ESSR BSSR OXFORD 2005
Abstracts of Oral Scientific presentations.

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08:30
SUSPECTED SCAPHOID FRACTURES, SHOULD WE KEEP ON REPEATING THE RADIOGRAPHS?

U Munir, C U Dussa, J Herbert, P Mobbs
Whiston Hospital, Prescot, United Kingdom

AIMS & OBJECTIVES: Wrist trauma with tenderness in the anatomical snuff box is traditionally considered to be diagnostic of scaphoid fracture. Even if no fracture can be seen on the radiographs, the wrist is immobilised and the radiograph repeated at 10 days. If there is still some tenderness in the scaphoid area, then the wrist is again immobilised for another 4 weeks. The repeat radiograph in such circumstances is considered helpful only if it shows the fracture, otherwise, it is ignored. We did this study to see the efficacy of repeated radiographs in diagnosing a scaphoid fracture. Moreover, we wanted to make a protocol in our department regarding the management of such injuries.
METHODS: It was a retrospective study on 271 patients between Jan'97 to Dec'03 The mean age was 37 years (range 12 – 84 years). All the patients were referred to the fracture clinics from accident and emergency department with the suspicion of a scaphoid fracture but the radiographs were normal. All the patients had bone scan to confirm / exclude a fracture.
RESULTS: Repeat radiograph at 1-3 week interval showed scaphoid fractures in 12 and distal radius fracture in 1 patient. A third radiograph taken in 113 patients between 2-6 weeks showed 2 scaphoid, 3 distal radius and 1 trapezoid fracture. Bone scan confirmed 80 scaphoid fractures; 15 distal radius fracture; metacarpal, capitate and trapezoid fracture in 5 patients each; triquetral fractures in 4 patients; and trapezium, hamate and ulna fractures in 2 patients each. Bone scan in 118 patients were normal while in 27 patients it showed arthritis of various carpal joints.
CONCLUSION: (1) the repeat radiographs showed very poor efficacy in our study and were useless (2) Bone scans confirmed fractures in a large number of patients (3) A large number of patients had normal bone scans and, therefore, were discharged from the clinics without any splintage
RECOMMENDATION: We recommend that if there is a high index of suspicion of a scaphoid fracture and the initial radiograph is normal, then an early bone scan should be requested rather than repeating the radiographs. The traditional practice of unnecessary splintage should be abandoned.

08:40
"CAN FOLLOW UP RADIOGRAPHY FOR ACUTE SCAPHOID FRACTURE STILL BE CONSIDERED A VALID INVESTIGATION?"

G Low, N Raby
Western Infirmary, Glasgow, United Kingdom

Purpose: To determine if follow up radiography is a valid diagnostic investigation in patients with suspected acute scaphoid fractures and normal initial radiographs
Materials and Methods: 50 sets of radiographs (initial and follow up) were independently assessed by 4 expert observers for the presence or absence of a scaphoid fracture. MRI, performed in all cases, was used as the gold standard to determine the sensitivity, specificity, positive and negative predictive values of the observers' assessment of the follow up radiograph. In addition, the reliability among observers of the follow up radiograph was determined by reliability variance analysis.
Results: Of the 50 sets of radiographs, 35 had a scaphoid fracture and 15 were normal, as established from MRI report. For individual observer's assessment of the follow up radiograph; we found: sensitivities of 11%, 9%, 43% and 49%; specificities of 93%, 93%, 87% and 80%; positive predictive values of 80%, 75%, 88% and 85%; and negative predictive values of 31%, 30%, 39% and 40%.
A reliability coefficient of more than 60% is needed for a diagnostic test to be considered reliable. Overall, the inter-observer reliability coefficient was 33.3%, with pair-wise inter-observer coefficients ranging from 18.2% to 53.4%.
Conclusion: With poor sensitivity, poor negative predictive value and poor reliability, follow up radiography cannot be considered a valid diagnostic examination for the detection of scaphoid fracture in patients with normal initial radiographs.

08:50

EXTREMITY MRI IN ACCIDENT & EMERGENCY: USE IN THE MANAGEMENT OF OCCULT WRIST INJURY

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Purpose: The installation of a 0.2T extremity MR scanner has revolutionized the local management of patients with wrist injuries. With the MR scanner situated in the Accident and Emergency department we have been able to offer instant access MR to patients with symptomatic wrist injury but negative initial radiographs as an acute management tool. This study reviews the findings in 120 radiograph negative wrist injuries with persisting symptoms at 7 to 14 days.
Method: All patients presenting to Accident and Emergency with clinical acute wrist trauma with initial negative radiographs were clinically reviewed at 7-14 days. Those who remained symptomatic underwent an early MRI study of the wrist on a 0.2T open permanent magnet rather than repeat radiographs or other ionising radiation based investigations. The imaging protocol used was coronal Spin-echo TI, coronal STIR, axial Spin-echo T2 and sagittal-oblique STIR sequence. The scans were "hot" reported by one of two dedicated musculoskeletal consultant radiologists.
Results: A total of 120 patients were scanned between May 2004 and February 2005. Of these, 42%(50/120) were normal. Scaphoid fractures were demonstrated in 18% (22/120) of cases and Radial fractures in 9% (11). The remainder of patients had other injuries the most prevalent of which were: significant soft tissue oedema (12), carpal

bone bruising (5), triangular fibrocartilage complex injury or tear (8), and capitate fracture(4).
Conclusion: Basic MRI of the wrist with a limited protocol using a low field extremity system is a clinically useful and highly productive diagnostic test for occult wrist injury . Repeated radiography in persistently symptomatic cases can be avoided.

9:00

POST-TRAUMATIC WRIST MRI IN FINDING FRACTURES NOT EVIDENCED AT CONVENTIONAL RADIOGRAMS: OUR EXPERIENCE IN 50 PATIENTS AND THEIR CLINICAL OUTCOME.

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PURPOSE: to evaluate the clinical usefulness of post-traumatic wrist MRI in depicting fractures in patients with negative radiograms.
MATERIALS AND METHODS: we reviewed the radiological exams and clinical course of 50 patients (26 males, 24 females, aged from 17 to 73 years, in the period from April 2003 to March 2005), whose the first wrist radiographic examination was negative for traumatic bone lesions and who underwent a successive radiographic and/or MR examination because the high suspicion of fracture (we excluded the patients whose the second radiographs clearly showed a fracture).
RESULTS: 21 patients underwent MR examination the same day of first radiographic examination; in 9 cases MR showed a fracture and in 12 cases didn't show any fracture. After 8-59 days the remaining 29 patients repeated the radiograms (average 20 days, mediana 10 days) and, because of persistence of clinical fracture suspicion, underwent MR examination in the same day (25 patients) or after 1-3 days (4 patients); in 15 cases a fracture was shown and in 14 cases the MR was negative. In 15 cases the fracture involved the carpal scaphoid, in 8 cases the radial epiphisis and 1 case the ulnar stiloid. On the whole, we found a fracture in 24 out 50 patients with negative radiografic controls.
Clinically, the 8 epiphiseal radial and ulnar stiloid fractures healed. Four scaphoid fractures were complicated by pseudoarthrosis; all of them underwent MR 20 days after trauma. We didn't find any case of necrosis of scaphoid fragments.
CONCLUSIONS: In high clinical suspicion of fracture, performing a wrist MR examination in the first 7-10 days after the trauma is mandatory, because a very high number fractures are evidenced improving the clinical outcome.

9:10

DYNAMIC GD-ENHANCED MRI TO DETERMINE THE VASCULARITY OF THE PROXIMAL POLE IN SCAPHOID NON-UNION

A Alam, M Watson, E McNally, D Wilson
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PURPOSE: Can dynamic gadolinium-enhanced MRI scans accurately predict the vascularity of the proximal pole for scaphoid non-unions? MATERIALS AND METHODS: Thirteen patients underwent surgical exploration with a view to grafting and fixation for scaphoid non-union. All 13 had pre-operative dynamic MRI studies to assess union and vascularity. The MRI and surgical findings were correlated. RESULTS: 10 patients were found to have non-union at surgery and in 3 patients, the fracture had united. MRI accurately predicted the extent of fracture union in all 13 patients. The proximal pole vascularity was documented in the operating notes for 12 patients. MRI accurately predicted the vascularity in 10 patients but there was poor correlation for 2 patients. CONCLUSION: MRI can accurately diagnose fracture non-union and can predict proximal pole vascularity.

09:20

SONOGRAPHIC FINDINGS OF MEDIAN NERVE AND PREVALENCE OF CARPAL TUNNEL SYNDROME IN COMPUTER 'MOUSE' USERS

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Purpose: To evaluate the median nerve sonographically and estimate the prevalence of carpal tunnel syndrome (CTS) in computer 'mouse' users.
Material and Methods: Forty-nine right wrists of 49 employees who had used 'mouse' were included in the study. Thirty-three right wrists of 33 non-mouse user employees were studied as control group. Both of the 'mouse' user and non-mouse user employees underwent sonography and electromyography (EMG). Axial sonograms of the median nerve were obtained proximally, in the middle and distally in the carpal tunnel. At each level, flattening ratio and the cross-sectional area of the median nerve were calculated.
Results: We found no significant difference for all parameters between 'mouse' users and control group, and between 'mouse' users with pain and control group ($p>0.05$). However, when we compared 'mouse' users having pain with the users without pain, there was a significant increase in the cross-sectional area of the median nerve proximally in the 'mouse' users having pain ($p<0.05$). Of all 'mouse' users, 8 (16.3%) have been diagnosed as sensory CTS, 4 (8.2%) of them as motor CTS by EMG. We also found that 4 (50%) CTS patients had proximal cross-sectional area of median nerve exceeding 10 mm² and 5 (62.5%) had distal flattening ratio above 3.
Conclusion: Prolonged use of 'mouse' may pose an occupational risk for the employees and sonography can use as an initial step in symptomatic patients for diagnosis of CTS.

9:30

MR FEATURES OF DISTAL BICEPS TENDON TEARS

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Aim
To illustrate various MR features of distal biceps brachii tears.
Methods
We present the typical appearances of the partial and full thickness tear of the distal biceps tendon. A retrospective review of 8 cases with confirmed distal biceps rupture is reviewed and their MR features are presented
Discussion
Biceps brachii is an important flexor of arm and is the main supinator of the forearm. Rupture of biceps most commonly occurs proximally in the long head which accounts of 96% of all biceps injuries. Injuries of distal biceps are rare and represent 3% of all biceps tendon ruptures. The injury occurs most commonly between fourth and sixth decade of life. Weight lifters, body builders and athletes are most commonly at the risk of having this problem. Decreases vascularity, tendon impingement, degenerative changes of distal biceps tendon and use of anabolic steroids have been postulated to predispose to tendon rupture. There is history of sudden extension during actively flexed elbow during a heavy lifting episode. Clinically, patient presents with acute pain at the time of injury with typical feeling of a "pop". The complete rupture of distal tendon is from its insertion on the radial tuberosity is thought to be more common than partial tears and often dramatic in appearance, easy to diagnose and needs surgical intervention. Patients with partial tear fail to describe an acute event but rather state their symptoms began insidiously. Partial tears are rarely seen and are rarely treated surgically. MR can help to confirm the rupture of distal biceps tendon, distinguish complete from partial tears and exclude any other lesion as the cause of patient's symptoms. On MR complete tears show retracted tendon surrounded by fluid and haemorrhage and fluid also seen in the bicipitoradial bursa. There can be associated irregularity of the radial tuberosity. MR findings of partial tear include increase intratendinous signal on T2W and PD fat saturated sequences, tendon thickening or thinning, peritendinous fluid, fluid in the bicipitoradial bursa and marrow oedema in the radial tuberosity due to microavulsive injuries
Conclusion
MR imaging is an important investigation to confirm the diagnosis of distal biceps tear and to differentiate partial from complete tear. This can also help to exclude any other lesion which can cause symptoms similar to distal biceps tear.

09:40

MR IMAGING OF THE ACROMIOCLAVICULAR-JOINT – RADIOLOGIC-PATHOLOGIC CORRELATION AND THE EFFECT ON CLASSIFICATION OF TOSSY INJURIES

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Purpose: To evaluate MRI for analyzing acromioclavicular-(AC) joint anatomy in cadaver shoulders, volunteers, and patients with traumatic AC-joint.
Material and Methods: Three fresh cadaver shoulder specimen were examined by MRI (1,5T) to determine best imaging planes and sequences (slice-thickness 3mm, FOV 180mm, matrix 210x256). Anatomic sections were correlated to MRI. Three

volunteers and 12 patients with injuries of the shoulder joint and suspected AC joint derangement were examined by radiography and MRI. Injuries were classified according to Tossy. Standard of reference was clinical examination and conventional radiography.
Results: MRI allowed excellent visualization of all AC-joint components in specimen, volunteers, and patients. Best imaging planes for AC-joint structures were parallel to the clavicula and perpendicular to AC-joint. Best imaging sequences were fatsuppressed protondensity-weighted, T2w-turbospinecho (TR/TE 4000/15 ms), and T1w-SE (TR/TE: 817/20 ms). Diagnoses based on MRI: 3x normal, 2x Tossy I, 1x Tossy I-II, 3x Tossy II, 3x Tossy II-III, 3x Tossy III.
In comparison to MRI 4 lesions (1 Tossy II, 3 Tossy III in MRI) were underestimated clinically and by conventional x-ray.
In 2 patients additional information obtained from MRI resulted in surgery.
Conclusion: MRI is well suited for imaging normal and traumatized AC-joints and may influence classification and therapy of AC-joint injuries.

9:50

THE WEB SERVICE RAQUANTIFY - AN ONLINE RHEUMATOID ARTHRITIS QUANTIFICATION TOOL FOR FULL-AUTOMATED METACARPO-PHALANGEAL JOINT SPACE WIDTH MEASUREMENTS

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Purpose:
The variability in scoring radiographic abnormalities is considerable even among experts. This has important implications for clinical decisions, therapeutic trials and cross-trial comparisons. An online rheumatoid arthritis quantification tool will allow the user, to upload hand radiographs and in return receive an automatically generated joint space measurement report. Preliminary results of its performance are presented.
Materials and Methods
A test set of 10 clinically indicated plain film hand radiographs was selected randomly and digitized with a laser scanner. Each image was uploaded by a scientific assistent and processed 10 times. Precision was evaluated by comparing results from multiple segmentation sessions and by calculating the coefficient of variation. The metacarpo-phalangeal JSWs of all 10 hands were defined by an expert with a dedicated interactive tool. This results were compared to the results of the web-service to determine accuracy. The time required for this procedure was recorded to evaluate efficiency.
Results
The standard deviation after repeated measurements was 0.13 mm for the mean JSW, 0.14 mm for the minimum JSW and 0.15 mm for the maximum distance respectively. This results in a coefficient of variation of 7.9% for the mean JSW, 8.4% for the minimum JSW and 9.3% for the maximum distance in this data set with a mean JSW of 1.6mm. Compared to the gold standard JSW measurements, the RAQuantify

procedure lead to an accuracy of 0.30 mm. 98% of results were within a range less than 1mm. Mean computation time was 1.5 minutes (1.1 -2.1 min.).
Discussion
RAQuantify can measure metacarpo-phalangeal JSWs accurately and with high precision in a highly efficient way.
This research has been supported by the Austrian Science Fund (FWF) under the grant P17083-N04.

10:00

EVALUATION OF A COMPUTER ASSISTED METHOD FOR INTERACTIVE DIGITAL DEFINITION OF BONE SHAPES

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Purpose:
To evaluate the accuracy, precision and efficiency of a computer assisted method for interactive segmentation of bone shapes on digital radiographs. To perform measurements in skeletal radiography and to derive models for future full automated bone contour analysis.
Material and Methods:
The shape (bone contour) of 11 fifth metacarpal bones (MC) was defined by three radiologists for an estimation of inter- and intra-user agreement. The radiologists used a dedicated software for the delineation of bone contours, based on the Live Wire algorithm. The time and number of mouse clicks needed per bone was recorded. The annotations of different radiologists were compared with respect to the percentage of total agreement of results. On a set of 256 landmarks the amount of variation was measured as the difference of results in regions were variation occurred given in millimetres.
Results:
The digital definition of a MC shape took 3.2 minutes in mean per bone, 5-8 manually indicated points were needed. The results of a single reader compared to three other segmentation results led to a probably perfect agreement of less than 0.1mm in 94.1 % of the contours. Taking only regions into account where differences occur, the mean difference is 0.1-0.38 mm, depending on the anatomical region. Inter–user differences occur mainly in regions where more control points have to be set manually.
Discussion:
A procedure for digital definition of bone shapes with excellent inter- and intra-user agreement is presented. Future application include morphometric analysis and training of shapes for advanced computer vision algorithms. The high accuracy of this procedure indicates that consensus reading is not recommendatory in every anatomical region. This research has been supported by the Austrian Science Fund (FWF) under the grant P17083-N04.

