.

RESULTS
64.2% (343) of the MRIs were performed at the academic institution while 35.8% (192) were done in the community. For the diagnosis of anterior cruciate ligament (ACL) rupture, AR had better sensitivity compared to CR (91% vs 81% p=0.0072), as well as higher specificity (99% vs 94%), though this difference only approached significance (P=0.054). AR achieved slightly higher sensitivity (89% vs 84%) and specificity (86% vs 75%) than CR for medial meniscus, though these differences only approached significance, p=.0987 and p=.0678, respectively.

CONCLUSION
The utilization of radiologists with subspecialty expertise in MSK radiology was associated with better MRI diagnosis of ACL and medial meniscal pathology. The preoperative MRI diagnosis of cartilage injury demonstrated similar outcomes for both academic and community radiologists.

CLINICAL RELEVANCE/APPLICATION
Academic radiology centers have improved diagnostic sensitivity and specificity compared to community radiology centers when diagnosing ACL injuries with MRI.

PURPOSE
To evaluate the mechanism of acute posterior cruciate ligament (PCL) injuries and associated soft tissue injuries in the knee.

METHOD AND MATERIALS
Our study was HIPAA compliant and IRB-approved. We performed a retrospective review of 75 acute PCL injuries with knee MRIs at our institution (36 ± 16 (range 15-74) years, 20 F, 55 M). All cases were reviewed by two independent musculoskeletal radiologists. Specifically, PCL, anterior cruciate ligament (ACL), medial and lateral menisci, extensor mechanism, medial and lateral collateral ligament, posterolateral corner, posterior joint capsule, popliteus, biceps femoris, gastrocnemius muscles, semimembranosus/posterior oblique ligament, patellar retinacula, osseous contusions/fractures, and acute cartilage defects were evaluated. The mechanism of injury was determined based on the pattern of soft tissue and osseous injury. Interobserver agreement on incidence of injury to each structure was assessed by calculating a Kappa coefficient (κ) for each structure.

RESULTS
κ ranged from 0.85 to 1.0, showing almost perfect agreement for all structures. The most common concurrently injured structures were: posterior capsule (66/75, 88%), ACL (47/75, 63%), and posterolateral corner (46/75, 61%). Posterolateral corner injuries occurred most commonly where the mechanism of injury was dislocation (11/12, 92%) and varus hyperextension (11/13, 85%). Medial (31/75, 41%) and lateral (36/75, 48%) collateral ligament tears occurred with similar frequency. Medial meniscal injuries (26/75, 35%) were more common than lateral meniscal injuries (8/75, 11%). Thigh and leg muscle injuries were common, ranging from 28-37%. Of note, semimembranosus injuries occurred in 31% (23/75), particularly in dislocations (8/12, 67%). Tibial and femoral fractures or contusions occurred in 73% (55/75) and 68% (51/75) of cases. The mechanisms of injury of the PCL cases were hyperextension only (21/75, 28%), valgus hyperextension (14/75, 21%), pivot shift (13/75, 17%), varus hyperextension (13/75, 17%), and dislocation (12/75, 16%).

CONCLUSION
Concomitant ligament and muscle injuries with PCL injury are common, particularly of the posterior capsule, ACL, and posterolateral corner.

CLINICAL RELEVANCE/APPLICATION
High suspicion for ACL tear, posterior capsule tear, and posterolateral corner injury should be maintained if an acute PCL tear is identified, especially as the presence of these injuries could affect management.

Morphometric and Volumetric Evaluation of Posterior Cruciate Ligament and Femoral Intercondylar Notch in Subjects with Suspected Anterior Cruciate Ligament Tears: A Comparative Flexed-Knee MRI Study

Participants
Atul K. Taneja, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Frederico C. Miranda, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo P. Prado, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marco K. Demange, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
PURPOSE
To determine the effect of posterior cruciate ligament (PCL) and femoral intercondylar notch (IN) dimensions in anterior cruciate ligament (ACL) tears.

METHOD AND MATERIALS
We conducted a prospective, IRB-approved, case-controlled MRI study including subjects between 14-50 years with non-contact knee injuries and suspected ACL tear. Exclusion criteria were previous surgery, findings of PCL tear, arthritis, tumors, infections or inflammatory conditions. All participants underwent a flexed-knee 3D-sequence, aiming to uniformly straighten PCL. MR images were reviewed independently by two musculoskeletal radiologists, and assessed for the following measurements: bi-condylar length; IN angle, depth, width and cross-sectional area; PCL width, thickness and cross-sectional area. Volumetry of IN and PCL was computed after manual segmentation. Subjects were divided into cases and controls (ACL tear vs. normal) and statistical analyses evaluated for inter-observer agreement, differences between groups and odds-ratio. Significance was considered for P<0.05.

RESULTS
The study comprised 64 subjects (30 cases vs. 34 controls), being the majority male with left knee injured. There was no significant difference between groups regarding age, weight, height or BMI. Agreement between readers ranged from strong to almost perfect (ICC=0.72-0.99). Subjects with ACL tear presented lower IN width (mean, 18.31 vs. 19.56 mm, P=0.03; OR=0.80), lower IN minus PCL widths (6.44 vs. 7.78 mm, P=0.01; OR=0.67), higher PCL/IN widths proportion (64.9% vs 60.5%, P=0.03; OR=1.08), higher PCL thickness (6.00 vs. 5.36 mm, P=0.04; OR=1.54), lower IN depth minus PCL thickness (19.74 vs. 21.48 mm, P=0.01; OR=0.77), and higher PCL thickness/IN depth proportion (23.3% vs 20.2%, P=0.03; OR=1.15). Moreover, higher PCL volumes (1.14 vs. 1.00 cm3, P=0.01; OR=12.18) and PCL/IN volumes proportion (25.3% vs 21.3%, P<0.001; OR=1.25) were also found in tear group.

CONCLUSION
Our study shows that subjects with ACL tears present larger PCL dimensions and decreased IN width when compared to subjects without tears. These findings, either isolated or combined, might be considered as risk factors for ACL tears.

CLINICAL RELEVANCE/APPLICATION
Prospective case-controlled MRI study with morphometric and volumetric evaluation demonstrates that posterior cruciate ligament and femoral intercondylar notch dimensions act as risk factors for anterior cruciate ligament tears, either isolated or combined.

Analysis of Nondiagnostic Image-guided Needle Biopsies of Musculoskeletal Lesions

PURPOSE
The diagnostic yield of repeat image-guided biopsy for initially non-diagnostic biopsy of musculoskeletal lesions has not been well evaluated in the scientific literature. This study assesses the diagnostic yield of repeat percutaneous CT-guided biopsy (CTB) of musculoskeletal lesions in the setting of initially non-diagnostic CTB, and evaluates factors that impact the success rate of repeat CTB.

METHOD AND MATERIALS
This study received IRB approval. A retrospective review of patients who underwent one or more repeat percutaneous CTB of MSK lesions over a 10-year period was performed utilizing PACS search. Thirty two patients were further analyzed. A successful repeat CTB was defined as a repeat CTB that yielded pathologic diagnosis following an initially non-diagnostic CTB. Pre-procedural diagnostic images, intra-procedural images, procedure notes, and pathology reports were reviewed. Core samples size, number of samples, patient positioning, and targeting of the lesion based on imaging review were analyzed for inter-observer agreement, differences between groups and odds-ratio. Significance was considered for P<0.05.

RESULTS
Repeat CTB was successful in 22/32 patients. Most common results on repeat CTB were tumor (benign or malignant) in 55% of cases (12/22) and osteomyelitis in 14% of cases [RN1] (3/22). 41% of the successful repeat biopsies utilized more core samples (9/22), and 27% utilized larger cores (6/22).

CONCLUSION
Increase in number of diagnostic core samples had highest impact in success rate of repeat biopsies of initially non-diagnostic biopsies of percutaneous CTB of musculoskeletal lesions. This was followed by larger core sample size.

CLINICAL RELEVANCE/APPLICATION
Knowledge of factors that contribute to higher success rate in repeat biopsy following initially non-diagnostic sampling of MSK lesions may improve diagnostic yield.
PURPOSE

To compare ultrasound (US) and MRI contrast-enhancement (CE) patterns in the diagnosis of soft tissue masses and to evaluate their respective diagnostic utility.

METHOD AND MATERIALS

255 patients with a histologically verified soft tissue mass (STM) were included in this retrospective study; 75.3% had undergone CE US, 82.7% CE MRI and 58.0% both prior to histological confirmation. Interrater and interest correlations were calculated and diagnostic properties of each of the four predefined CE patterns were assessed through Fisher's exact test (sensitivity, specificity, positive [PPV] and negative predictive value [NPV], likelihood ratios [LR]). Finally, a logistic regression analysis was performed to determine the correlation final diagnosis and CE pattern, lesion size, age and gender. Furthermore, the influence of size on the occurrence of inhomogeneous CE patterns in malignancies was determined.

RESULTS

Homogeneous CE patterns both in US and MRI were highly specific for benign lesions, while inhomogeneous CE was moderately specific for malignancy. A combination of CE patterns predicted malignancy with 88.3%/88.7% sensitivity, 66.7%/59.7% specificity, 73.4%/68.2% correct classification rates, 54.6%/47.8% PPV, 92.6%/92.7% NPV, 2.65/2.20 positive LR and 0.18/0.19 negative LR for CEUS and CE MRI, respectively. Cases with at least one modality demonstrating homogeneous CE were also predominantly benign/intermediate. An increase in lesion size correlated with a higher likelihood of inhomogeneous CE in malignancies.

CONCLUSION

CE patterns offer important clues on the differentiation of a newly diagnosed STM. CEUS and CE MRI may reveal complementary tissue characteristics and should therefore be routinely used as an adjunct.

CLINICAL RELEVANCE/APPLICATION

Incorporation of complementary US and MRI contrast-enhanced examinations into a diagnostic algorithm can improve diagnostic performance in soft tissue tumors.