FRIDAY AM 10:40 to 12:00

Edmund Safra Theatre

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10:40

AN EXAMINATION OF THE COMPOSITION AND ROLE OF THE ROTATOR CUFF INTERVAL AS PART OF THE ANTEROSUPERIOR SHOULDER COMPLEX

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PURPOSE: To investigate the histologic and anatomic appearance of the rotator cuff interval (RCI), its relationship to adjacent rotator cuff tendons, the long head of the biceps tendon, and the normal MR imaging appearance.
MATERIALS AND METHODS: Twenty four shoulder examinations were performed on 12 matched pairs of fresh frozen cadaveric shoulders. The shoulders were scanned on Signa 1.5-T MRI units and the images interpreted by 2 experienced musculoskeletal radiologists. Following imaging, all shoulders underwent gross and microscopic anatomic dissection. The specimens were also decalcified and stained.
RESULTS: In the location of the rotator cuff interval, gross dissection revealed a continuation of superficial fibers of the subscapularis and supraspinatous tendons. These fibers were found to extend from the tendon bodies across the location of the rotator cuff interval and merge together in this region forming a confluence of tendon fibers. The deep fibers of both the subscapularis and supraspinatus tendons were found to attach to the greater tuberosity and interdigitation of the superior subscapularis fibers with the anterior supraspinatus fibers and the coracohumeral ligament was uniformly identified as the proximal covering of the intertubercular groove. Longitudinal fibers of the supraspinatus tendon were also noted to travel the length of the rotator cuff interval deep to the other interdigitating fibers, but superficial to the biceps tendon.
CONCLUSIONS: Histologic and anatomic evidence demonstrates that fibers from the subscapularis and supraspinatus tendons merge superficially and surround the coracohumeral and biceps tendon constituents of the interval and form a functional unit that incorporates the anterosuperior rotator cuff, the RCI, the biceps tendon, and the coracohumeral ligament. Based upon this anatomic configuration, injury to one of the components of the RCI should be highly associated with injuries of the other structures and may have implications for subsequent surgical repair.

10:50

ULTRASOUND OF THE REFLECTION PULLEY OF THE BICEPS TENDON

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PURPOSE: To describe the US appearance of the coracohumeral and superior glenohumeral ligaments (forming the reflection pulley) in normal subjects and patients with pulley tears associated with rotator cuff pathology and biceps tendon instability.
MATERIALS AND METHODS: A correlative US-anatomic study was performed on freeze-frozen cadaveric shoulders and correlated with the normal US appearance of the reflection pulley in 20 healthy volunteers. Patient's positioning with the arm in posterior flexion and short-axis planes over the rotator cuff interval were used. Then, 12-5, 15-7 and 17-5MHz US images were obtained in n=21 consecutive patients with pulley lesions. Patients with massive rotator cuff tears and biceps tendon rupture were excluded.
RESULTS: High-resolution US was reliable to image the reflection pulley system in normal subjects. In the patients group, pulley lesions occurred in isolation (n=1) or combined with either subscapularis (n=9) or supraspinatus (n=11) tendons tears. Main US signs of reflection pulley lesions included hypoechoic thickening (n=3), discontinuity (n=7) and nonvisualization (n=11) of the coracohumeral ligament. Pulley thickening was associated with subscapularis tears but not with an abnormal biceps tendon position. Biceps tendon subluxation was observed over the subscapularis in patients with pulley rupture combined with anterior tears of the supraspinatus or superior tears of the subscapularis. In complete tears of subscapularis, the biceps was dislocated.
CONCLUSION: US is valuable in detecting lesions of the ligamentous structures forming the reflection pulley regardless of the associated cuff pathology. US allows differentiation of a pulley lesion from an isolated tear of the anterior border of the supraspinatus and superior border of the subscapularis.

11:00

MR IMAGING FINDINGS IN ADHESIVE CAPSULITIS

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The purpose of the present study was to describe the MRI findings in patients with a clinical and/or surgical diagnosis of adhesive capsulitis.
14 patients (10 women, 4 men, mean age 55 y) underwent MRI examinations (T1-w, T2-w with fat suppression, contrast enhanced fat suppressed T1-w, in three planes, 1T scanner).
All images were studied for
a) coracohumeral ligament (CHL) thickening,
b) abnormal signal in the rotator cuff interval (RCI),
c) enhancement in the RCI, and
d) synovial thickening and abnormal enhancement in the axillary pouch.
A control group consisting of 21 age and sex-matched patients with a final diagnosis of impingement syndrome was also studied.
All patients showed an intermediate soft tissue density exhibiting intense enhancement, in the RCI.

Only two of the controls (with MRI diagnosis of tendinitis) presented with such a finding.
Seven patients and 6 controls showed synovial thickening and enhancement of the axillary pouch.
CHL measured 4mm in patients and 2.5mm in controls.
In conclusion, abnormal signal and enhancement in the RCI and CHL thickening are MR imaging findings which correlate significantly with frozen shoulder.

11:10

ADHESIVE CAPSULITIS: SONOGRAPHIC CHANGES IN THE ROTATOR CUFF INTERVAL WITH ARTHROSCOPIC CORRELATION

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Purpose*:* To evaluate the sonographic findings of the rotator interval in patients with clinical evidence of adhesive capsulitis immediately prior to arthroscopy.
Materials and methods: We prospectively compared thirty patients with clinically diagnosed adhesive capsulitis (20 females, 10 males, mean age 50 years), with a control population of 10 normal volunteers and 100 patients with a clinical suspicion of rotator cuff tears. Grey-scale and colour Doppler sonography of the rotator interval was used.
Results: Twenty-six patients (87%) demonstrated hypoechoic echotexture and increased vascularity within the rotator interval, all of which had symptoms for less than one year. Three patients had hypoechoic echotexture but no increase in vascularity, and one patient had a normal sonographic appearance. All patients were shown to have fibrovascular inflammatory soft-tissue changes in the rotator interval at arthroscopy commensurate with adhesive capsulitis.
Conclusions: Sonography can provide an early accurate diagnosis of adhesive capsulitis by assessing the rotator interval for hypoechoic vascular soft tissue.

11:20

CHANGES IN THE ROTATOR INTERVAL ON MRI FOLLOWING ROTATOR CUFF TEARS: ASSESSMENT WITH STANDARD MRI SEQUENCES

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PURPOSE: To determine the effect of rotator cuff tears on variability of appearance of the rotator interval (RI) on standard shoulder MRI.
MATERIALS and METHODS: Retrospective analysis of 40 shoulder MRI studies of 40 patients (12 females, 28 males, mean age 47 years). Non-arthrographic standard MRI sequences were employed. Supraspinatus (SST) and subscapularis (SCT) tendons, RI width, RI capsule (RIC), long head biceps tendon (LHBT) and coracohumeral ligament (CHL) were assessed. Tears of SST and SCT were correlated with changes in RI anatomy.

RESULTS: The RI was seen in 35/40 (83%) cases. Average RI width was 15.95 mm [range 0 - 30.6 mm]. There was no significant correlation between RI width and SST/SCT tendinosis, partial or complete tear. The widest RI was seen in complete SST and SCT tear with tendon retraction (30.6 mm). SST tears were associated with reduced visualization of the RIC (p=0.041) but not the CHL (p=0.702). Conversely, SCT tears were associated with reduced visualization of the CHL (p=0.05) but not the RIC (p=0.72). SST/ SCT pathology did not statistically affect CHL thickness, or identification and thickness of LHBT.

CONCLUSION: The RI has a variable appearance on standard MRI sequences. Tears of SCT are associated with decreased visualization of the CHL and tears of the SST are associated with reduced visualization of the RIC. Tears of the antero-superior rotator cuff tendons are associated with significant anatomical changes in the RI.

11:30

VARIANTS OF THE SUPERIOR LABRUM AND LABRO-BICIPITAL COMPLEX: A COMPARATIVE STUDY IN SHOULDER SPECIMENS USING MR ARTHROGRAPHY, MULTI-SLICE CT ARTHROGRAPHY, AND ANATOMIC DISSECTION

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Purpose: To examine the anatomic variability of the superior labrum and to compare the value of MR arthrography and multi-slice CT arthrography in the diagnosis of variants of the labro-bicipital complex.
Material and Methods: Forty-three human shoulder specimens were examined with the use of MR arthrography and multi-slice CT arthrography prior to joint exploration and macroscopic inspection of the superior labrum and labro-bicipital complex. Two radiologists evaluated MR and CT arthrograms and the results were compared with macroscopic assessments.
Results: Anatomic dissection of all shoulder specimens revealed a sublabral recess in 32/43 (74%) of cases. The attachment of the superior labrum was categorized as type 1 in 10 (23%), as type 2 in 8 (19%), as type 3 in 10 (23%), and as type 4 in 14 (33%) cases. One superior labral attachment was classified as SLAP type 3 lesion.
On MR arthrography and CT arthrography the attachment of the superior labrum was categorized in concordance with macroscopic assessments in 79% and 84% of cases, respectively. The anteroposterior extension of sublabral recesses was determined accurately with MR and CT arthrography in 59% and 81% of cases, respectively.
Conclusion: The attachment of the superior labrum shows considerable variability. Thus, exact depiction of variants is essential in order to avoid the false positive diagnosis of a superior labral tear (SLAP or Andrews lesion). MR arthrography and multi-slice CT arthrography were highly effective in detection and classification of sublabral recesses.

11:40

PREVALENCE OF SLAP TEARS SHOWN BY MR ARTHROGRAPHY OF THE SHOULDER IN PATIENTS WITH GLENOHUMERAL INSTABILITY.

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Introduction
SLAP (superior labrum anterior-posterior) tears cause shoulder discomfort and pain. They are well demonstrated by MR arthrography (MRA) but are generally regarded as lesions which arise in patients without glenohumeral instability (GHI). We have observed SLAP tears in several patients having MRA for GHI but a previous arthroscopic study suggested that this was an infrequent occurrence and we were unable to find a documented prevalence for this in the radiology literature. Recognition of co-existing SLAP tears can influence surgical management of patients with GHI.
Methods
To define the prevalence of SLAP tears in patients with GHI, we undertook a retrospective review. Over a 5 year period we identified 100 patients who had undergone shoulder MRA. All examinations followed injection of 15-20ml gadolinium solution and included T1 fat saturated 3mm slices obtained in 3 planes.
Results
60 of 100 patients who had shoulder MRA had GHI and were being considered for surgical treatment. In 24 of these (40%), SLAP tears were identified.
Conclusion
There is a (previously undocumented) high prevalence of co-existing SLAP tears in patients undergoing MRA to investigate GHI. Awareness of this association and recognition of these SLAP tears is helpful in planning surgical intervention.

11:50

MR ARTHROGRAPHY OF THE SHOULDER FOLLOWING ROTATOR CUFF REPAIR; CORRELATION WITH CLINICAL OUTCOME (RESTORE TRIAL)

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Objective The aim of the study was to compare MR Arthrography of the shoulder with clinical outcome after mini-open repair of the rotator cuff with augmentation by a porcine xenograft.
Method and Materials
22 patients (45-75years, 12Male:10Female) with moderate or large full thickness (FT) rotator cuff tears were assessed pre-operatively using the modified Constant Score and the clinical scores were repeated post-operatively at 6 weeks, 6 months and 12 months. All patients underwent MR Arthrography (MRA) routinely at 12 months post-operatively or earlier if the repair was deemed to have failed clinically. An increase of 15 or more points in the Constant Score was accepted as a satisfactory clinical outcome whereas a lower value was taken to represent failure. 14 patients had a satisfactory outcome clinically with an average increase of 33.7 points in Constant score whereas 8 patients had an unsatisfactory outcome with an average decrease of 12 points. Two of the patients with an unsatisfactory outcome failed at 6 weeks, one at

6 months and five at one year. The MRA findings were compared with the clinical outcome.
Results
Of the 14 patients with a satisfactory outcome, 3 had no re-tear, 6 patients had a FT tear smaller than the original tear, 2 had a FT tear of similar size and 3 patients had a FT tear larger than the original tear. Both patients that failed at 6 weeks had larger tears than the original tear but the patient that failed at six months had a smaller re-tear. Of the 5 patients that failed at one year, 4 had a FT tear smaller than the original tear and one had a FT tear larger than the original tear.
Conclusions
In this study, the size of the cuff re-tear did not correlate with functional outcome. This supports the concept that the integrity of the rotator cuff itself cannot be the only factor determining the outcome of surgery involving the rotator cuff.

FRIDAY PM 13:20 to 15:10
Rhodes Trust Theatre

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13:20
EVALUATION OF PATELLAR CARTILAGE VOLUME AND THICKNESS AT 3.0T: 3D-FLASH VS. 3D-TRUEFISP

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Purpose. Magnetic resonance imaging (MRI) at 1.5 T has proven a valuable technique to monitor osteoarthritis. At 3 T there is few experience. The purpose of the study was to compare the reproducibility of patellar cartilage volume and thickness measurements with a previously validated 3D-FLASH water excitation sequence and an optimized 3D-TrueFISP water excitation sequence which has not been used for assessment of cartilage volume on a 3.0T scanner so far. **Materials and Methods.** Patellar cartilage of the right knee joint of 6 healthy volunteers (mean age 26.5 years) was examined. In order to avoid load-induced compression the volunteers were asked to rest physically for 1 hour prior to imaging. The MR measurements were performed on a 3.0T whole body imager (Magnetom Trio, Siemens Medical Solutions) using a commercial transmit-receive extremity-coil. The patella was covered by 40 axial partitions (thickness 1.5 mm), the in-plane resolution was chosen 0.31^2 mm^2. Image data were acquired with a 3D-FLASH water excitation sequence (TR/TE 12.4/5.3 ms, flip angle 10°, bandwidth 130 Hz/pixel) and a 3D-TrueFISP water excitation sequence (TR/TE 8.9/3.2 ms, flip angle 28°, bandwidth 290 Hz/pixel). To assess the reproducibility of the cartilage volume and thickness measurements, we acquired 3 consecutive data sets of each volunteer for both sequence techniques, the knee joints being repositioned. The patellar cartilage was delineated by an interactive segmentation routine. Cartilage volume, mean and maximum thickness were calculated with a previously described algorithm. Intra-individual and average reproducibility were determined and the interindividual variability of cartilage volume and thickness was estimated. **Results.** In all 3 data sets of the 6 volunteers, the patellar cartilage volume and thickness calculated from the TrueFISP images were smaller

than in the FLASH images. However, differences were not significant ($p>0.5$). Possibly, the lower volume and thickness values resulting from the TrueFISP sequence might be attributable to the high SNR and CNR of the synovial fluid that tend to lead to an underestimation of cartilaginous tissue during segmentation. In healthy young adults, the intra-individual reproducibility of cartilage volume and thickness showed a tendency to lower values for the TrueFISP sequence, reflecting a complex signal behaviour with a correspondingly slightly lower reliability of cartilage delineation. The inter-individual variabililty of cartilage volume and mean/maximum cartilage thickness was comparable for both sequence techniques. **Conclusion.** In healthy volunteers, quantitative assessment of the patellar cartilage volume and thickness from the 3D-TrueFISP image data lead to smaller cartilage volume and thickness values as compared to the previously validated 3D-FLASH image data, with a slightly better reproducibility for the FLASH sequence. Free precession techniques however, may improve cartilage segmentation especially in OA patients where cartilage-joint contrast is more difficult.