MK195-ED-THB8 Acetabular Labral Tears: When to Call it

TABLE OF CONTENTS/OUTLINE

1. Acetabular labrum overview:
   - Histology
   - Anatomy
   - Morphology
   - Signal variability
   - Clock face and Quadrant orientation
2. MRA criteria for acetabular labral tears.
3. Types of acetabular labral tears:
   - Fraying
   - Intralabrum
   - Partial thickness
   - Complex tear
   - Full thickness through labrum
   - Full thickness-detachment from bone
4. MRA classification of acetabular labral tears.
5. Arthroscopic classification of acetabular labral tears.
6. Etiologies of acetabular labral tears:
   - Femoroacetabular impingement
   - Hip dysplasia
   - Iliopsoas Impingement

TEACHING POINTS

The purpose of this exhibit:
1. To review acetabular labrum histology, anatomy and morphology as well as anatomic variants that can be misdiagnosed as tears on Magnetic Resonance Arthrography (MRA) of the hip.
2. To learn acetabular labral tears etiologies, arthroscopic (Lage) and MRA classifications (Czerny and Blankenbaker).
3. To discuss conservative and surgical management of acetabular labral tears as well as MRA evaluation of postoperative acetabular labrum.
MK241-ED-THB9

Tendon Pathology on MRI: Pulling it all Together

Station #9

Awards
Cum Laude

Participants
Katryana M. Hanley-Knutson, MD, Winston Salem, NC (Presenter) Nothing to Disclose
Pavani Thotakura, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Scott D. Wuertz, MD, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Teaching Points
Review the normal anatomy, biomechanics, and MRI appearance of tendons. Present an approach to tendon pathology based on signal characteristics, size, shape, and location. Use this approach to review case examples of typical tendon pathology.

TABLE OF CONTENTS/OUTLINE

Normal Tendons
Anatomy
Biomechanics
MRI Appearance
Signal characteristics
Size, shape, and location
Normal causes of increased signal intensity
Magic-angle phenomenon
Entheses

MRI of Tendon Pathology
Tendon degeneration
Tendon tears
Causes of tendon tears
Partial Complete Tendon avulsions
Tenosynovitis
Causes of tenosynovitis
Stenosing tenosynovitis
Inflammatory/Infiltrative Process
Terminology - paratendinitis, paratenonitis
Calcific tendinosis
Other - xanthoma, gout, rheumatoid
Tumor - giant cell tumor of tendon sheath
Abnormal tendon location and/or movement
Subluxation/Dislocation
Entrapment
Intersection syndrome
RC704

**Musculoskeletal Pain Management Injections**

Thursday, Dec. 1 4:30PM - 6:00PM Room: S406B

<table>
<thead>
<tr>
<th>MK</th>
<th>CT</th>
<th>IR</th>
<th>MR</th>
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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

**Participants**
William E. Palmer, MD, Boston, MA *(Director)* Nothing to Disclose

**LEARNING OBJECTIVES**

Sub-Events

**RC704A**  **Steroids and Anesthetics: Pick Your Poison**

Participants
Peter J. MacMahon, MD, Dublin 7, Ireland, (pmacmahon@mater.ie) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the commonest corticosteroid preparations. 2) Examine the adverse effects associated with corticosteroids, highlighting severe neurological complications. 3) Appraise the various excipients (e.g. benzyl alcohol) used in corticosteroid formulations. 4) Assess the adverse effects associated with local anesthetics. 5) Explain the recent warnings and consensus statements relevant to spine injections.

**ABSTRACT**

**RC704B**  **Non-Spine Injections: Ultrasound Versus Fluoroscopy**

Participants
Theodore T. Miller, MD, New York, NY *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) The learner will be able to describe the advantages and disadvantages of ultrasound guided and fluoroscopically guided injections.

**RC704C**  **MR Spine: Intervention Correlation**

Participants
William E. Palmer, MD, Boston, MA *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Correlation of clinical symptoms with MR findings helps to differentiate active pain generators from nonpainful structural abnormalities. 2) Corticosteroid treatment success depends on whether symptoms result from inflammation, inflammation is reversible and drug reaches the inflamed tissue. 3) In the U.S., corticosteroid injection represents off-label usage because the FDA has not approved corticosteroids for epidural injection.

**RC704D**  **Spine Injections: Fluoroscopic Guidance**

Participants
Humberto G. Rosas, MD, Madison, WI *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the advantages and disadvantages of fluoroscopically versus CT guided spine injections. 2) Describe practices that minimize radiation dose in physicians and patients during imaging-guided interventions.

**RC704E**  **Spine Injections: CT Guidance**

Participants
Nicolas Amoretti, MD, Nice, France, (amorettinicolas@yahoo.fr) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Evaluate the usefulness of CT scan guidance, in applying existing infiltrations techniques to some innovative indications, allowed by the use of such an imaging guiding tool. 2) Evaluate the clinical effectiveness of these novel indications. 3) Emphasize on the importance of the clinical aspects of Interventional pain management. 4) Show that CT guidance is an added value to any procedures as it allows safe, precise, reproducible, accurate and effective needle placement in most procedures

**ABSTRACT**

**RC704F**  **Panel Discussion**
Participants
William E. Palmer, MD, Boston, MA (Presenter) Nothing to Disclose
RC708

Imaging of the Extremities (An Interactive Session)

Thursday, Dec. 1 4:30PM - 6:00PM Room: E350

MK ER

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

Participants

Sub-Events

RC708A  Shoulder

Participants
Manickam Kumaravel, MD, FRCR, Houston, TX, (manickam.kumaravel@uth.tmc.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize subtle injuries of the glenohumeral joint, acromioclavicular joint complex, coracoid, scapula and other less recognized injuries around the shoulder. 2) Understand the pathophysiology of shoulder injuries. 3) Learn to use cross-sectional imaging to better evaluate for clinically pertinent injuries. 4) Identify postoperative hardware in treated shoulder injuries. 5) Correlate the clinical significance of various types of injuries around the shoulder, so as to produce reports which will be relevant to the referring clinician.