13:30

CARTILAGE AND MENISCAL LESIONS IN THE KNEE JOINT: COMPARISON OF MR ARTHROGRAPHY (3.0T) AND CT ARTHROGRAPHY

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Abstract:
Objective. To compare MR arthrography (3.0T) and CT arthrography for the evaluation of cartilage and meniscal lesions in the knee joint.
Design and patients. Twenty-six consecutive patients with clinically suspected cartilage lesions or meniscal tear or retear were prospectively included in the study. A CT scanner (slice thickness 0.6/0.3 mm) and a MR examination (3.0 T) (slice thickness 1.5/1mm) were successively performed after conventional arthrography. A 1:1 mixture of diluted gadoteridol (1/200) and iopamidol (300 mg iodine/ml) was injected. The articular cartilages of the femur, tibia and patella; and the menisci were analyzed separately by two musculoskeletal radiologists. A review panel consisting of two musculoskeletal radiologists and an orthopedic surgeon represented the standard of reference.
Results. For reader 1 accuracy of MR arthrography in the femur/tibia/patella/menisci (87% / 94% / 92% / 93%) was slightly inferior to CT arthrography (87% / 94% / 92% / 95%). For reader 2, the accuracy was (90% / 96% / 96% / 97%) for MR arthrography, and (99% / 96% / 92% / 93%) for CT arthrography, respectively. Interobserver agreement for MR arthrography was 90% for cartilage lesions and 92% for meniscal lesions, while interobserver agreement for CT arthrography was 88% and 92%, respectively.
Conclusion. MR arthrography (3.0T) appears to be equal to CT arthrography for the detection of cartilage lesions and for the detection of meniscal tear and retear in the knee joint.

13:40

CORRELATION OF HIGH-RESOLUTION 23NA MRI OF OSTEOARTHRITIC CARTILAGE WITH MAPS OF TISSUE FIXED CHARGE DENSITY

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Purpose

Contrast-enhanced proton T1 mapping has been proven a sensitive and specific method of detecting early osteoarthritic changes by mapping fixed charge density (FCD) in cartilage (1,2). However, such measurements have difficulties in vivo.

Sodium MRI of is an option for FCD mapping in cartilage (3,4). In our work, we compared for the first time high resolution 23Na images of cartilage degraded by natural disease progress, with an established method for FCD mapping.

Materials and Methods

Cartilage-bone specimens obtained from knee and hip joint replacements in osteoarthritic patients were immersed in saline with contrast agent (Magnevist, Schering) prior to MR measurements performed on a 3T Medspec (Bruker, Germany) scanner with a microimaging gradient insert (≤200 mT/m).

Cartilage 23Na transverse and longitudinal relaxation times were measured in a series of pulse-acquire experiments.

Gd-DTPA^{2-}-enhanced proton T1 maps were calculated for the morphologically best preserved specimens (5 x IR MS SE, 4x4cm^{2}x2mm, 256x64).

23Na MRI images were measured using corresponding geometry (3D GE, 4x4x4cm^3, 128x48x16, TE/TR = 1.9/18 ms).

Results and Conclusions

Average cartilage relaxation times were determined to be 0.4 and 4.5 ms for two T2* components, respectively, and 15.6 ms for T1. Corresponding lesions in 23Na images and Gd-DTPA^{2-}-enhanced 1H T1 maps were found (Fig. 1).

Sodium MRI was optimized for the highest resolution with sufficient SNR, so that the measurement time would be less than 10 hours. SNR in 23Na images was approximately 9:1 for areas with highest FCD to 5:1 for areas corresponding to focal lesions. The results demonstrate that sodium MRI is a potential tool for detecting early cartilage defects.

(1) Bashir A. et al. Magn Reson Med. 41:857, 1999.
(2) Mlynarik V. et al. J Magn Reson Imaging. 17:440, 2003.
(3) Shapiro E. M. et al. Magn Reson Med. 47:284, 2002.
(4) Wheaton A.J. et al. Radiology. 231:900, 2004.

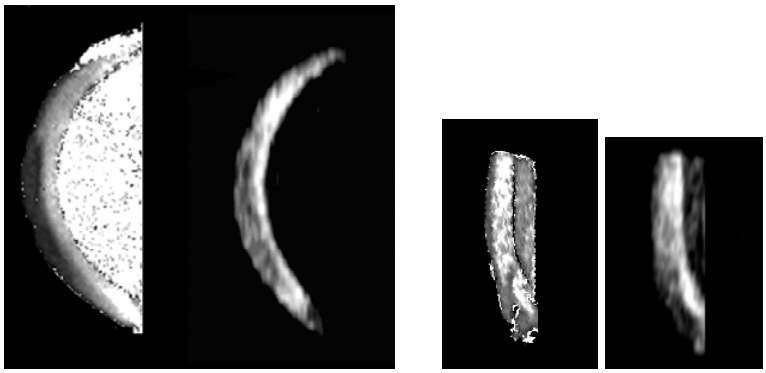

Figure 1: Early steoarthritic lesions in human articular cartilage. In each pair, left slice is a proton Gd-DTPA^{2-}-enhanced calculated T1 map, right slice is a corresponding sodium MR image.

Sodium MRI was optimized for the highest possible resolution with sufficient SNR and

for the measurement time in which system stability problems would be avoided (<10 hours). Short TR and low flip angle were chosen to maximize efficiency of the measurement. SNR in 23Na images was approximately 9:1 for areas with highest FCD to 5:1 for areas corresponding to focal lesions. The results demonstrate that sodium MRI is a potential tool for detecting early cartilage defects. For future experiments, hardware improvements (higher field magnets, faster gradients for shorter TE) may lead to increasing sensitivity of the method, which can then be traded for measurement time.

(1) Bashir A. et al. Magn Reson Med. 41:857, 1999.
(2) Mlynarik V. et al. J Magn Reson Imaging. 17:440, 2003.
(3) Shapiro E. M. et al. Magn Reson Med. 47:284, 2002.
(4) Wheaton A.J. et al. Radiology. 231:900, 2004.

13:50

T2 RELAXATION TIMES IN ARTICULAR CARTILAGE ARE REDUCED AFTER ENZYMATIC PROTEOGLYCAN DEPLETION

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Purpose: To analyze alterations of T2 relaxation times in human articular cartilage following enzymatic depletion of proteoglycans.
Materials and Methods: Eight macroscopically intact human patellae were imaged within 48 hours of death in a clinical 1.5T scanner. Imaging was performed before and after 6 hours of exposition of the medial patellar facets to 330 u/ml hyaluronidase. 20 transverse partitions/ sections (resolution: 0.6 x 0.6 x 3.0 mm^3) were acquired with a 3D FLASH WE sequence (17.6/8.8ms; 25°) and a multi echo sequence (TR/TE_{min}=3000/13.2ms; 8 echoes). The cartilage was segmented (WE sequence) and superimposed on the multi echo data. T2 values were calculated on a pixel-by-pixel basis using a monoexponential fit procedure. Average T2 values were extracted for the medial and lateral patellar facets in both, the superficial, intermediate and lower layers of the cartilage. Safranin´O staining and Scanning Electron Microscopy (SEM) were performed on excised cartilage-on-bone samples from both facets.
Results: T2 values varied between 29 and 48 ms. Average T2 was decreased by 23% in the intermediate and by 19% in the superficial layer after hyaluronidase. NaCl controls showed but a small decrease of T2 in the superficial layer and no significant changes in the intermediate layer. SEM showed an intact collagenous fibre architecture in all excised samples.
Conclusion: T2 relaxation times of patellar articular cartilage are reduced after treatment by hyaluronidase. A possible explanation may be a reduced water content of cartilage consecutive to depletion of proteoglycans.

14:00

CONTRAST ENHANCED HIGH RESOLUTION MR IMAGING OF AUTOLOGOUS CARTILAGE IMPLANTS OF THE KNEE JOINT

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Purpose: To investigate if the enhancement of synovial fluid by intravenous administration of contrast agent improves the magnetic resonance (MR) evaluation of cartilage repair in the knee joint.
Methods and Materials: Eleven patients after matrix-based autologous cartilage transplantation in the knee joint were examined by proton-density fast spin echo sequence (PD-FSE) without and after intravenous administration of gadododiamide (indirect MR-arthrography). High-resolution MRI could be achieved by the use of a surface coil placed over the implant site. Implant thickness, surface and integration of implant to the adjacent native cartilage and subchondral bone were evaluated.
Results: Contrast enhanced MR imaging of matrix-based autologous chondrocyte implants was superior to non-enhanced cartilage imaging. In particular, incomplete integration of the cartilage implant to adjacent normal hyaline cartilage was better delineated with indirect MR arthrography. Implant thickness and surface abnormalities such as fibrillations and fissures were better visualized by filling of defects with contrast-enhanced synovial fluid. Each of these properties could be distinguished significantly better with contrast enhanced imaging ($p<0,001$ for all 3 parameters).
Conclusion: Indirect MR arthrography is a promising technique for the evaluation of cartilage repair, since it allows to combine the advantage of high-resolution PD-FSE imaging for subtle intrachondral abnormalities with a better delineation of cartilage implant surface and integration defects.

14:10

THE MRI FEATURES OF OSTEOCHONDRAL TRANSPLANTATION WITH DONOR SITE RECONSTRUCTION - A NEW SURGICAL TECHNIQUE

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Purpose
Articular cartilage damage is an increasingly recognised component of knee injuries and there is a corresponding interest in the treatment of articular cartilage damage in order to improve prognosis. One surgical option is osteochondral transplantation (OCT). Clinicians and radiologists need to familiarise themselves with the post-operative imaging appearances following surgical treatment. We present a pictorial review of the magnetic resonance imaging (MRI) findings in an early series of patients undergoing a novel technique of donor site reconstruction during OCT.
Materials and Methods
Eleven patients aged 22 to 51 years (mean 37 years) with full thickness chondral lesions of the articular cartilage of the knee were treated by osteochondral transplantation with donor site reconstruction. All patients were examined post-operatively on a 1.0 Tesla MR using a dedicated knee coil at a median of 182 days after surgery. The sequences performed were: sagittal proton density (PD), coronal PD, axial PD, coronal turbo STIR & sagittal fat saturation flash 3d gradient echo. The plugs were assessed for protrusion/depression, the signal of the plug articular cartilage was compared with that of surrounding cartilage and the subchondral plate was assessed for congruity. The plug marrow signal was compared with that of

surrounding marrow and the presence of bone marrow oedema and fluid surrounding the plug sought on the coronal STIR images.

Results

The recipient site surface was congruent in 10 out of 11 patients. The subchondral plate was incongruent in 7 patients. The recipient site plug signal was decreased in 4/11 patients. Marrow oedema at the recipient site was present in 6/11 patients, although only 2 of these showed moderate or severe marrow oedema. No fluid was seen at the recipient site in any of the patients. At the donor site the articular cartilage was congruent in 7/11 patients. The donor site articular cartilage was absent in 2 patients and homogeneously iso-intense in 8/9 patients. The subchondral plate was incongruent in 3 patients and the articular surface was incongruent in 3 patients. Donor site oedema was seen on STIR sequences in 7 patients. A minimal amount of fluid was present at the donor site in 4 patients and a marked amount present in one case.

Conclusion

We have described the MRI findings following the novel surgical technique of osteochondral transplantation with donor site reconstruction. The sequences used are available on commercial MRI units.

14:20

ASSESSMENT OF BONE MARROW EDEMA AND SUBCHONDRAL LESIONS OF THE KNEE: MRI CONTROLLED OUTCOME FOLLOWING ORAL TREATMENT WITH ILOPROST OR TRAMADOL

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PURPOSE: To determine the outcome of bone marrow edema (BME) and subchondral lesions of the knee after treatment with either the prostacyclin analogue Iloprost or Tramadol in a double-blind, randomized MR imaging study.

MATERIALS AND METHODS: 29 patients with painful BME of the knee caused by early-stage osteonecrosis, osteoarthritis, bone bruise or stress were included. Written informed consent was obtained from each patient. Coronal T1-weighted and STIR images of the affected knees were obtained at 1.0 or 1.5 Tesla. After the initial MR examinations, patients were randomized either to Iloprost (n=14, group 1) or to Tramadol (n=15, group 2). The treatment duration was 4 weeks. Follow-up MR images were obtained after a period of 3 months and a second time after at least 1 year. For both baseline and follow-up STIR images, the mean relative volume and mean signal contrast of the bone marrow edema (BME) were assessed using a computer-assisted method of quantification, thus allowing accurate monitoring of BME course between baseline and follow-up examinations. In addition to quantification of BME, the presence of subchondral lesions, which are immediately adjacent to the subchondral bone and have distinct edges on T1- and T2-weighted images, was assessed.

RESULTS: Relative BME volume regression at final follow-up (after at least one year) indicated a better treatment effect in favor of Iloprost (median for Iloprost: -3.2%; median for Tramadol: -0.7%). BME signal contrast regression was similar for both groups (median for Iloprost: -9.8 grey-scale values; median for Tramadol: -9.6 grey-scale values). In regard to subchondral lesions, there was a clear trend for better healing following Iloprost treatment. The subchondral lesions in group 1 decreased distinctly from 11 at baseline to 1 at final follow-up while in group 2 subchondral lesions only decreased from 5 at baseline to 3 at final follow up.
CONCLUSIONS: Regression of BME was more pronounced in patients treated with Iloprost. In addition, healing of subchondral lesions, which have been reported to indicate lesion irreversibility, was observed in 91% of cases treated with Iloprost, as opposed to 40% of cases treated with Tramadol.

14:30

MRI ARTHROGRAPHY IN THE DETECTION OF RECURRENT MENISCAL TEARS

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Aim: To determine whether MR arthrography confers any benefit in the detection of recurrent tears when compared to conventional MR of the knee.
Materials and Methods: A prospective blinded study of 20 patients with a history of previous partial menisectomy and recurrent symptoms was undertaken.
All patients had a conventional MRI of the knee followed by an MR arthrogram..
The plain MR was interpreted first and the results recorded. Then the MR arthrogram was viewed. It was noted whether this resulted in a change of interpretation of the findings
All patients then underwent arthroscopy irrespective of the MR findings. The surgeon was not aware of any of the MR results. The results were correlated.
Results: Plain MR had a sensitivity of 66% and specificity of 90%. The addition of MR arthrogram resulted in a sensitivity of 44% and specificity of 90%
Conclusion: MR arthrography does not improve the detection of recurrent meniscal tears. The possible reasons for this and literature on the subject will be reviewed

14:40

CORRELATION BETWEEN PATELLAR VARIANCES AND CHRONIC OVERUSE SYNDROME OF THE KNEE :MRI EVALUATION

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Purpose: The aim of this study was to examine and show the correlation between variences of patella and chronic overuse syndrome of the knee(iliotibial band friction syndrome /ITBFS) detected with magnetic resonance imaging.
Materials and Methods:22 knees of 20 patients(7 Female,13 Male) suffering from iliotibial band friction syndrome detected with routine MRI were evaluated retrospectively.

1.5 Tesla magnetic resonance device was used .Axial /coronal T2 weighted images with fat suppression,saggital T1/T2 weighted images were examined.
Findings: Findings of MRI in the ITBFS were ; localized fluid collection deep to the ITT, thickening of the ITT,focal contusions of the anterior part of the lateral femoral condyle due to kissing of cartilage layers of the lateral patellar facet and the anterior part of the lateral femoral condyle , decreased lateral patello-femoral joint distance, and fair lateral movement of the patella in the axial plane.One senior an one junior radiologist evaluated the MR images at the same time and when two or more of these signs were detected then, patellar positions and shapes were noted in order to show correlation between patellar variences and ITBFS.
Results:9 knees of the patients had Wiberg's type II (%41) ,6 knees of the patients had type I(%27) and 7 knees of the patients showed type III patellar shapes .(%32)
5 patients had patella alta(%22) whereas all others stayed in normal range as patellar position.
In 13 patient's case no other abnormalities were seen apart from ITBFS and 6 of them had shown type III patellar shape.
8 patient have had some extra pathology besides ITBFS such as meniscal degenerations-tears,wide femoral contusions,popliteal cysts and chondromalaciae.
.
Discussion -Conclusion:
People having Wiberg type III patella and/ or alta variation are more susceptible to improve ITBFS as their ratio in our limited patient group was higher than the normal population.

14:50

MRI OF THE POPLITEOFIBULAR LIGAMENT: ISOTROPIC 3D WATER EXCITATION DOUBLE ECHO STEADY-STATE (WE DESS) VS. CORONAL OBLIQUE FAT-SUPPRESSED T2-WEIGHTED MRI.