ABSTRACT

Injuries to the shoulder may result from a variety of mechanisms; however, they are often subtle and difficult to recognize. The glenohumeral joint, acromioclavicular joint, coracoid, and scapula are commonly injured in shoulder trauma. Cross-sectional imaging is an essential tool in the evaluation of these injuries.

RC708B  Pelvis

Participants
Ken F. Linnau, MD, MS, Seattle, WA, (klinnau@uw.edu) (Presenter) Royalties, Cambridge University Press; Speaker, Siemens AG

LEARNING OBJECTIVES
1) Identify pelvic ring disruptions and acetabular fractures. 2) Examine emergency department radiographs and CT scans of the pelvis to detect and describe PRD and acetabular fractures. 3) Differentiate PRD associated with a high risk of major pelvic hemorrhage from less severe injuries in order to aide in efficient clinical decision making and patient triage to angiography. 4) Describe acetabular fractures in a way that allows efficient communication with consultants and aid in clinical decision making for treatment.

ABSTRACT

Injuries to the pelvic ring (pelvic ring disruption, PRD) and acetabulum are relatively uncommon. Accordingly, such injuries are often treated at tertiary care centers by highly specialized providers. On the other hand, such injuries are often detected on trauma bay radiographs in the Emergency Department. PRD and acetabular fractures tend to be complex and associated with substantial morbidity and mortality. Pelvic radiographs are common initial studies for detection of PRD and acetabular fractures, but tend to be insufficient for full characterization of them. As a result CT scanning is often performed to aid in treatment decision making and operative planning. The purpose of this interactive presentation is to highlight specific clinical features and settings of such injuries which mandate expedited clinical decision making while the patient is still in the emergency room.

Active Handout: Ken Floris Linnau

RC708C  Ankle/Foot

Participants
Claire K. Sandstrom, MD, Seattle, WA, (cks13@uw.edu) (Presenter) Royalties, Cambridge University Press; Speaker, Siemens AG

LEARNING OBJECTIVES
1) Detect common clinically significant imaging abnormalities encountered in the foot and ankle in the emergency setting. 2) Detect subtle imaging abnormalities seen in the foot and ankle in the emergency setting. 3) Recommend appropriate follow up for various findings in the foot and ankle in the emergency setting.

ABSTRACT

Injuries to the foot and ankle may result from a variety of mechanisms; however, they are often subtle and difficult to recognize. Cross-sectional imaging is an essential tool in the evaluation of these injuries.

RC708D  Hand/Wrist

Participants
Jonathan A. Flug, MD, MBA, Denver, CO, (jonathan.flug@ucdenver.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Detect imaging abnormalities commonly seen in the hand and wrist in the emergency setting. 2) Identify commonly encountered hand and wrist pathology in the emergency setting. 3) Recommend appropriate follow up for various findings in the hand and wrist in the emergency setting.

ABSTRACT

Injuries to the hand and wrist may result from a variety of mechanisms; however, they are often subtle and difficult to recognize. Cross-sectional imaging is an essential tool in the evaluation of these injuries.
Radiologists routinely encounter imaging of the hand and wrist in both the general and subspecialty radiology settings. Appropriate recognition of various types of injuries and pathology are crucial for accurate diagnosis and optimal patient care. This lecture will review the various types of pathology the radiologist may encounter in the hand and wrist with an explanation of injury mechanism and appropriate follow up care.
Participants

Sub-Events

RC718A  **Pulmonary Complications**

Participants
Michelle S. Ginsberg, MD, New York, NY, (ginsberm@mskcc.org ) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) To recognize complications in the postoperative thoracic patient in both immediate and late periods. In the immediate period this will include lobar collapse, hemorrhage, pulmonary edema, pneumonia, as well as rarer complications such as bronchopleural fistula, chylothorax and lung torsion. In the later period it is important to follow these patients and to recognize and distinguishing recurrent tumor from treatment changes and new primary tumors.

**ABSTRACT**

RC718B  **GI Complications**

Participants
Nina Tunariu, MD, Sutton, United Kingdom, (nina.tunariu@icr.ac.uk ) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be familiar with classification of novel targeted and standard anticancer drugs. 2) Able to identify GI toxicity imaging appearances by understanding the mechanisms of action of the chemotherapeutic agents. 3) Be aware that toxicities can be asymptomatic and that radiologists are instrumental in identifying and reporting early manifestations of toxicities. 4) Describe the imaging appearance of GI complications of anti-cancer therapy. 5) Differentiate between post-therapeutic changes and disease progression.

**ABSTRACT**

RC718C  **Musculoskeletal Complications**

Participants
Hassan Douis, MRCP, FRCR, Birmingham, United Kingdom *(Presenter)* Spouse, Grant, Eisai Co, Ltd; Spouse, Grant, Pharma Mar SA

**LEARNING OBJECTIVES**

1) To describe common chemotherapy-induced, radiation-therapy induced and surgical complications of the musculoskeletal system2) To recognize early and late musculoskeletal complications of oncological treatment3) To describe the imaging features of common musculoskeletal complications of oncological treatment

**ABSTRACT**
Participants
Ehsan Samei, PhD, Durham, NC (Coordinator) Research Grant, General Electric Company; Research Grant, Siemens AG
Norbert J. Pelc, ScD, Stanford, CA (Coordinator) Research support, General Electric Company; Research support, Koninklijke Philips NV; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Medical Advisory Board, OurCrowd, LP;

Sub-Events

RC721A    Breast

Participants
John M. Boone, PhD, Sacramento, CA (Presenter) Research Grant, Siemens AG; Royalties, Wolters Kluwer nv;

RC721B    MSK

Participants
Wojciech Zbijewski, PhD, Baltimore, MD, (wzbijewski@jhu.edu) (Presenter) Research Grant, Carestream Health, Inc

LEARNING OBJECTIVES

1) Describe the special purpose CT systems for musculoskeletal (MSK) imaging. 2) Compare the capabilities of special purpose MSK CT systems to conventional modalities. 3) Identify diagnostic applications enabled by special purpose MSK CT.