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Chelsea and Westminster Hospital, London, United Kingdom

Purpose: Injury to the posterolateral corner of the knee usually occurs in association with injury to the cruciate ligaments. An unrecognised posterolateral corner injury may lead to post-operative graft failure or persistent rotatory instability if not treated at the time of cruciate repair. The popliteofibular ligament (PFL) is considered to be the most important restraining structure of the posterolateral corner. The purpose of this study is to determine if the PFL can be identified using isotropic 3D water-excitation DESS gradient echo MRI and to compare this sequence with coronal oblique fat-supressed T2 weighted images (STIR or Fast-saturated T2 turbo spin echo). The presence of an acute cruciate injury in the ability to identify the PFL has also been assessed.
Materials and Methods: A prospective analysis of patients referred for MRI of the knee following acute trauma was performed. MRI findings were correlated with clinical evaluation, MUA, arthroscopy, and open surgery when performed. Subjects were imaged on 1.5T MRI using isotropic WE DESS volume acquisition through the whole knee and a coronal oblique STIR or fat-saturated T2 – weighted fast spin echo sequence through the posterolateral corner. All images were assessed on the MRI viewer by two musculoskeletal radiologists. The presence of the popliteus and biceps

femoris tendons, lateral collateral and PFL was documented. 10 volunteers with no history of knee trauma were imaged to evaluate these structures in normal individuals (controls). 119 patients with acute knee trauma were evaluated. The study group was analysed as a whole then sub-divided into those with, and those without, cruciate ligament injury.
Results: The lateral collateral ligament, biceps femoris and popliteus tendon were identified in all cases on all sequences. In the control group, the PFL was seen in 9/10 and 5/10 on the WE DESS and coronal oblique T2-weighted sequences respectively. In the study group, the PFL was seen in 105/119 (88%) cases on the WE-DESS images and 82/119 (69%) cases on the coronal oblique T2-weighted images ($p<0.001$). In those patients with cruciate ligament injury, the PFL was seen in 20/24 (83%) and 17/24 (71%) of the WE DESS and coronal oblique T2-weighted sequences respectively ($p=0.1$). In those without cruciate injury, the PFL was identified in 79/86 (92%) and 61/86 (72%) on the WE DESS and coronal oblique T2-weighted sequences respectively.
Conclusion: Isotropic 3D- WE- DESS MRI significantly enhances our ability to identify the popliteofibular ligament when compared to conventional coronal oblique fat-supressed T2- weighted images.

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13:20
DIAGNOSTIC ACCURACY OF PERCUTANEOUS BIOPSY OF INTRAMEDULLARY LYTIC BONE LESIONS

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The Royal National Orthopaedic Hospital NHS Trust, London, United Kingdom

PURPOSE: Primarily to determine the diagnostic accuracy of image-guided percutaneous biopsy of intramedullary lytic bone lesions. As a secondary objective, we assessed the value of obtaining blood clots as diagnostic material while performing core biopsies on intramedullary lytic bone lesions.
MATERIALS AND METHODS: Four hundred patients with intramedullary lytic bone lesions underwent image guided percutaneous needle biopsy using fluoroscopy, computed tomography (CT) or ultrasound (US). Two hundred and fifty six of these patients had a subsequent surgical procedure and surgical histology was available in theses cases. Analysis of biopsy results included if the lesion was neoplastic or non-neoplastic, benign or malignant and the histological type. The type of specimen obtained at needle biopsy for each of these cases was also noted from the histopathological records.
RESULTS: The positive predictive value for malignancy was 99% and the negative predictive value for malignancy was 96.5%. The overall diagnostic accuracy of needle biopsy was 85%. In 36 of the 400 cases, needle biopsy failed to provide lesional tissue, giving a failed biopsy rate of 9%. Of the lesions where needle biopsy failed to provide lesional tissue, only two eventually were proven to be malignant lesions. In

40 of the 45 cases where the specimen consisted mainly of blood clot and surgical histology results were available for comparison, diagnostic accuracy of biopsy was 89%.
CONCLUSION: Percutaneous needle biopsy of lytic bone lesions has a high diagnostic yield. Also, diagnosis from aspirated blood clots obtained from such lesions is possible in approximately 90% of cases.

13:30

RADIOFREQUENCY ABLATION (RFA) IN THE TREATMENT OF OSTEOID OSTEOMA – MID TERM RESULTS

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Purpose:
The aim of our study was to determine the efficacy of thermal ablation in the treatment of osteoid osteoma and the mid term results regarding complication rate of the procedure and duration of pain relief.

Materials and methods:
Within 3 years 18 patients (10 male, 8 female, age 9 to 45 years) suffering from osteoid osteoma were treated using RFA. In children the treatment was performed under general anaesthesia while in adults analgo-sedation together with local anaesthesia was preferred.
In 8 of 18 patients the OO were localized in the lumbar (5 of 8) or thoracic spine (3 of 8), whereas the other OO were located in the femur (5 of 10), the acetabalum (2 of 10) or other long bones (radius, tibia).
For treatment we used two different RF – systems. 6 patients were treated with the RITA system (RITA medical systems, Mountain View, USA) using a RITA starburst SDE needle (diameter 1 cm) and 12 patients with the Radionics system (Tyco Healthcare, Burlington, USA) using a single electrode. Ablation protocols were adapted from the protocols suggested by the manufacturer of the RF – systems. Ablation periods of 5 to 8 minutes at a temperature of 90^{o}C were used.
Prior to ablation the access path was created either by using a bone biopsy canula or by using a drill. Cooling of the skin using ice-packs was performed in osteoid osteoma next to the skin (tibia, radius) and an additional needle was inserted to perform cooling by saline flushing if the OO was next to nerval structures (spine).
Primary success rate, complications, the disease-free interval and the follow-up time were evaluated.
Results:
Within the observation period of up to 36 months (3-36 months) all of our patients were successfully treated and had no more complaints. 15 of 18 patients were free of pain after the first ablation while in 3 patients the ablation had to be repeated to obtain complete response. No major complications occurred. In 2 patients minor complications (1 hematoma, 1 skin burn degree 1) were observed.
Conclusions:
Radiofrequency ablation is a highly effective, efficient, minimally invasive and safe method of treating osteoid osteoma.

13:40

OSTEOID OSTEOMA: ROLE OF DYNAMIC MRI IN DEFINITION OF THE SUCCESS AFTER CT-GUIDED RADIOFREQUENCY THERMAL ABLATION

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Purpose: To evaluate the role of dynamic Gadolinium-enhanced MRI (D-MRI) in the nidus detection of osteoid osteoma (OO) and in the assessment of the results after radiofrequency (RF) thermal ablation.
Materials and Methods: Twenty-five patients with histologically proven OO underwent MRI before and 6 months after percutaneous CT-guided RF ablation. MRI protocol included a conventional study (C-MRI: SE-T1w, GRE-T2w and FSE-IR) and D-MRI (FastSPGR-T1w) after Gd injection. MRI images were evaluated to assess bone oedema and joint effusion on C-MRI, and degree of nidus contrast uptake on D-MRI.
Results: Pre-procedural C-MRI revealed specific abnormal findings in all cases, with clear nidus delineation only in 9; at D-MRI, early and high contrast uptake allowed accurate nidus identification in 20/23 cases. After treatment, 8 patients reported persistent pain. In these cases, where persistent oedema and nidus contrast uptake was identified, patients underwent further treatment. In asymptomatic patients and in patients reporting residual discomfort not requiring medical therapy after treatment, D-MRI did not demonstrate residual nidus contrast uptake, and C-MRI showed reduction of bone edema and joint effusion, allowing definition of success. Moreover, in 9 cases of successful treatment, C-MRI showed an area of apparently normal bone marrow delineated by a rim recalling osteonecrosis in the site of previous RF ablation.
Conclusion: D-MRI allows nidus detection in OO. After RF ablation, MRI enables accurate assessment of results, and D-MRI is able to differentiate a persisting active nidus from bone oedema and signal intensity bone alteration related to the treatment.

13:50

RF ABLATION IN OSSEOUS METASTASES. AN EFFECTIVE TOOL IN PAIN PALLIATION.

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Red Cross Hospital, Athens, Greece

Purpose: To evaluate the efficacy of RF ablation in painful skeletal metastases.
Material and Method: In a two and a half-year period we treated with RFA technique 26 patients with skeletal metastases (23 from gastrointestinal tract carcinoma, 7 from lung carcinoma, 1 from thyroid follicular carcinoma, 2 from breast, and 1 from urinary bladder carcinoma). We ablated 34 lesions (3 scapular, 13 iliac, 8 sacral, 7 costal, and 3 lumbar) in 41 sessions.
We used RITA generator and a hooked electrode. The ablation lasted 15-20 minutes.
No complications occurred.

Results: We had total necrosis in 29(85,3%) lesions, and partial necrosis in 5 (14,7%). We detected peripheral scleroses in 16(47%) lesions. The 6-month follow-up revealed recurrence in three lesions (8,8%) that were treated again with a second session.
We had no complications. All patients (100%) had elimination of their pain symptoms. Ten patients complained for mild pain during ablation.
Conclusion: RFA is a minimally invasive technique with no late complications (as we observed in radiation therapy) that can be used as an alternative treatment in skeletal metastases with very good results in pain control and in amelioration of patient's life quality.

14:00

PRE-OPERATIVE EMBOLISATION, NOT WITHOUT AN OCCASIONAL RISK!

M K Sayana, S Bandi, A Bing, V Jasani, C K Jadun
University Hospital of North Staffordshire, Stoke-on-Trent, United Kingdom

Purpose:
To highlight the interdisciplinary approach to the complex management of musculoskeletal tumours and present a complication encountered in one such case.
Background:
Transcatheter embolisation of musculoskeletal tumours prevents major blood loss during surgery, provided the operation was carried out within three days.
Case report:
38-year-old man underwent a planned preoperative embolisation of a suspected peripheral nerve sheath tumour, which was located in the paravertebral gutter of the left hemithorax, measuring 16cm × 11 cm and causing cord compression at D11 and D12. He underwent preoperative vascular hemostatic embolisation followed by debulking of the tumour, D10 and D11 corpectomy and anterior reconstruction of the spine.
On the 3rd postoperative day, patient developed pseudo-obstruction. Abdominal radiograph showed dilated bowels and a coil mass on the right side of the L2 vertebra. Further CT scan evaluation revealed the coil mass blocking a segmental artery of the right kidney leading to infraction of the anterior half of the middle part of the right kidney. Patient recovered with conservative treatment and his renal function was never abnormal throughout the peri-operative period.
Discussion:
Pre-operative embolisation of the tumour decreases the vascularity of the tumour and thereby decreases the intra-operative blood loss and increases the speed of surgery. We encountered a rare complication in which, a packed bunch of embolization microcoils used to block an intercostal artery placed reasonably deep in the feeding intercostals artery via a microcatheter migrated into the aorta and blocked the contralateral right renal segmental artery that resulted in post-operative pseudo-obstruction.

14:10

ROLE OF ANGIOGRAPHY IN DIAGNOSING RARE COMPLICATIONS OF FRACTURE NECK OF FEMUR FIXATION

G K Kakarala, L Van Rensburg, M Parker
Peterborough District Hospital, Peterborough, United Kingdom

Purpose:

Internal fixation of fracture neck of femur is a routine surgical procedure in trauma theatre lists. We report an unusual case of Pseudo aneurysm of the lateral circumflex femoral artery following fixation of an undisplaced intra capsular neck of femur fracture.

Material and Methods:

A seventy-five year old retired rail worker presented with an undisplaced intracapsular fracture of his right neck of femur following a low energy fall. He underwent surgery the following day, the fracture was stabilized using three cannulated AO screws, inserted percutaneously under Image Itensifier. His immediate postoperative recovery was uneventful and he was discharged home on the sixth postoperative day. One week later, he complained of pain and swelling of right thigh. His Hb was 7.3 g/dl and coagulation profile was normal. An Ultrasound venogram showed no evidence of deep vein thrombosis. He was transfused two units of blood and discharged home with a post transfusion Hb of 10.4 g/dl. He was reviewed a week later with fainting episodes. At this time his Hb was 8.1 g/dl. On examination he had a swollen thigh, normal pulses and no pulsatile masses over the thigh or femoral triangle.

Results:

The diagnosis of a pseudo aneurysm of the femoral vessels was considered and a repeat Ultrasound and MRI scan showed a large haematoma from the groin with unknown origin. Two weeks later he presented with further swelling and an Hb of 8.3 g/dl. An angiogram at this time revealed a pseudoanuerysm of the lateral circumflex femoral artery. The vessel was embolised using an intravascular coil and the pseudo aneurysm occluded.

Conclusions:

Pseudo aneurysm following fractures around the proximal femur is rare, yet well recognised complication. Clinical evaluation is not always accurate in diagnosing pseudoaneurysms.The classic signs of arterial injury such as pulse deficit, bruit, arterial bleeding and expanding or pulsatile haematoma may be absent despite significant damage to the arterial wall. It has been suggested duplex ultrasound is accurate in diagnosis of vascular lesions however its operator dependant and did not demonstrate the aneurysm in our case. We would suggest angiography as the investigation of choice as this allows for definitive diagnosis and treatment.

14:20

ULTRASOUND GUIDED AUTOLOGOUS BLOOD INJECTION FOR TENNIS ELBOW

D Connell, M Ahmad
Royal National Orthopaedic Hospital, London, United Kingdom

PURPOSE

Tennis elbow or lateral epicondylitis are terms used to describe a syndrome of pain over the common extensor origin of the extensor muscles of the forearm at the lateral epicondyle. Recently autologous blood injection has been used for the treatment of

lateral epicondylitis[3]. We thought that to adapt the technique by also using ultrasound guidance to accurately identify the location of the injection may improve the outcome in patients with refractory tennis elbow.

METHODS

Thirty five consecutive patients with lateral epicondylitis were recruited into the study. Tendinopathy was identified as areas of low reflectivity with preservation of tendon fibres and vascularity within these areas.

Autologous blood was injected directly into the affected tendon under ultrasound guidance of the extensor tendon origin. Patients were asked to rate their pain on a visual analogue scale. In addition they categorised themselves according to the Nirschl staging 0-7. The pain and Nirschl scores were recorded prior to the procedure, followed by assessment at four weeks and six months.

RESULTS AND CONCLUSIONS

A total of 35 patients with a mean age of 40.9 years (age range 26-59) were recruited. There were 23 men and 12 women. The mean time of symptoms was 13.8 months (range 6-48 months).

The mean visual analogue pain score prior to the treatment was 8.89 (range 6-10). The mean Nirschl score prior to the treatment was 6.22 (range 4-7). Following the treatment the mean VAS score was 5.17 and 0.84 at 4 weeks and six months respectively. The Nirschl score was 3.4 and 0.69 at 4 weeks and six months respectively.

We feel the combined action of the blood and the use of ultrasound to direct the injection into the areas of abnormality in the tendon improve the outcome in patients as demonstrated by the significant fall in pain scores in this group of patients.

14:30

ANALYSIS OF THE CHANGES IN ULTRASOUND EXAMINATION AFTER SHOCK WAVE THERAPY ON CHRONIC ACHILLES TENDINOPATHY

P Lakshmanan, K Lyons, DP O'Doherty
University Hospital of Wales, Cardiff, United Kingdom

Background:

Extra-corporeal shock wave therapy (ESWT) has gained importance in the treatment of chronic Achilles tendinopathy (CAT) during the last few years. However the results analysed until now focussed on the improvement of symptoms after ESWT. We aimed to evaluate the ultrasonographic changes in CAT after ESWT.

Material and Methods:

This prospective study performed between the period August 2003 and March 2004 included 21 cases of CAT in 19 patients. All had pre-therapy ultrasound examination, and had three sessions of radial ESWT, one week parting each session. Post-therapy ultrasound examination was performed at the end of six weeks after the third session of ESWT. Ankle hindfoot scale (AHS) was used to evaluate the functional outcome.

Results:

The lesion was located in the middle-third of the tendon in 19 cases. The pre-therapy thickness of the lesion decreased from 9.4 + 1.9 mm to a post-therapy thickness of 8.2 + 1.8 mm ($p < 0.001$; 95% C.I. +0.7 to +1.7). Abnormal hypervascularity was seen in the lesion in 57% of the cases before the therapy and in 14% of the cases after the therapy. None of the lesions showed new appearance or

increase in the hypervascularity after ESWT. Persistent hypervascularity after the therapy was associated with poor AHS score. Improvement was also noted with the appearance of paratenon inflammation after the therapy.
Conclusions:

ESWT produces significant improvement in ultrasonographic findings in the lesions of chronic Achilles tendinopathy. Significant decrease in hypervascularity in the lesions is associated with good functional outcome. Ultrasound is an useful tool in evaluating the effects of shockwave therapy and can be used to determine whether the condition is responding to treatment or not.

14:40

CT-GUIDED OBTURATOR NERVE BLOCK VIA POSTERIOR APPROACH: A PILOT STUDY

CV House, DA Connell
Royal National Orthopaedic Hospital, Stanmore, United Kingdom

Purpose: The objective of this study was to describe the technique of obturator nerve block via the posterior approach, under CT guidance and to evaluate the efficacy of the procedure in the short-term and mid-term relief of chronic hip pain.
Materials and Methods: Under CT guidance, via a posterior approach through the pelvis with the patient lying prone, a 22G long spinal needle was positioned adjacent to the obturator nerve in the obturator canal. Infiltration of bupivicaine and steroid was performed in this manner on 51 consecutive patients (19 male, 32 female), mean age 54 years, with mainly arthritic hip pain which was unresponsive to conventional treatment. Patients were assessed using Visual Analogue Score of pain before the procedure and at 30 mins, 24 hours, 1 week and 3 months thereafter.
Results: Pain scores within 30 mins showed a decrease from a mean score of 8.41 (SD=1.22) to 2.86 (2.1), $p<0.001$. At 24 hours, the mean pain score was 2.06 (1.76), a decrease of 76% from pre-procedural score, $p<0.001$. Sustained pain relief at 1 week was attained in 92% of patients, with mean pain score of 2.41 (2.2), $p<0.001$. Eighty-two per cent of patients experienced lasting benefit at 3 months, with a mean pain score of 3.80 (2.94), $p<0.001$. Follow-up data was complete for all 51 patients. No serious side-effects were reported.
Conclusions: In patients with hip pain refractory to conventional pain control measures, CT-guided obturator nerve block can provide relief from pain in the short to medium term. The posterior approach offers safe, reliable and effective access to the nerve, in a procedure which is well-tolerated by the patient.

14:50

A NATIONAL UK WEB-BASED DATABASE DEVELOPED FOR AUDIT OF PERCUTANEOUS VERTEBROPLASTY BY THE UK VERTEBROPLASTY GROUP.

RSD Campbell[1], D Lynch[2]
[1] Royal Liverpool University Hospital, Liverpool, United Kingdom, [2] Dept of Information Technology, RLBUHT, Liverpool, United Kingdom

The National Institute of Clinical Excellence (NICE) published guidance on percutaneous vertebroplasty (PVP) in September 2003. This advice included the statement "...provided normal arrangements are in place for audit and clinical governance." As a result of this advice, it was evident that a web-based database would be useful tool to measure outcome scores in PVP, providing a means for an individual to audit outcomes of their patients, and compare those outcomes with a national average.

A web-based system has been developed using Microsoft's ASP web development platform to code a web application which can be accessed via any standard web browser such as Internet Explorer, Firefox or Netscape. The ASP application is written in VBscript and is hosted on the Trust's internal web farm servers, and runs on a website that is accessible from NHSnet. Data is stored in a Microsoft SQL server database which is hosted on the Trust SQL cluster; this provides stability and superior performance by using a number of servers in tandem for fault.
Users are provided with a password and operator code by the administrator which keeps the site secure from unauthorised users.
The system allows the users to enter PVP case data via web forms and generates automatic follow up reminders after 1 month and 1 year to monitor the success of the procedure. The resulting data is anonymous and can then be used for reporting and analysis.
The system does not allow users to view cases entered by any other users for security reasons and security from the wider Internet is maintained by the systems location on NHSnet.
The database contains 8 separate tables each of which is linked by either a Case ID number or Operator ID number. It is a standard mutli-table relational database. The tables include generic patient data, radiology data, and pre-and post assessment data as well as procedural details.
This system provides a framework upon which other national databases could be developed.

FRIDAY PM 15:30 to 17:10

Rhodes Trust Theatre

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15:30

IS MRI SCAN NEEDED TO RULE OUT OCCULT FRACTURES OF THE HIP IN ALL NON-WEIGHT BEARING ELDERLY PATIENTS?

P Lakshmanan, A Sharma, K Lyons
University Hospital of Wales, Cardiff, United Kingdom

Background

Non-weight bearing hip is a common problem in the elderly population after minor falls. Magnetic reasonance imaging (MRI) is used to diagnose occult fractures in the hip and the pelvic ring in these individuals. The aim of this study is to find the

relationship between the incidence of occult fractures in the hip and that in the pelvic ring following low velocity trauma in the elderly.

Material and Methods

Between January 2000 and February 2004, 106 consecutive elderly patients (mean age = 81.4 years; range = 67-101 years), presented with non-weight bearing hips after a history of trivial trauma. All of them had plain radiographs of their pelvis and orthogonal radiographs of the hip which revealed no fracture of the hip. However, eight patients had fracture of the pubic rami visible on plain radiographs. MRI scans of the pelvis and the hips were performed in them subsequently.

Results

Out of the 106 patients, 17 (16%) had intracapsular neck of femur fracture, 26 (24.5%) had extracapsular neck of femur fracture, 26 (24.5%) had pubic rami fracture, 17 (16%) had sacral fractures, and 37 (34.9%) had no fractures. In 10 patients there was significant soft-tissue injury with no fractures. All the sacral fractures occurred in patients with pubic rami fractures. Further except in one patient where the pubic rami fracture and the sacral fracture were contralateral, the remaining 16 patients had ipsilateral pubic rami and sacral fractures. None of the patients with pelvic ring fracture had associated femoral neck fracture.

Conclusion

Inability to weight bear after a fall is a common presentation in the elderly population. Falls can lead to fracture neck of femur or a fracture of the pelvic ring but seldom both. We can also conclude that in an elderly patient with low velocity injury, if a fresh pelvic ring fracture is detected in the plain radiograph there is no indication for further MRI to rule out femoral neck fracture. Further, the fracture in the anterior and posterior pelvic ring commonly involves the same side than the contralateral side, in the elderly after trivial trauma.

15:40

THE BRISTOL HIP VIEW – A NEW RADIOGRAPHIC PROJECTION FOR FEMORAL NECK FRACTURES

M Shaw, M Bradley, D Fox

[1] Bristol Royal Infirmary, Bristol, United Kingdom, [2] Southmead Hospital, Bristol, United Kingdom

Purpose

This experimental study is to evaluate a modified radiographic view of the femoral neck in the assessment of femoral fractures.

Materials and methods

A dry femur and pelvis was set up in a rig to simulate the positioning of a routine AP pelvis xray view. Films were exposed to create a routine AP pelvis, AP hip and two views with external tube angulation of 15° and 30°. Observers were asked to evaluate the films using a visual analogue score on two separate occasions. The same films were performed on a further fractured femoral neck to assess the fracture clarity.

Results

There was good intra-observer and inter-observer correlation.

Observers ranked the 15° and 30° angled films as showing the femoral neck most clearly, over and above the traditional views ($p<0.001$). The

fracture was best demonstrated on the 30° angled film ($p<0.001$).
Conclusion
The 30° angled view appears to demonstrate the femoral neck anatomy more clearly than the traditional views but also showed increased fracture sharpness. The authors are proceeding to a clinical trial to assess this in trauma practice.

15:50

ESTIMATION OF PELVIC TILT ON AN ANTEROPOSTERIOR PELVIC RADIOGRAPH – A COMPARISON OF SIX METHODS

M Tannast[1], SB Murphy[2], SE Anderson[3], KA Siebenrock[1]
[1] Department of Orthopaedic Surgery, University of Berne, Berne, Switzerland, [2] Center for Computer Assisted and Reconstructive Surgery, Tufts University, Harvard Medical School, Boston, United States, [3] Department of Diagnostic, Interventional and Pediatric Radiology, University of Berne, Berne, Switzerland

Purpose: Variation in pelvic position can drastically affect the image of anteroposterior radiographs and compromise the accuracy of radiographic measurements. Increased or decreased lumbosacral lordosis in particular can affect pelvic tilt and largely affect the contour of the native acetabular rim and the position of the prosthetic acetabular cup. These variations impede the accurate measurement of prosthetic cup orientation and objective interpretation of acetabular malformations, particularly acetabular retroversion and excessive acetabular overcoverage. A simple method of correcting for variations in pelvic tilt on plain radiographs would potentially improve the clinician's ability to diagnose malformations of the acetabulum, and post-operative position of the prosthetic acetabulum.
Material and Methods: In order to determine the best method of correcting for pelvic tilt, 6 previously described parameters for tilt estimation were measured prospectively on AP pelvic radiographs of 104 patients and compared to the actual pelvic tilt as measured on corresponding lateral radiographs. The parameters were: 1. the distance between the upper edge of the symphysis and the mid of the sacrococcygeal joint; 2. the distance between the upper edge of the symphysis and a line connecting both femoral head centers; 3. the projected distance between the upper edge of the symphysis and a line connecting the lower ends of the sacroiliac joints; 4. the ratio between the vertical and the horizontal diameter of the pelvic foramen; 5. the ratio between the maximum vertical diameter and the maximum horizontal diameter of the obturator foramen; and 6. the ratio between the maximum height of the obturator foramen and the line connecting the teardrops. Linear regression analysis was performed to detect the best parameter for pelvic tilt.
Results: Linear regression analysis revealed that the projected distance between the upper border of the symphysis and the center of the sacrococcygeal joint was the most reliable tilt indicator both for men ($R = 0.68$, $p < 0.001$) and women ($R = 0.63$, $p < 0.001$). Based on this correlation, a easy-to-use nomogram for correction of prosthetic acetabular cup orientation was derived.
Conclusions: The distance between the upper border of the symphysis and the sacrococcygeal joint is not only the easiest and fastest parameter to measure pelvic tilt, it is also the most reliable in comparison to other parameters described in literature. The derived nomogram enables fast, tilt-corrected cup version

measurements in clinical routine use. For tilt-correction of the native irregular acetabular rim, computerized methods have been developed.

16:00

DEFINING THE PREDISPOSING FACTORS AND IMAGING CRITERIA FOR FEMOROACETABULAR IMPINGEMENT

DP Beall[1], CL Lastine[1], CF Sweet[1], JR Webb[1], DE Grayson[2], JQ Lee[2], JR Fish[1]
[1] Univerisity of Oklahoma College of Medicine, Oklahoma City, United States, [2] Wilford Hall Medical Center, Lackland AFB, United States

Purpose: To illustrate the imaging appearance found in patients with femoroacetabular impingement (FAI) and to define the anatomic criteria for this diagnosis across multiple modalities.
Methods: Femoroacetabular impingement occurs secondary to various anatomic anomalies of the femoral head neck junction and acetabulum. Patients with clinical signs and symptoms of impingement have been found to have characteristic radiologic and anatomic characteristics that predispose them to the development of this impingement process. Measurements and morphologic observations of FAI were determined by evaluation with plainfilm radiography, computed tomography, and magnetic resonance imaging.
Results: Anatomic findings of FAI included a decreased tapering at the femoral head neck junction (decreased femoral head-neck offset) and a reduction in femoral anteversion. Primary radiologic findings of FAI included reduced concavity of the anterolateral femoral head-neck junction, an abnormal femoral head to neck ratio, differences in scaled width of the femoral neck, and a convex appearing femoral head-neck junction that may be quantified with the α angle measurement. Secondary findings of seen in patients with anatomic evidence of FAI include anterosuperior acetabular labral tears, adjacent impaction injury to the anterolateral femoral head/neck junction, lateral acetabular cartilage damage (with or without early onset degenerative arthritis), and synovial herniation pits.

Conclusion: The process of femoroacetabular impingement is based on an impaction phenomenon resulting from anatomic anomalies of the acetabulum and proximal femur. These anomalies have typical appearances on plainfilm radiography and cross sectional imaging and may be divided into primary and secondary imaging findings. The recognition of these anatomic criteria and imaging findings may result in the proper characterization of FAI and an expedited process of treatment.

16:10

MR *ARTHROGRAPHY* IN FEMOROACETABULAR IMPINGEMENT SYNDROME: FINDINGS IN 50 PATIENTS WITH SURGICAL CORRELATION

S.B. Rai, D Griffin
University Hospital of Coventry and Warwickshire, Coventry, United Kingdom

PURPOSE:
To assess characteristic MR ***ARTHROGRAPHY*** findings in patients with femoroacetabular impingement syndrome.

MATERIALS AND METHODS:
MR ***ARTHROGRAPHY*** of 50 consecutive patients with surgically proven femoroacetabular impingement were analyzed for labral abnormalities, cartilage lesions, femoral waist deficiency and osseous abnormalities. The femoral waist as well as the acetabular depth were quantitatively assessed.
RESULTS:
In 70% of patients the main cause of femoroacetabular impingement was femoral, in 30% of patients the main cause was acetabular. Anterior labral lesions were seen in almost all (94%) patients (tears 58%, degeneration 40%). Superior labral lesions were found in 84% (tear 54%, degeneration 41%). Posterior labral lesions were seen in 38% (10% tear, 28% degeneration) ,82% of patients had an anterior waist deficiency, 34 % a lateral femoral waist deficiency. In approximately 16% an acetabular retroversion and in 18% a deep acetabulum was seen. Anterior acetabular cartilage lesions were seen in 68%/18% (labral-acetabular junction/ medial articular cartilage).
CONCLUSION:
Characteristic MR ***ARTHROGRAPHY*** findings of femoroacetabular impingement are anterior femoral waist deficiency, anterior and superior labral lesions and cartilage lesions at the labral-acetabular junction. Also osacetabuli,femoral head and acetabular developmental dysphasia's are common findings in the femoroacetabular Impingement syndromes.

16:20
LEG-LENGTH INEQUALITY AND HIP OSTEOARTHROSIS

M Lohman, K Tallroth, M Ylikoski
ORTON Orthopaedic Hospital, Helsinki, Finland

Purpose:
To evaluate a possible association between a difference in leg length and osteoarthrosis in the hip.
Materials and methods:
One hundred consecutive patients undergoing arthroplasty for primary hip osteoarthrosis were studied with weight bearing plain radiographs before the operation. The mean age of the patients was 69 years (age range 38-88 years) and 52 were women, 48 men.
The difference in leg length, the pelvic tilt and the severity of osteoarthrosis were recorded from weight bearing radiographs. A plumb line was used for vertical reference. The measurements are explained in the oral presentation. Measurements were made by two senior Musculoskeletal Radiologists.
Results:
Severe osteoarthrosis was more common in the longer leg.
Of the 100 patients 19 showed no difference in leg length.
In 39 patients the right leg was longer, and in 42 the left.
In 68 patients the hip arthroplasty was performed in the longer leg and for 13 patients in the shorter leg.
Conclusions:
According to our study primary hip osteoarthrosis occurs more frequently in the longer leg. Further imaging studies of this issue should be conducted.

16:30

LATERAL VIEWS OF THE HIP - NOT HELPFUL IN THE PRE-OPERATIVE PLANNING OF INTERTROCHANTERIC FRACTURES

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[1] Unicersity Hospital of North Staffordshire, Stoke-on-Trent, United Kingdom, [2] Weston General Hospital, Weston-Super-Mare, United Kingdom

Introduction:
Hip fractures are common in orthopaedic and trauma practice. Intertrochanteric fractures are seen in elderly patients and are the most common fractures of proximal femur. These are traditionally assessed by 2 views of the hip - AP and lateral. AP view helps identifying the fracture, fracture pattern, and allows comparison with opposite hip. A lateral view is supposed to confirm the fracture and identify the posterior communition and predict if the fracture is stable or not. It is not uncommon to see inadequate or poor quality lateral views in these patients.

Materials and Methods:
We retrospectively reviewed x-rays of consecutive patients admitted with Intertrochanteric fractures for six months. The x-rays were retrieved from film library and were reviewed by 2 independent reviewers. Poor quality or inadequate films were defined as the films, which needed the spot light or did not include the whole part of interest in the x-ray.

Findings:
In all 80 patients were studied, all underwent D.H.S. fixation.
- 76(95%) patients had an adequate AP view.
- 43(54%) patients had an adequate lateral view.

Conclusion:
The decision to go ahead with D.H.S. fixation was made in all these patients whether they had a good pre operative lateral view of the hip or not.

These patients underwent DHS fixation on the fracture table under x - ray control and the fracture was manipulated to a satisfactory position before internally fixing the fracture.