ABSTRACT

RC721C    Interventional

Participants
Charles M. Strother, MD, Madison, WI (Presenter) Research Consultant, Siemens AG Research support, Siemens AG License agreement, Siemens AG
Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on)

Thursday, Dec. 1 4:30PM - 6:00PM Room: E263

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; ;
Afshin Gangi, MD, PhD, Strasbourg, France, (gangi@unistra.fr) (Presenter) Proctor, Galil Medical Ltd
Todd S. Miller, MD, Bronx, NY, (tmiller@montefiore.org) (Presenter) Nothing to Disclose
Stanley Golovac, MD, Coral Gables, FL, (sgolovac@mac.com ) (Presenter) Nothing to Disclose
Allan L. Brook, MD, Bronx, NY (Presenter) Nothing to Disclose
Michele H. Johnson, MD, New Haven, CT (Presenter) Nothing to Disclose

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.k

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.
Muscle Imaging: Beyond the Basics

Friday, Dec. 2 8:30AM - 10:00AM Room: E450A

AMAPRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Robert D. Boutin, MD, Davis, CA (Director) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with normal anatomy and common pathology of muscles and tendons of the torso and pelvis. 2) Demonstrate understanding of the pathomechanisms and imaging findings of musculotendinous disorders of the torso and pelvis. 3) Define the musculo-tendinous anatomy of the hamstring and quadriceps muscle groups. 4) Identify on imaging and classify patterns of injury to the hamstrings and quadriceps muscle complexes. 5) Develop criteria for evaluation of the prognostic significance of imaging findings in injuries of the hamstrings and quadriceps muscle complexes. 6) Recognize common muscle disorders in the leg and foot due to a variety of traumatic, inflammatory, congenital and neurogenic causes. 7) Use imaging findings to help prognosticate and guide therapy for muscle disorders in the calves. 8) Recognize clinical situations in which percutaneous therapy for muscle injuries may be indicated. 9) Describe the logistics and risks of percutaneous therapy. 10) Understand the current evidence for efficacy of percutaneous treatment of muscle injuries.

Sub-Events

RC804A  Sarcopenia is Significant: Why Muscle Matters

Participants
Robert D. Boutin, MD, Davis, CA (Presenter) Nothing to Disclose

RC804B  Musculotendinous Disorders in the Torso and Pelvis

Participants
Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with normal anatomy and common pathology of muscles and tendons of the torso and pelvis. 2) Demonstrate understanding of the pathomechanisms and imaging findings of musculotendinous disorders of the torso and pelvis.

ABSTRACT

RC804C  Musculotendinous Injuries in the Thigh

Participants
James M. Linklater, MBBS, St Leonards, Australia (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

Define the musculo-tendinous anatomy of the hamstring and quadriceps muscle groups. Identify on imaging and classify patterns of injury to the hamstrings and quadriceps muscle complexes. Develop criteria for evaluation of the prognostic significance of imaging findings in injuries of the hamstrings and quadriceps muscle complexes.

ABSTRACT

Active Handout: James Macpherson Linklater

RC804D  Muscle Derangements Below the Knee

Participants
David A. Rubin, MD, Saint Louis, MO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize common muscle disorders in the leg and foot due to a variety of traumatic, inflammatory, congenital and neurogenic causes. 2) Use imaging findings to help prognosticate and guide therapy for muscle disorders in the calves.

ABSTRACT

RC804E  Sonographic Evaluation and Percutaneous Treatment of Muscle Injuries

Participants
Christopher F. Beaulieu, MD, PhD, Stanford, CA, (beaulieu@stanford.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize clinical situations in which percutaneous therapy for muscle injuries may be indicated. 2) Standardize the logistics and data.
1) Recognize clinical situations in which percutaneous therapy for muscle injuries may be indicated.
2) Describe the logistics and risks of percutaneous therapy.
3) Understand the current evidence for efficacy of percutaneous treatment of muscle injuries.

ABSTRACT

Advanced MRI Techniques; Myositis, Myopathy, and More

Participants
John A. Carrino, MD, MPH, New York, NY (Presenter) Research Consultant, BioClinica, Inc; Research Consultant, Pfizer Inc; Research Consultant, Carestream Health, Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc; ;

LEARNING OBJECTIVES

1) To describe the technical advances of muscle MRI. 2) To show normal features of muscle with MRI advanced techniques. 3) To illustrate common and uncommon muscle pathologies revealed by MRI.