From this audit we concluded that lateral view should not be attempted
1.If an Intertrochanteric fracture is clearly visible on AP view.

A lateral view would required if:
1.The AP view does not show a clear fracture line.
2.If the fracture is a intracapsular fracture neck of femur.

Cutting down the lateral views -
- Saves the patients from the painful experience of having a lateral view.
- Cost saving measure

16:40

POSTOPERATIVE MRI EVALUATION OF PATIENTS WITH SLIPPED CAPITAL FEMORAL EPIPHYSIS

T Pudas, K Mattila, E Svedström, T Hurme
University of Turku, Turku, Finland

Purpose
The purpose of the study was to use MR imaging for evaluation of the position of titanium screws in femoral head used for the treatment of slipped capital femoral epiphysis (SCFE).
Introduction
SCFE is a rather common disorder, it occurs during the adolescent growth spurt and is most frequent in obese children, especially boys. Up to 40 percent of cases are bilateral. The cause of the SCFE may be traumatic but more commonly it is an idiopathic disorder. Epiphysis of the femur usually slips off through the physeal plate in a backward direction. SCFE is suspected based on symptoms and the diagnosis is usually confirmed using plain films. The physical examination will show restricted range of motion. The treatment of choice is operative fixation at least in unstable cases. The head is fixed through the femoral neck to prevent it slipping further. The screws should not penetrate through the articular hyaline cartilage. However, it may be difficult to define the exact site of the screws using fluoroscopy during the operation. We obtained postoperative MRI in order to determine the screw position in the femoral head.
Materials and methods
Four patients with slipped epiphyses were taken postoperatively to MR examination, three girls (10, 10 and 11 years of age) and one boy (14 yrs). Two patients had had bilateral operations. In all patients fixation was performed using two titanium screws. 0,23 tesla open configuration MR scanner was used for the imaging. Coronal T1 weighted spin echo (SE) (TR/TE, 460 ms/24 ms, slice thickness 3 mm) and oblique sagittal T1 weighted gradient recalled echo (GRE) (TR/TE, 28 ms/9 ms, FA 45 degrees) images were obtained. One patient was additionally imaged in a 1,5Tscanner.
Results
The contour of titanium screws was delineated well and the place of the screws was easy to estimate in MRI. In two patients the screw penetrated the articular surface. After re-operation, control MRI verified exact position of the screw tip inside the femoral head. On SE sequences the screws produced less artefacts than on GRE. Using a 1,5 T scanner the artefacts were more pronounced and the estimation of the screw position was more difficult than in 0.23T.
Conclusions
Postoperative MRI is recommendable to patients treated with titanium screws due to slipped capital femoral epiphysis. Based on our results we are developing a method to treat epiphyseolysis using MRI guidance.

16:50

ASYMMETRIC CLOSURE OF THE ISCHIOPUBIC SYNCHONDROSIS: A PHYSIOLOGICAL PROCESS CLOSELY CORRELATED WITH FOOT DOMINANCE

A.M. Herneth, M.L. Pretterklieber, K.M. Friedrich, F.M. Kainberger, C. Czerny, H. Imhof
Medical University Vienna, Vienna, Austria

Objective.
The enlarged ischiopubic synchondrosis is a well known anatomical structure, however, little is known about its physiology. In early childhood enlargement of this synchondrosis occurs bilaterally, whereas before complete ossification it is frequently found unilaterally. In the vast majority of children unilateral enlarged ischiopubic synchondrosis is observed in the left hemipelvis, which is hitherto unexplained. During common athletic activities increased ground reaction forces are exerted onto the weight bearing non dominant limb, which is in up to 87% of the general population the left leg, which may explain the distinct closure sequence of this "temporary joint". The purpose of this study was to correlate unilateral enlarged ischiopubic synchondrosis with foot dominance.
Materials and methods.
The study cohort consisted of 32 children, who were underwent unenhanced radiography, CT, or MRI for reasons other than bone disorders, and who presented with enlarged ischiopubic synchondroses. In these children the distribution of enlarged ischiopubic synchondrosis and foot dominance was evaluated either retrospectively (n=11) or prospectively (n=21).
Results.
In this cohort, 78% of patients were right-footed and 22% were left-footed. Nine of the 32 children presented with unilateral enlarged ischiopubic synchondrosis (left: seven (78%) of nine; right: two (22%) of nine). All children with enlarged left ischiopubic synchondrosis were right-footed and all children with enlarged right ischiopubic synchondrosis were left-footed.
Conclusion.
Asymmetric closure of the ischiopubic synchondrosis is a physiological process, which is closely correlated with foot dominance.
Unilateral ischiopubic synchondrosis is indicating delayed ossification of this "temporary joint", which is due to increased mechanical forces applied to the non dominant limb.

17:00

WHAT IS THE CLINICAL SIGNIFICANCE OF INCIDENTAL EXTRA-SPINAL LESIONS DETECTED AT MRI OF THE THORACOLUMBAR SPINE?

M Calleja, C McCarthy, J Teh
Nuffield Orthopaedic Centre, Oxford, United Kingdom

PURPOSE:
To illustrate the prevalence and spectrum of clinically significant extra-spinal lesions incidentally detected at thoracolumbar spine MRI by highlighting relevant review areas.
MATERIALS AND METHODS:
Consecutive thoracolumbar spine MRI examinations (n=4596) were retrospectively reviewed for previously undiagnosed extra-spinal pathology unrelated to co-existing

spinal disease and requiring further investigation and management. Incidental extra-spinal lesions were followed up with ultrasound (n=82), CT (n=39), MRI (n=16), plain radiography (n=10), ureteropyelography (n=4), angiography (n=3) and histopathological evaluation (n=39).
RESULTS:
Clinically significant extra-spinal pathology was incidentally detected in 138 patients (3%) and responsible for patient symptoms in 1%. Five review areas were defined. Retroperitoneal review detected 46% of lesions. Renal lesions included hydronephrosis (n=9) with transitional cell carcinoma in 3 patients, renal cell carcinoma (n=2), renal abscess (n=1), staghorn calculus (n=1) and horseshoe kidney with calculi (n=2). Lymphadenopathy (n=7), retroperitoneal fibrosis (n=2), pancreatic carcinoma (n=1) and a neurenteric cyst (n=1) were further retroperitoneal lesions. Pelvic assessment in female patients yielded 25% of lesions including endometrial, cervical and ovarian carcinoma (n=6), ovarian teratodermoid (n=2), endometrioma (n=1) and hydrosalpinx (n=1). Review of the thorax detected 13% of lesions including bronchogenic carcinoma (n=3), pulmonary tuberculosis (n=2), pulmonary fibrosis (n=1), pleural metastases (n=2), mediastinal lymphadenopathy (n=2) and rib tumours (n=2). Evaluation of paravertebral tissues detected 12% of lesions such as psoas abscess (n=6), neurogenic tumours (n=4), haemangioma (n=2), myositis (n=2) and leiomyosarcoma (n=1). Hepatic and splenic pathology including hepatic metastases (n=3), haemangioma (n=2), haemachromatosis (n=1), splenic infiltration (n=2) and gallstone cholecystitis (n=1) were detected with review of the localiser constituting 7% of lesions. A giant cisterna chyli (n=7), thoracic duct (n=2) and vascular variants (n=1) were normal structures mistaken for retroperitoneal pathology.
CONCLUSION:
Clinically significant incidental pathology is common. Review areas including the localiser need to be assessed to ensure the wide spectrum of lesions are detected. Normal structures require differentiation from retroperitoneal pathology.

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15:30
DIAGNOSTIC ACCURACY OF RADIOGRAPHY AND MAGNETIC RESONANCE IMAGING: A STUDY OF 200 CONSECUTIVE BONE TUMOURS OF THE HAND

S.H.M. KHAN[2], L.F.I. OUDENHOVEN[1], E DHONDT[1], A NEIBORG[1], H.M. KROON[1], P.C.W. HOOGENDOORN[1], J.L. BLOEM[1], A DE SCHEPPER[1]
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Purpose: To determine the usefulness of radiography and magnetic resonance imaging in differentiating benign from malignant bony tumours of the hand and in making a tissue specific diagnosis.
Materials and Methods: Two hundred consecutive bony tumours of the hand originating from a national databank were studied in a prospective way by radiography (100 %) and by MRI (25 %). All tumours were graded on a five points scale from certainly benign to certainly malignant using location and morphology as diagnostic parameters. For all tumours a tissue specific diagnosis was made by proposing three possibilities in decreasing order of probability. Histological diagnosis was made by peer review according to the WHO-classification.
Results: By combining "certainly" and "probably" benign (grade I and II) and "certainly" and "probably" malignant (grade IV and V), a correct grading was obtained in 165 (82.5 %) of the cases (154 of the 173 benign and 11 of the 27 malignant tumours). A correct tissue specific diagnosis was included in the three proposed differentials in 87.5 %. MRI confirmed a correct diagnosis made on radiography in 72% and improved the grading capability by correctly upgrading malignant and downgrading benign tumours in respectively 8 and 12 %. The capability to obtain a tissue specific diagnosis improved with change of an incorrect diagnosis on radiography to a correct one on MRI in 12 cases (24%).
Conclusion: Subjective (semi quantitative) grading on radiography by an expert group proved to be superior when compared with the results of a quantitative analysis of individual grading parameters or a combination of them. The additional value of MRI in grading was amply demonstrated. Already high accuracy of radiography in making a tissue specific diagnosis improved substantially after performing MRI.

15:40
GIANT CELL TUMOURS OF BONE OF THE HAND AND WRIST

SLJ James, AM Davies
The Royal Orthopaedic Hospital, Birmingham, United Kingdom

Giant-cell tumour of bone (GCTOB) is a benign, locally aggressive, primary bone tumour. Involvement of the distal radius accounts for between 10% and 12% of cases of GCTOB, with the bones of the hand and wrist being rarely affected. They are expansile, lytic, subarticular tumours that may demonstrate locally aggressive features and rarely metastasize. As a tertiary referral centre for Orthopaedic oncology, we have treated 452 cases of GCTOB of which 57 (13%) involved the hand and wrist.
GCTOB arising in the bones of the hand has a more central appearance than its more usual eccentric location. At presentation, hand lesions occur more commonly at an advanced clinical stage than tumours in the distal forearm or elsewhere in the body. Multicentric involvement is more common in lesions involving the hand. The radiographic features of GCTOB in the hand and wrist are presented.

15:50 in
GIANT CELL TUMORS OF TENDON SHEATH MAY PRESENT AS INTRINSIC OSSEOUS LESIONS.

A.M. De Schepper, L. Oudenhoven, P.C.W. Hogendoorn, J.L. Bloem

Leids Universitair Medisch Centrum, Leiden, Netherlands

Purpose: To document that giant cell tumors of tendon sheath (GCTTS) may initially present as intrinsic osseous lesions on radiography.
Material and Methods: In a series of 200 consecutive osseous (pseudo-) tumors of the hand, 6 patients presented with an intrinsic osseous lesion on radiography caused by a neightboring GCTTS, proven on Magnetic Resonance Imaging (MRI) in 5 and on pathological examination in all 6 patients.
Results: Radiography showed osseous lesions consisting of well defined cortical defects in 4, a slightly expansile process in 1 and scalloping of the cortical surface in another patient. MRI showed the extra-osseous lesion with intra-osseous extension in 4 and the extra-osseous lesion in the case with cortical scalloping. All lesions were polylobular (cauliflower- or mushroomlike), neighbored tendon sheaths and presented with low to intermediate signal intensity on T2-weighted MR-images. On pathological examination all 6 specimens contained multinucleate giant cells, foamy macrophages, siderophages, a characteristic stromal distribution with branching strands of collagen and fragments of tendinous tissue. In one case the contiguity of the large extra-osseous and the small intra-osseous component was demonstrated.
Conclusion: ***1***.GCTTS may initially present as an intrinsic osseous lesion on radiography.***2***.MRI easily demonstrates the main extra-osseous component with characteristic morphology and signal intensity features.***3***.Knowledge of imaging findings will facilitate diagnosis on histopathology.

16:00

HIBERNOMA – CORRELATION OF HISTOPATHOLOGY AND MAGNETIC RESONANCE IMAGING FEATURES IN TEN CASES

H Aniq[1], D A Ritchie[1], A M Davies[2], C Mangham[2], T Helliwell[1]
[1] Royal Liverpool University Hospital, Liverpool, United Kingdom, [2] Royal Orthopaedic Hospital, Birmingham, United Kingdom

Purpose, Materials and Methods: Hibernoma is an uncommon, slow growing benign soft tissue tumour resembling brown adipose tissue. The histological appearances are well documented but there are relatively few descriptions of the magnetic resonance (MR) imaging features. This study is a retrospective comparison of the histopathological and MR imaging appearances of ten hibernomas of the extremities.
Results: Four lipoma-like hibernomas were well defined and ranged from 4-27cm in maximum size. Lesions were either homogeneous or slightly inhomogeneous and three of the four were isointense with subcutaneous fat on T1-weighting. The other lesion was slightly hypointense on T1-weighting and slightly hyperintense on T2-weighting. Two lesions were slightly hyperintense on STIR. The two lesions that were slightly inhomogeneous contained thin (<5mm thickness) tortuous structures. Only one patient received intravenous contrast but the lesion did not enhance. The six non-lipoma like hibernomas measured 2-15.5cm in maximum size. Four were well defined and two slightly ill defined. Lesions were predominantly slightly hypointense to subcutaneous fat on T1-weighting and slightly hyperintense on STIR. However, four lesions showed marked or moderate inhomogeneity with prominent nodular and linear foci (>10mm thickness) that were hypointense on T1-weighting and hyperintense on STIR. Of the two cases that received intravenous contrast, one showed marked generalised enhancement and the other focal enhancement centrally.

Conclusions: MR imaging has shown some distinguishing features between lipoma-like and non-lipoma like hibernomas. Lipoma-like hibernomas are usually isointense with subcutaneous fat on T1-weighting, are either homogeneous or slightly inhomogeneous and may contain thin tortuous fibrovascular structures. Non-lipoma like hibernomas are predominantly slightly hypointense to subcutaneous fat on T1-weighting, often display marked or moderate inhomogeneity with prominent hypointense nodular and linear foci and enhancement is typical. The appearances of non-lipoma like hibernomas are not diagnostic and may be mimicked by lipoma variants and by well-differentiated liposarcoma or atypical lipomatous tumours.

16:10
HIBERNOMA: MRI FEATURES IN EIGHT CONSECUTIVE CASES

JC Lee, A Saifuddin, A Flanagan, AJ Gupta, TWR Briggs, SR Cannon, JA Skinner
Royal National Orthopaedic Hospital, London, United Kingdom

Purpose: Hibernoma is a rare benign soft-tissue tumour of brown fat cells. We describe the MR imaging findings in eight consecutive cases.
Materials and Methods: All cases were identified from the pathology database of a tertiary referral sarcoma unit. Patient age, sex, and duration of symptoms were recorded. The MR images were retrospectively reviewed. The size, site, signal intensity and homogeneity were assessed on T1W SE and STIR/ fat-saturated T2W FSE images. Four patients underwent post-gadolinium fat-saturated T1W SE imaging.
Results: Three females and five males, average age 36 years (range 16-53 years) were included. Seven lesions occurred in the thigh, four in the anterior compartment and three in the posterior compartment. One lesion occurred in relation to the scapula. All cases demonstrated common MR findings of a well-defined, heterogeneous mass, slightly or clearly hypointense to subcutaneous fat, with prominent thin low signal bands on T1 W SE images. The lesions failed to fully suppress on STIR or fat-saturated T2 weighted images. Only one of the four contrast-enhanced studies demonstrated increased vascularity.
Conclusion: This is the largest case series of hibernoma in the MR literature. The MR findings described should prompt the operator to consider this rare diagnosis in the assessment of an atypical fatty mass on MRI.

16:20
"FLOW VOIDS" AS A PREDICTOR OF RENAL CELL METASTASIS

GM Allen, P Li
Royal Orhtopaedic Hospital, Birmingham, United Kingdom

After reading a publication on the presence of flow voids in renal cell metastasis on MRI we decided to see if this was a good predictor of the presence of a renal cell primary in metastatic disease.
We reviewed the MRI images of 91 patients with osseous lesions and proven diagnoses looking for flow voids, scoring the extent of voids . We noticed a separate type of void caused by calcification.