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/

John A. Carrino, MD, MPH - 2013 Honored Educator
John A. Carrino, MD, MPH - 2015 Honored Educator
Science Session with Keynote: Musculoskeletal (Technique and Outcome in Intervention)

Friday, Dec. 2 10:30AM - 12:00PM Room: E451A

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

Participants
Luca Maria Sconfienza, MD, PhD, Milano, Italy (Moderator) Travel support, Bracco Group
William E. Palmer, MD, Boston, MA (Moderator) Nothing to Disclose

Sub-Events

SST06-01 Musculoskeletal Keynote Speaker: When Technique Matters

Friday, Dec. 2 10:30AM - 10:50AM Room: E451A

Participants
William E. Palmer, MD, Boston, MA (Presenter) Nothing to Disclose

SST06-03 Safety of Omitting Routine Coagulation Blood Testing Prior to Image Guided Musculoskeletal Biopsy

Friday, Dec. 2 10:50AM - 11:00AM Room: E451A

Awards
Student Travel Stipend Award

Participants
Yuri Shif, MD, Boston, MA (Presenter) Nothing to Disclose
Justin W. Kung, MD, Brookline, MA (Abstract Co-Author) Nothing to Disclose
Colm J. McMahon, MBChB, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jennifer Nimhurchearligh, MBChB, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jim S. Wu, MD, Boston, MA (Abstract Co-Author) Research Grant, Kaneka Corporation

PURPOSE
Preprocedure coagulation testing prior to image guided musculoskeletal (MSK) soft tissue and bone biopsy can increase cost and may delay patient care. The purpose of the study is to evaluate the safety of withholding preprocedure coagulation blood testing, international normalized ratio (INR) and platelets, in a population undergoing musculoskeletal soft tissue and bone biopsies.

METHOD AND MATERIALS
Prior to 10/7/2014 all patients undergoing image guided bone or soft tissue biopsy at one institution underwent pre-procedure INR and platelet count testing. All cases (N=1167) from 1/5/2006 through 10/2/2014 were retrospectively reviewed to determine the incidence of biopsy related bleeding complication (hematoma, ecchymosis, or excessive bleeding). Due to the low rate of bleeding complications a policy was adopted whereby patients were screened with a bleeding risk questionnaire, and unless risk factors were identified, pre-procedure blood tests were withheld. Under the new policy, all cases (N=190) from 10/7/2014 through 10/28/2015 were prospectively followed and the incidence of bleeding complications recorded.

RESULTS
Preceding the new policy there were 551 soft tissue biopsies and 616 bone biopsies. In total there were 30 biopsy related bleeding complications (2.6%). Soft tissue biopsies had a higher rate of bleeding than bone (20 vs 10 respectively) (p=0.031). No patient with a bleeding complication had an INR (>1.5) or platelet count (<50) which exceeded the recommended limits based on hospital policy or the Society of Interventional Radiology Consensus Guidelines. In the subsequent year after implementation of the new policy there were 2 bleeding complications (1.1%) which was not significantly different that the prepolicy group (P = 0.201).

CONCLUSION
Omitting routine pre-procedure coagulation profiles does not result in an increase in hemorrhagic complications during MSK lesion biopsy. Routine coagulation testing does not help predict which patients will have bleeding complications after undergoing MSK soft tissue or bone biopsy.

CLINICAL RELEVANCE/APPLICATION
Radiologists can consider omitting pre-procedure coagulation testing during MSK biopsy as doing so does not adversely affect patient care, and may simplify the pre-procedure work-up and reduce costs.

SST06-04 Utility of Core Needle Rebiopsy of Initially Non-Diagnostic Musculoskeletal Lesions

Friday, Dec. 2 11:00AM - 11:10AM Room: E451A

Participants
Jim S. Wu, MD, Boston, MA (Presenter) Research Grant, Kaneka Corporation
Colm J. McMahon, MBChB, Boston, MA (Abstract Co-Author) Nothing to Disclose
Santiago Lozano-Calderon, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Justin W. Kung, MD, Brookline, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the utility of repeat image guided core needle biopsy (CNB) of musculoskeletal lesions in the setting of an initially non-
diagnostic biopsy.

**METHOD AND MATERIALS**

Following IRB approval, a retrospective review was conducted of 1302 consecutive CNBs performed on bone or soft tissue lesions at a single institution. All cases where a repeat biopsy of the same lesion was requested by the referring physician due to non-diagnostic biopsy results were included in the study. Tumor characteristics such as lesion size and type (bone versus soft tissue) were correlated with diagnostic yield on repeat biopsy. Technical factors including the modality used, number of passes performed, gauge of the biopsy device, radiologist performing the procedure and portion of the lesion biopsied were also correlated.

**RESULTS**

Of the 1302 CNBs performed, 26 (2.0%) were referred for repeat biopsy. A diagnosis was obtained in 38.5% (10/26) of cases following a repeat CNB. In 5 out of the 26 cases (19.2%), a repeat CNB yielded malignancy. Overall, eleven cases were ultimately of malignant histology, of which 5 (45.4%) were diagnostic following rebiopsy. Fourteen cases were benign, of which 5 (35.7%) were diagnostic following rebiopsy. One case was lost to follow-up. A statistically significant difference in diagnostic yield was found between cases where an increased number of passes were made between the initial and repeat (p=0.047) biopsies.

**CONCLUSION**

Repeat core needle biopsy of initially non-diagnostic musculoskeletal lesions can be potentially useful. Increasing the number of passes on the second biopsy can increase diagnostic yield.

**CLINICAL RELEVANCE/APPLICATION**

Repeat CNB of musculoskeletal lesions should be considered after an initially non-diagnostic result as an alternative to more invasive and costly surgical biopsy.