23 out of 27 of osseous renal cell carcinoma metastases showed vascular flow voids but the four that did not were either fractures or cases where there was rapid destruction of bone. Other primary lesions and metastasis also show vascular flow voids (8/64) . Including non vascular voids then a figure of 19/64 was obtained. Lesions with a grade 3 vascular flow voids were either renal cell metastasis or haemangiopericytoma.

16:30

DIAGNOSTIC SIGNIFICANCE OF FLUID-FLUID LEVELS IN BONE AND SOFT TISSUE TUMORS

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[1] University Antwerp, Antwerp, Belgium, [2] University Leiden, Leiden, Netherlands

***Purpose*:** to determine the frequency and diagnostic significance of fluid-fluid levels (FFL) in bone and soft tissue tumors.
***Material and Methods*:** Out of a multi-institutional database (Netherlands and Belgian Bone Tumor Committee, Belgian Soft Tissue Neoplasm Registry) MRI of 700 consecutive patients with a bone tumor and MRI of 700 consecutive patients with a soft tissue neoplasm were reviewed for the presence of FFL. In all patients, pathologic correlation was available.
***Results*:** Of the 700 bone tumors, 19 (10 male, 9 female, mean age 29 y) presented with a FFL (2.7%). Diagnoses included aneurysmal bone cyst (10 cases), fibrous dysplasia (2 cases), osteoblastoma (2 cases), simple bone cyst (1 case), telangiectatic osteosarcoma (1 case), "brown tumor" (1 case) and giant cell tumor (2 cases). The diagnostic accuracy of FFL on MRI for ABC was 96% with a sensitivity=37%, specificity=99%, positive predictive value=58% and negative predictive value=97%. Of the 700 soft tissue tumors, 21 (10 male, 11 female, mean age 34 y) presented with a FFL (3%). Diagnoses included cavernous hemangioma (12 cases), synovial sarcoma (3 cases), angiosarcoma (1 case), aneurysmal bone cyst of soft tissue (1 case), myxofibrosarcoma (1 case), high-grade sarcoma NOS (2 cases) and hematoma (1 case). The diagnostic significance of FFL on MRI for cavernous hemangioma was 97% with a sensitivity=50%, specificity=99%, positive predictive value=57% and negative predictive value=98%.
Conclusion:
FFL in bone and soft tissue tumors is a rare finding (2.7% and 3% in bone and soft tissue tumors, respectively).
FFL can be seen in a wide range of bone and soft tissue tumors and therefore should not be considered diagnostic of any particular type of tumor. However, the presence of a FFL in a bone or soft tissue tumor remains strongly suggestive of an aneurysmal bone cyst or a soft tissue (cavernous) hemangioma, respectively.

16:40

LOW-DOSE WHOLE BODY MDCT PROTOCOL FOR THE DIAGNOSTICS IN MULTIPLE MYELOMA PATIENTS

SB Buhmann, MFR REiser, AW Wieser, AB Baur-Melnyk
Department of Radiology University Hospital Grosshadern, Munich, Germany

Purpose:
To compare two low-dose MDCT protocols performed on a 16-row-multidetector computed tomography scanner for the diagnosis of osteolytic bone lesions in patients suffering from multiple myeloma.
Patients and methods:
In 30 patients with attested diagnosis of multiple myeloma, whole-body MDCT (120kV, 1.5mm collimation, bone cernel) and consecutively whole-body MRI (1.5Tesla, Siemens Symphony, coronal/sagittal STIR and unenhanced T1-w SE sequences) serving as gold standard, were performed. The patients were divided into group A which was examined using 100mAs compared to group B with 50mAS. The images were reconstructed in 3mm axial slices as well as the spine in 3 mm sagittaly oriented slices. The quality of MDCT images was evaluated by 2 experienced radiologists using a four-grade scaling reaching from 1=excellent to 4= not sufficient and the quantification was evaluated by ROI measurements(S/N+C/N ratio).
Results:
The mean image noise value for group A (12HU) was significantly lower compared to group B (24HU) but the image quality for group B was rated as excellent. The 100mAs protocol resulted in an overall score of 1 while for the 50mAs protocol a value of 1.3 was found. Mean radiation dose in group A was estimated with 4 mSv and in group B 2mSv using the CT Expo software by Nagel&Schramm. All osteolytic lesions were identified using both modalities (MDCT,MRI).
Conclusion:
Our low-dose whole-body MDCT protocols reached similar, even estimated lower dose values as x-rays of the skeleton and was proved to be a valuable tool for the sensitive detection of osteolytic bone lesions in patients with multiple myeloma.

16:50

IMAGING DIAGNOSTICS IN PATIENTS WITH MULTIPLE MYELOMA: WHOLE-BODY MRI VERSUS 16-ROW WHOLE-BODY MDCT

A Baur-Melnyk, S Buhmann, HR Dürr, MF Reiser
Clinical Radiology, Munich, Germany

Objective:
The aim of the study was to compare the detection rate of bony involvement in whole-body Multi-detector computed Tomography (MDCT) with whole body MRI in patients suffering from multiple myeloma.
Subjects and Methods:
Thirty patients with histologically confirmed diagnosis of multiple myeloma, were prospectively examined with whole body 16-row-MDCT using a low dose protocol and whole body MRI using a 1.5 Tesla system (Siemens-systems). MDCT-datasets were reconstructed in 3mm axial, coronal and sagittal orientation. The MRI protocol consisted of T1-weighted SE as well as STIR sequences. For data analysis the entire skeleton was divided into 104 regions per patient. Thus, a total of 3120 regions were evaluated. Image evaluation was performed in a consensus reading by two radiologists separately for both imaging modalities and blinded to clinical and histological data. The combination of MDCT and MRI including clinical and follow up data served as gold standard in a second expert reading.
Results:

645/3120 regions were affected. 159/645 lesions were detected in MDCT, 633/645 lesions were detected in MRI. 5 false positive lesions were detected in MDCT, 2 in MRI. The sensitivity/specificity for MDCT resulted in 24%/99.7%, and 98.1%/ 99% for MRI, respectively. Diagnostic accuracy was 84.4% for MDCT and 99.7% for MRI.
Conclusion:
Although MDCT allows for high resolution imaging of bony structures, MRI resulted in a higher detection rate of bony involvement in patients with multiple myeloma. This is due to the direct visualisation of the bone marrow in MRI before visually detectable osteoclastic lesions occur.

17:00

US WITH CONTRAST MEDIUM COULD IMPROVE THE STUDY OF SOFT TISSUE TUMORS OF THE LIMBS

A De Marchi, L Verga, A Gallo, S Pozza, C Faletti
Azienda Ospedaliera CTO, CRF, MA Torino, turin, Italy

Background- Soft tissue lesions are frequent, sometimes it is difficult to identify sarcomas with inexpensive imaging.US Power Doppler and contrast medium can give dynamic vascular imaging and identify malignancy.
Material and Methods-From 2002 to 2004, 320 soft tissue lesions of the limbs were studied with US contrast medium(2nd generation, more stable gas bubbles) with dedicated machine; real-time evaluation of number and patterns of vessel was performed.Age: range 12-83y.Imaging was related to histological results in 230.
Results-Different patterns were identified: regular, thin and few vessels inside the mass in 90% lipomas; numerous and irregular vessels with anarchic distribution in 90% sarcomas, exept some mixofibrous-sarcomas presenting very rare vessels;very numerous vessels in hypercellular zone and few in fibrous area in aggressive fibromatosis; synusoidal regular vessels in angiomas.No complications occurred both in children and adults patients.
Discussion-Us PowerDoppler with contrast medium is able to identify dynamically different vascularization of soft tissue lesions.In MRI-CT contrast enhancement occurs in interstitial spaces,i.e. the real flow through the vessels is not demonstrated.This method could be useful to understand the in vivobiology of the soft tissue tumors, distinguishing between benign and malignant lesions.

SATURDAY AM 08:30 to 10:10
Rhodes Trust Theatre

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8:30
CAN THE "SOFT SIGNS" OF ULTRASOUND HELP PREDICT ROTATOR CUFF TEARS

G M Allen, M Pakkal, M Green, H G Said
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Potential secondary signs of cuff disease have been observed in my clinical ultrasound practice:-
A "parallel line sign", due to the acoustic rebound of the ultrasound beam from the cartilage when there is a tear present in the rotator cuff.
"Roughing" of the cortex of the greater tuberosity under the footplate of insertion of the supraspinatus tendon.
This study was designed to assess whether the first could predict a full thickness tear and whether the second could predict a tear whether full thickness or partial.
The arthroscopy results of fifteen patients with these signs were recorded and the size and presence of tears recorded.
RESULTS
Eighty percent of patients with a "parallel line sign" had a full thickness tear.
Seventy-three percent of patients with "roughing of the greater tuberosity" had supraspinatus tears detected on ultrasound and arthroscopy.
CONCLUSION
These "soft signs" when performing shoulder ultrasound maybe useful in helping to diagnose a tear of the rotator cuff but further data is needed and our study continues.

8:40
THE ROLE OF US IN AFFECTING THE MANAGEMENT OF PATIENTS REFERRED TO A HAND SURGEON.

M Dhillon, G M Allen, V Rajaratnam, M Tan
Royal Orthopaedic Hospital, Birmingham, United Kingdom

METHOD:
This was a prospective study of all patients referred for US of the hand, wrist and forearm conditions (including the elbow) in a hand unit. Referrals were made by three hand surgeons. The US was performed by one dedicated musculoskeletal radiologist. The clinical diagnosis was recorded from the request card and clinic notes. The ultrasound findings were recorded and it was noted whether the US made a difference to the decision in further management. The findings were compared with the final histological diagnosis for those patients who went to surgery.

RESULTS
A total of 31 patients are included in the study. The majority (24 patients - 77%) of these were referred to US with a single proposed diagnosis. Of these cases US confirmed the diagnosis in 15 patients (63%) but in the remaining 9 patients (37%) other diagnoses were made. These included 'no foreign body', 'focal synovitis in a case thought clinically to be giant cell tumour of the tendon sheath', and identifying a case of 'Kienbock's disease' causing diffuse wrist pain.
Of the remaining 7 patients 6 were referred with more than one clinical diagnosis and a single patient had no provisional clinical diagnosis. US agreed with one of the possible differentials in one third, and excluded several of the possibilities in patients who had previously undergone complex hand surgery in another third. In the final third of patients within this subgroup the clinical and US diagnoses were at variance. In this group US detected one solid mass lesion that needed excision. There were 2 cases of unsuspected nerve tumours.
CONCLUSION
Ultrasound is a very useful adjunct to clinical assessment, altering preoperative diagnoses in a significant number of patients potentially saving the patient unnecessary surgery.

08:50

THE MULDER'S CLICK- THE ULTRASOUND DEMONSTRATION OF THIS CLINICAL SIGN

mj bradley, ig winson
North Bristol Trust, Bristol, United Kingdom

Background
Orthopaedic surgeons diagnose Morton's neuroma's in the forefoot when there are a certain specific criteria in the history but the clinical examination may not yield much further information. The surgeon will however attempt to demonstrate a Mulder's click which may displace
the neuroma from between the metatarsal heads thus demonstrating a palpable click.
Aims
This study demonstrates the technique during an ultrasound scan and with the aid of video clips demonstrates how to reliably confirm the click visually. It will compare the cases of intermetatarsal bursitis and neuroma.
Methods
Consecutive patients with this clinical diagnosis are scanned . The sensitivity and specificity of grey scale ultrasound is compared to demonstration of the Mulder's click. All patients are followed up surgically.
Results
The full results will be presented showing that the ultrasound demonstration of the Mulder's click is highly specific for Morton's neuroma and allows a reliable differentiation between bursitis and neuroma.

9:00

THE PLANTAR PLATE AND METATARSALGIA: ANATOMY, TECHNIQUE AND REVIEW OF PATHOLOGY

WA Bhatti[1], JPB O'Connor[2], H Price[1], NM Kurdy[1]
[1] South Manchester University Hospitals, Manchester, United Kingdom, [2] University of Manchester, Manchester, United Kingdom

Purpose: To describe the sonographic anatomy of the plantar plate and metatarsal region. To demonstrate operator technique and to describe the typical appearances of metatarsal pathology with high resolution ultrasound.
Methods: Patients with metatarsalgia (n=168) referred from a specialist Foot Clinic between January and December 2004, were positioned in the supine and prone positions and examined by an experienced musculoskeletal radiologist. A 14 MHz high resolution probe was used to image both the dorsal and plantar aspects of the metatarsal bones, metatarsophalangeal joints, tendons and soft tissues in the transverse and longitudinal planes. Contralateral plantar plate thickness was recorded in the midpoint of the transverse plane for each of the lesser toes in a subgroup (n=17).
Results: Plantar plate degeneration is increasingly recognised as a common cause of metatarsalgia, in addition to the well documented Morton's neuroma, arthritis and stress fractures. These and other conditions including plantar fasciitis, flexor tenosynovitis, submetatarsal bursitis, hallux-seasamoid complex dysfunction and Frieberg's infraction were also clearly demonstrated on high resolution ultrasound. Patient symptoms were correlated with sonographic findings in all cases. The plantar plate was clearly defined by two echo-bright curvilinear bands lying between the metatarsal head and flexor tendon. The ultrasound reference ranges were 1.06-2.23mm (mean values 1.83 2nd toe, 1.76 3rd toe, 1.67 4th toe and 1.47 5th toe), differing from the cadaveric and magnetic resonance studies values currently used to interpret ultrasound findings.
Conclusion: Metatarsalgia is a common clinical presentation, representing a spectrum of pathology. Ultrasound can demonstrate highly detailed metatarsal anatomy, and is an effective, dynamic and cost effective technique for assessing forefoot pain. This study demonstrates that ultrasound frequently provides a definitive diagnosis for patients with metatarsalgia, thus avoiding the need for routine magnetic resonance imaging. It highlights the need for a reference range for normal plantar plate anatomy. A follow up pilot study in healthy volunteers has begun to further delineate this normal anatomy.

9:10

LATERAL INSTABILITY OF THE ANKLE – DYNAMIC ULTRASOUND AS A METHOD OF CHOICE

MD DZIANACH, TP PIONTEK, TO OWCZARSKI
Department of Radiology, 2. Paediatric Orthopaedic Clinic, University of Medical Sciences in Poznan, 3. Orthopaedic Hospital, Poznan, Poland

Purpose. To evaluate value of sonography in estimation of the ATFL and CFL injuries with special emphasis on dynamic examination.
Materials and methods. This study consisted of a review of 170 patients referred for ultrasound examination because of ankle sprain. In 115 cases there was sonographic diagnosis of the ATFL and/or CFL injury in acute or chronic phase and in different grades of injury (grade I, II, III). In 38 cases sonographic findings were compared

with surgery. Sonographic examinations were carried out with Logiq 7 (GE) equipment.
Results. There was sonographic diagnosis of ATFL injury in 115 cases (including antero-lateral instability in 76 cases), CFL injury in 42 cases (including postero-lateral instability in 19 cases). 36 antero-lateral instabilities (after grade III ATFL injury) and 7 postero-lateral (after grade III CFL injury) were confirmed in surgery.
Conclusions. Superficial and multiplanar localization of the ATFL and CFL is a main indication for sonographic examination of these structures. In our opinion the reason why US is a method of choice in imaging of injuries of these ligaments is dynamic examination and possibility of image-proven ankle instability recognition.