**SST06-05**  Selective 3-Tesla MR Neurography-guided Retroperitoneal Genitofemoral Nerve Blocks for the Diagnosis of Genitofemoral Neuralgia

Friday, Dec. 2 11:10AM - 11:20AM Room: E451A

Participants
Jan Fritz, MD, Baltimore, MD (Presenter) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG
A. L. Dellon, Towson, MD (Abstract Co-Author) Nothing to Disclose
Eric H. Williams, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Gedge D. Rosson, Baltimore, MD (Abstract Co-Author) License agreement, Ageria Soft Tissue LLC
Alan Belzberg, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Frederick Eckhäuser, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Diagnostic genitofemoral nerve blocks are frequently utilized to establish and validate the diagnosis of genitofemoral neuralgia. Genitofemoral nerve blocks in the groin area are widely performed, but are prone to inaccuracies due to concomitant anesthesia of nearby nerves. Therefore, we prospectively evaluate the technical and diagnostic effectiveness and safety of 3-Tesla MR neurography-guided retroperitoneal genitofemoral nerve blocks.

**METHOD AND MATERIALS**

Our institutional review board approved this prospective HIPAA compliant study. Informed consent was obtained from all participants. Patients with intractable groin pain were included. Diagnostic MR neurography-guided genitofemoral nerve blocks were performed using a retroperitoneal approach and clinical wide-bore 3 Tesla MRI system. Outcome variables were assessed including technical success, complications, and efficacy. P-values ≤ 0.05 were considered statistically significant.

**RESULTS**

30 retroperitoneal genitofemoral nerve blocks were performed in 26 subjects (16 men, 10 women; mean age, 42 years; age range, 24–78 years; mean body mass index (BMI), 28 kg/m2, BMI range 20-35 kg/m2), of which 12/30 (40%) were performed with an anterior, 12/30 (40%) lateral and 6/30 (20%) posterior needle path. Genitofemoral nerve blocks achieved appropriate anesthesia in 24/26 (92%) subjects. No complications occurred. Genitofemoral nerve blocks had a sensitivity, specificity, positive and negative likelihood ratio, and accuracy of 93%, 75%, 3.73, 0.09, and 84%, respectively for the diagnosis of genitofemoral neuralgia.

**CONCLUSION**

Selective retroperitoneally-directed MR neurography-guided genitofemoral nerve blocks are safe and effective with high technical success and diagnostic accuracy for the diagnosis of genitofemoral neuralgia.

**CLINICAL RELEVANCE/APPLICATION**

Selective MR neurography-guided genitofemoral nerve blocks in the retroperitoneum are safe, allow for a technical success rate of 92% and a diagnostic accuracy of 84% for the diagnosis of genitofemoral neuralgia.

**SST06-06**  Ultrasound-Guided Dry Needling and High Volume Stripping for Achilles Tendinopathy: Outcomes For Our Cohort

Friday, Dec. 2 11:20AM - 11:30AM Room: E451A

Participants
Maira Hameed, BA,BMBCh, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Catherine A. Reid, MBBS, MA, Portsmouth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ajay Sahu, MBBS, MRCs, Plymouth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Maria B. Johnson, MB CHB, FRCR, Southampton, United Kingdom (Presenter) Nothing to Disclose

**PURPOSE**

Chronic Achilles tendinopathy is a prevalent overuse injury often observed in athletes. There is significant morbidity associated with chronic pain and stiffness of the ankle joint. The purpose of this study was to evaluate the clinical outcomes of ultrasound-guided dry needling and high volume stripping for Achilles tendinopathy in a cohort of patients.
Chronic Achilles tendinopathy is a prevalent overuse injury often observed in athletes. There is significant morbidity associated with surgical treatment and so minimally invasive treatments are now in favour. There are multiple potential modalities of treatment including autologous blood injection and corticosteroids. Dry needling is the procedure of repeatedly passing a fine needle through the abnormal tendon substance under local anaesthesia. Its rationale is to stimulate an inflammatory response followed by formation of reparative tissue, with a view to strengthen the tendon. We aimed to analyse our practice of ultrasound-guided dry needling and percutaneous high volume stripping of the Achilles tendon as a novel treatment paradigm for this condition.

**METHOD AND MATERIALS**

Sixty-four patients with sonographically-confirmed Achilles tendinopathy were analysed. All were symptomatic for more than four months and had failed alternative conservative treatment modalities. Ultrasound-guided dry needling of neovascular areas and percutaneous high volume stripping was undertaken by two dedicated musculoskeletal radiologists. We performed sonographic assessment of the tendon's thickness and neovascularity. Patient satisfaction was the primary outcome measure with a follow up period of three months. Secondary outcome measures included, pain scores (comparing these to pre-procedure levels), complication rate, and success rate.

**RESULTS**

54 out of 64 tendons have been successfully treated and the remainder are still undergoing their long term follow up. Our combined therapeutic intervention led to a significant improvement in pain scores and the majority of the patients, >85%, are satisfied with outcomes. There were no adverse events reported.

**CONCLUSION**

Ultrasound-guided dry needling and percutaneous high volume stripping has a high treatment success rate and few adverse events in our cohort of Achilles tendinopathy. Patients satisfaction rates are high and comparable to those documented in the literature for other minimally invasive treatment options. This option is favourable to the longer recovery time and higher risks associated with surgery.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound-guided dry needling and percutaneous high volume stripping shows promise as a novel minimally invasive treatment modality for chronic Achilles tendinopathy.


**Friday, Dec. 2 11:30AM - 11:40AM Room: E451A**

Participants
Federico Bruno, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Simone Quarchioni, Laquila, Italy (Abstract Co-Author) 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
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

**PURPOSE**

To evaluate and show the different clinical and instrumental outcome after intratendinous injection of Platelet Rich Plasma (PRP) and percutaneous needle tenotomy (needling) in patients with tendinosis of Achilles tendon.

**METHOD AND MATERIALS**

60 patients (30 men, 30 women, mean age 49.1 years) with refractory Achilles tendon tendinopathy who underwent either dry needling (n=30) or PRP injection (n=30). Pre-treatment evaluation included ultrasound and MRI scan, analysis of visual analogue pain scores (VAS) and VISA-A score for functionality. Clinical (VAS and VISA-A) and instrumental (US and MRI) follow-up was performed 6 months after the treatment.

**RESULTS**

The study group (PRP) showed recovery of tendon echogenicity and MRI signal intensity in 20 patients, 6 patients showed no improvement and 4 patients showed worsening of the tendinopathy. 24 patients (80%) reported mild to moderate pain reduction (mean VAS score 3, range 0-5), 6 patients had no improvement. The mean VISA-A values improvement was 65%. In the control group we noted recovery of tendon echogenicity and MRI signal intensity in 19 patients, 5 patient showed no improvement and 6 patients showed worsening of the tendinopathy. 75% of the patients showed improvement in VAS and 60% in VISA-A values.

**CONCLUSION**

Both PRP and needling are effective minimally invasive treatments for chronic, recalcitrant tendinosis of the Achilles tendon.

**CLINICAL RELEVANCE/APPLICATION**

Dry needling shows promise as an alternative, cheaper and effective treatment for the management of Achilles tendon degenerative pathology. As for PRP injection, it is important to carry out this technique under sonographic guidance so that the abnormal tendon can be targeted precisely for dry needling.

**SST06-08 Short-term Comparison Between Blind and Ultrasound-guided Injection in Morton Neuroma**

**Friday, Dec. 2 11:40AM - 11:50AM Room: E451A**

Participants
Fernando Ruiz Santiago, PhD, granada, Spain (Presenter) Nothing to Disclose
Nicolas Prados Olleta, PhD, Granada, Spain (Abstract Co-Author) Nothing to Disclose
Pablo Tomas Munoz, MD, Granada, Spain (Abstract Co-Author) Nothing to Disclose
Percutaneous LFSC rupture is a safe and effective minimally invasive procedure which may obviate the need for surgical intervention.

CLINICAL RELEVANCE/APPLICATION
More than half of treated patients were able to avoid subsequent surgery. Percutaneous LFSC rupture is an effective and safe non-surgical treatment for LFSC with higher technical success rate using CT vs fluoroscopy-guidance. More than half of treated patients were able to avoid subsequent surgery.

CONCLUSION
Injections relieved symptoms of Morton neuroma in a high percentage of patients.

SST06-09 Clinical Outcomes of Percutaneous Lumbar Facet Synovial Cyst Rupture

PURPOSE
Lumbar facet synovial cysts (LFSC) can cause low back pain (LBP), spinal stenosis and radiculopathy. The purpose of our study was to evaluate the therapeutic value, safety and clinical outcomes of percutaneous LFSC rupture in patients with LBP.

METHOD AND MATERIALS
Our study was IRB approved and HIPAA compliant. The study group comprised 48 patients (19 m, 29 f, mean age: 67±1.7 (SEM) yrs) with LBP and MRI findings of LFSC that corresponded with the patients' clinical symptoms, who underwent CT or fluoroscopy-guided percutaneous synovial cyst rupture and steroid injection. Success of LFSC rupture, injectate, complications, and long-term clinical outcome including repeat procedures or surgery were recorded. Groups were compared using the Chi-square or Fisher's Exact test.

RESULTS
Fifty-six percutaneous LFSC ruptures were performed in 48 patients. CT-guidance was used in 38 cases and fluoroscopy-guidance in 18 cases. LFSC rupture was technically successful in 40/56 cases (71%) confirmed by contrast filling the LFSF and extending into the epidural space. There was a higher likelihood of a technically successful rupture using CT vs fluoroscopy-guidance (p=0.03). In 48 cases LFSC rupture was performed by facet joint injection and in 8 cases by direct puncture of the synovial cyst, which did not result in a difference in technical success rate (p=0.8). In all cases a mix of 1 cc of triamcinolone and 1 cc of 2% mepivacaine and 40 mg of triamcinolone in each web space with Morton neuroma. According to the patient's evolution, up to 4 injections were allowed during the first 2 months of follow-up. Follow-up was performed by phone calls and/or scheduled consultations at 15 days, 1 month, 45 days, 2 months, 3 months, 6 months and 1 year. Statistical analysis was performed by unpaired Student’s t-test.

CONCLUSION
Percutaneous LFSC rupture is an effective and safe non-surgical treatment for LFSC with higher technical success rate using CT vs fluoroscopy-guidance. More than half of treated patients were able to avoid subsequent surgery.

CLINICAL RELEVANCE/APPLICATION
Percutaneous LFSC rupture is a safe and effective minimally invasive procedure which may obviate the need for surgical intervention.