9:20

OBLIQUE MR IMAGING OF FREQUENTLY INJURED ANKLE TENDONS THREE-DIMENSIONAL ORIENTATION

MJ Breitenseher, ME Mayerhoefer
Department of Diagnostic Radiology, Medical University of Vienna, Vienna, Austria

PURPOSE: To determine the three-dimensional course of three frequently injured ankle tendons (peroneus longus, peroneus brevis, and tibialis posterior tendon) and use this information for oblique MR imaging of their proximal (perimalleolar) segments, where injury commonly occurs.
MATERIALS AND METHODS: 20 healthy volunteers with no history of ankle injury were included in the study. Axial gradient echo (GRE) MR images were obtained with 3D technique and a high resolution matrix at 1.5 Tesla. Sagittal and coronal images were reformatted from the original axial image stack. Using markers, 3D paths along the course of the proximal segments of the tendons (peroneus longus and brevis, tibialis posterior) were constructed. Tangents were applied to the paths, and the angles between the tangents and three reference lines (one for each imaging plane) were determined. Reference lines were: for the axial imaging plane, a line along the long axis of the calcaneus (RFL-1); for the coronal imaging plane, a line along the talus plateau in its mid-position (RFL-2); for the sagittal imaging plane, a line connecting the anterior and posterior edge of the distal tibial extremity (RFL-3). To determine the optimal MR imaging planes for full-length visualization of the tendon segments, the arithmetic means of the angles were calculated.
RESULTS: For the peroneus longus tendon, mean angles were: 19.2 degrees to RFL-1, 86.4 degrees to RFL-2, and 74.9 degrees to RFL-3. For the peroneus brevis tendon, mean angles were: 10.1 degrees to RFL-1, 89.4 degrees to RFL-2, and 69.0 degrees to RFL-3. For the tibialis posterior tendon, finally, mean angles were: 22.0 degrees to RFL-1, 86.4 degrees to RFL-2, and 60.8 degrees to RFL-3.
CONCLUSIONS: Based on knowledge of their three-dimensional orientation, the commonly injured proximal segments of the peroneus longus, peroneus brevis, and tibialis posterior tendon can be depicted in their entire length on oblique MR images in more than one slice position. This may help increase the diagnostic accuracy of MRI for detecting injuries to these ankle tendons.

09:30

MR EVALUATION OF THE ACCESSORY MUSCLES AROUND THE ANKLE

J.C Vilanova, J Barceló, M Villalón
Clínica Girona, Girona, Spain

Purpose: To review the prevalence, clinical presentations and the different MR imaging features of the more common accessory muscles around the ankle.
Materials and Methods: We have evaluated retrospectively 200 MR studies of the ankle (106 male, 94 female) with age ranging from 12 to 72. We analyzed the presence of accessory muscles, MR imaging description and the clinical presentation.
Results:
An accessory muscle has been found in 21 studies (10,5%). The most common accessory muscle found has been the peroneous quartus, in 14 studies (7%). The flexor digitorum accessorious longus (FDAL) has been found in 4 cases (2%), the accessory soleus muscle in two cases (1%) and one case of the peroneocalcaneus internus (0,5 %) (PCI). 17 cases (80%) were asymptomatic. 3 cases (15%) presented with a tarsal tunnel syndrome (2 FDAL and 1 PCI). One case (5%) of accessory soleus muscle presented as a soft tissue mass related to exercise. All the cases showed isointense signal with normal musculature.
Conclusion:
Accessory muscles of the ankle are common and they appear with multiple variants. Usually is an incidental finding. Occasionally, can mimic a soft tissue mass or present with pain or nerve entrapment. Knowledge of the presence of accessory muscles allows MR imaging to detect them and exclude neoplasms.

9:40

ANTERIOR TARSAL TUNNEL SYNDROME FOLLOWING A CLOSED DEGLOVING INJURY IN THE LOWER LIMB (BAELDE N, VASILEVSKI D, DE MAESENEER M, CAPOEN J, DE MEY J, SHAHABPOUR M)
AKADEMISCH ZIEKENHUIS VRIJE UNIVERSITEIT BRUSSEL (AZ-VUB) - BRUSSELS BELGIUM

N Baelde, D Vasilevski, M DeMaeseneer, J Capoen, J DeMey, M Shahabpour
Akademisch Ziekenhuis Vrije Universiteit Brussel, Brussels, Belgium

Purpose: Assessing MRI contributions in a patient with a Morel-Lavallée effusion (closed degloving injury) and anterior tarsal tunnel syndrome following motorcycle trauma.
Methods: Clinical examination showed poorly damaged skin and on standard X-rays no bone lesions were found. A swelling at the medial side of the knee was interpreted on ultrasound as a large subcutaneous liquefied hematoma. Further assessment of knee and ankle was made by means of MRI in order to reveal more subtle soft tissue lesions. Both MRI examinations had long term follow-up after 1.5 and 3 years.
Results: MRI of the knee confirmed the presence of a fluid collection at the posteromedial side of the left knee located between subcutaneous tissue and fascia superficialis. Follow-up MRI showed only a small remaining fluid collection at the most superior part of the knee. A new cystic collection has appeared within the medial head of the gastrocnemius muscle.

MRI of the ankle showed a lesion at the medial part of the tibio-navicular ligament associated with secondary cystic distension in the anterior tarsal tunnel. The

chronic appearing cystic formation caused nerve entrapment of the lateral branch of the deep peroneal nerve in the anterior tarsal tunnel as suggested on clinical examination and EMG. The comparative MR images disclosed atrophy of the muscles in the specific denervation areas. Lymphatic edema due to the degloving injury was also diagnosed.
Conclusion: High resolution MRI deploys thin intrastructural lesions as well as changes due to extravasated blood in post traumatic patients. In this case of motorcycle trauma MRI showed the details of superficial tissue damage in Morel-Lavallée syndrome and the importance of associated lesions leading to nerve entrapment in the anterior tarsal tunnel.

9:50

US AND MR IMAGING OF PERONEAL INTRANEURAL GANGLIA: EMPHASIS ON THE ARTICULAR BRANCH

LE Bacigalupo[1], MB Damasio[1], F Zuccarino[1], G Succio[1], E Silvestri[1], S Bianchi[2], C Martinoli[1]
[1] Cattedra di Radiologia R - DICMI - University of Genova, Genova, Italy, [2] Fondation des Grangettes, Geneva, Switzerland

PURPOSE: To describe US and MR imaging findings in patients with peroneal intraneural ganglia.
MATERIALS and METHODS: Seventeen consecutive patients with a palpable mass in the fibular neck area and foot-drop suggesting dysfunction of the common peroneal nerve were prospectively evaluated with high-resolution (12-5MHz and 17-5MHz) US and 1.5T MR imaging. All patients had abnormal nerve conduction studies
RESULTS: In all but one patients, US and MR imaging identified ganglia of variable size and shape in proximity to the superior tibiofibular joint. Based on their relationship with the peroneal nerve, US and MR imaging divided these cysts in extraneural ganglia (n=9/16), which developed outside the nerve, and intraneural ganglia (n=7/16), developing within the nerve. Intraneural ganglia had a stereotypical appearance. US found the bulk of the ganglion on the anterolateral aspect of the superior tibiofibular joint, located remotely from the position of the peroneal nerve. The ganglion was invariably associated with a dilated articular branch of this nerve. This branch appeared as a long tubular process coursing along the posterolateral aspect of the fibula to join the bulk of the ganglion with the nerve. In all cases, it was markedly enlarged and assumed a cystic appearance without detectable fascicles. More proximally, the fascicles of the deep and common peroneal nerve were displaced eccentrically by the cyst growing within the epineurium. In three nonoperated cases, the overall size of the ganglion and the entity of the nerve deficit varied with time with fluctuating phases of worsening and recovery of symptoms: one of them completely regressed at 6-months follow-up.
CONCLUSIONS: US and MR imaging are promising for evaluating patients with peroneal neuropathy caused by superior tibiofibular joint ganglia. By providing unique information on the intraneural location of the cyst and the status of the involved nerve, US and MR imaging have potential for major impact on treatment planning.

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8:30
OCCULT HIP FRACTURES

C U Dussa, R Kaul, G Herdman
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Aim: To find out the incidence of fracture neck of femurs in patients with negative plain radiographs presenting with post traumatic hip pain and effectiveness of an early MRI in management of these injuries.
Design: Retrospective study
Materials and methods: MRI scans and case notes of all patients with negative plain radiographs presenting with posttraumatic hip pain were reviewed between January 2003-January 2005.
Results: 420 patients were admitted for hip injury from January 2003 – January 2005. Of these 388 patients had noticeable fractures of hip on plain radiographs. In 32 patients plain radiographs did not reveal any fractures. All these patients had a significant fall, tenderness of hip, painful attempted rotations, and inability to walk. The mean age is 75.81 years. MRI was done in all these patients. 17 patients (53%) were demonstrated to have hip fractures. The mean age group of this group was 81.5 years. All these patients were treated surgically with successful outcome.

Conclusions: The incidence of occult hip fractures in a District general hospital is about 4%. Considering the high incidence, we advise routine early MRI scans on all elderly patients with history of trauma, inability to weight bear, painful rotations, in spite of negative X-Rays, rather than repeating the plain radiographs. If these fractures are missed there is a significant chance of displacement more complex surgery and longer rehabilitation.

08:40
MAGNETIC RESONANCE IN EARLY DIAGNOSTICS OF RHEUMATOID ARTHRITIS AND FOLLOW UP AFTER SPECIFIC TREATMENT

A. Platkajis, A. Lejnieks, H. Mikazane, V. Mikazans
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The aim of study: To assess the effectiveness of magnetic resonance (MR) imaging for the diagnosis of early-stage rheumatoid arthritis (RA) and follow up patients during specific treatment.
Material and method: 35 patients with polyarthralgia and clinical signs of rheumatoid polyarthritis were examined with MR. For the entire patient the

conventional X-ray of both hands in two projections were performed, as well as clinical laboratorial analyses. MR of the hands, including the wrist joint, carpal, metacarpal bones, the joints and bones of phalanxes were performed using *GE 1.0 T Signa Horizon LX Highspeed* system with head coil and in accordance with a standardized MR examination protocol. Follow-up examinations of patients with RA were performed during and after specific treatment with the same examination technique as baseline examination.

Results: 20 patients were diagnosed uneven thickening of the synovium around the metacarpophanalngeal joint of the first finger, 12 patients - in the joint of the wrist - radiocarpal, ulnocarpal, intercarpal bone joints. 15 patients were diagnosed with inflammatory type changes in the flexor and extensor tendon sheaths. 10 patients were diagnosed local osteoporosis around inflamed joint. 16 patients were diagnosed minor erosions up till 1 cm in diameter. 1 patient was not diagnosed any changes in the wrist bones and joints. 12 patients underwent follow-up MR imaging during specific treatment. 11 had MR criterion–positive RA at the time of the first MR examination. In 8 patients the synovial thickening and amount of synovial fluid were reduced. In 9 patients erosions in carpal, metacarpal and phalanx bones still remain in the same size. In all patients there was no evidence of progression of disease in MR scans, which correspond with clinical status.

Conclusions: MR is a highly sensitive method for visualizing RA inducted inflammatory changes in the hand joints - bones and synovium and is a perspective method for using MR for radiological diagnostics of RA for the prognostication of the course of the disease and the assessment of aggressive pharmacotherapy. Early and aggressive treatment could prevent progression of early manifestation of disease such as - local osteoporosis (OP), synovitis, cartilage, bone erosions, decreases the development of contractur.

08:50

VALUE OF CONTRAST ENHANCED GREY- SCALE SONOGRAPHY IN ASSESSMENT OF JOINT VASCULARITY IN RHEUMATOID ARTHRITIS: RESULTS FROM THE IACUS GROUP

RESULTS FROM THE IACUS GROUP

A Klauser[1], J Demharter[5], A De Marchi[2], D Sureda[4], A Barile[3], C Faletti[2], C Masciocchi[3], M Schirmer[6], T Kleffel[5], K Bohndorf[5]

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PURPOSE:

To assess the value of contrast enhanced grey- scale ultrasound (CEUS) in detection of vascularity in joints of patients with rheumatoid arthritis (RA) in a multicentre study of the International Arthritis Contrast Ultrasound (IACUS) group.

MATERIALS AND METHODS:

We assessed 113 joints in 113 patients (44 men, 69 women; mean age 51 ± 14 years) with clinical diagnosis of RA. Grey-scale ultrasound (US), power Doppler US (PDUS) and CEUS, using a low mechanical index US technique, was performed.

CEUS was done by bolus administration of the contrast agent SonoVue® (Bracco, Milan, Italy) with a dosage of 4.8-mL SonoVue® and flushed with 10 mL saline. Detection of joint vascularity was performed for differentiation of active synovitis from inactive intraarticular thickening (synovitis/effusion).
RESULTS:
Using US and PDUS active synovitis could be differentiated from inactive intraarticular thickening in 6/113 joints (60.1%), whereas CEUS enabled differentiation in 110/113 (97.3%) joints ($p<0.0001$). Thickness measurement of active synovitis was significantly improved after contrast administration ($p = 0.008$).
CONCLUSION:
CEUS improves the differentiation of active synovitis from inactive intraarticular thickening. Since CEUS has shown to enable assessment of synovial vascularity in RA joints, this technique may further have potential in monitoring therapy.

9:00

VISUALIZATION OF SYNOVIUM THICKENING OF THE KNEE JOINT BY BALANCED TURBO FIELD ECHO (B-TFE)

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Purpose: The aim of this study is to evaluate the usefulness of B-TFE for synovium thickening in the knee joint.
Material and Method: 11patients (5 males, 6 females, age 40 to 83 years) suffering from knee joint pain were involved in this study. Preoperative MRI was performed on a 1.5T system (Philips, Intera) using a Quadrature knee coil. Pre contrast sagittal T1WI SE, T2*WI GRE, B-TFE and contrast-enhanced (CE) T1WI were obtained in each case. The synovium thickening behind the patellar and around the posterior cruciate ligament (PCL) were scored ranging from 0 (not visualized) to 3 (excellent) with the consensus of two radiologists. The thickening of synovium was confirmed by operation.
Results: The synovium thickening was seen in all of the case. For the synovium of the area behind the patellar, the average score was 0.36 (T1WI), 0.45 (T2*WI), 2.6 (B-TFE), and 3.0 (CE T1WI). For the area of the PCL, the average score was 1.45 (T1WI), 0.9 (T2*WI), 2.54 (B-TFE), and 3.0 (CE T1WI). There was significant difference among these sequences ($p<0.01$, Kruskal- Wallis test). There was no significant difference between B-TFE and CE T1WI ($p=0.03$, Mann-Whitney U test). Flow artifacts were seen in some of the CE T1WI's whereas no artifacts were visible in the B-TFE images.
Conclusion: B-TFE is useful for visualizing synovium thickening in knee joints without contrast enhancement.

09:10

CLASSIFICATION OF ANKLE JOINTS IN CHILDREN WITH HAEMOPHILIA — COMPARISON OF MRI SCORES AND CLINICAL DATA

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Purpose: To compare Denver and European MRI scoring of haemophilic arthropathy.
Materials and methods: Fifty-six ankles in 38 haemophilic children ages 4–17 (mean 10) years were investigated by MRI at nine European haemophilia centres. Staff at the centres were supplied with a protocol designed for a 1.5 T VISION MRI system (Siemens, Erlangen, Germany) and were asked to produce images that were as similar as possible using their own MRI equipment. The example comprised sagittal T1-weighted (TR/TE 418/12 ms), T2-weighted (TR/TE 4200/96 ms), fat suppressed 3D GE (TR/TE/ 50/11 ms, FA 40^0), and coronal STIR (TI/TR/TE 150/4500/60 ms) sequences. Each ankle was classified according to both the Denver and the European MRI scoring systems by two radiologists in consensus, and for each ankle the children's physicians provided data on the total number of joint bleeds and the results of a physical examination performed using the orthopaedic joint score recommended by the World Federation of Haemophilia. Spearman rank order correlation coefficients and p-values were calculated to compare the MRI scores with the number of bleeds and the orthopaedic score.
Results: Denver scores (possible: 0–10) for the 56 ankles were as follows: 0 for two, 1 for twenty-one, 2 for two, 4 for eleven, 7 for one, 9 for seven, and 10 for twelve ankles. Considering the European score, the e, s and h components (possible: 0–4) ranged from 0 to 4, and the A component (possible: 0–16) ranged from 0 to 10. The number of bleeds in individual ankles ranged from 0 to 80. The orthopaedic score was 0 for forty-nine ankles and ranged from 1 to 4 for seven ankles. The Denver and European MRI scores were strongly correlated with each other (coefficient 0.95, $p < 0.001$), and they were both weakly but significantly correlated with the number of bleeds (coefficients 0.39 and 0.38, p 0.003 and 0.004) and the orthopaedic score (coefficients 0.32 and 0.37, p 0.015 and 0.005).
Conclusion: The Denver MRI scoring method is progressive (based on worsening stages), whereas the European method considers different components of the arthropathy separately and uses an additive strategy (changes are added). In the comparison, the arthropathic changes were more efficiently differentiated by the European than by the Denver method, but the two different scores were highly correlated with each other and showed similar correlation with the number of joint bleeds and the orthopaedic joint score.

9:20

ROLE OF DYNAMIC MRI IN THE ASSESSMENT AND FOLLOW-UP OF THE CHARCOT'S FOOT

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Purpose: To evaluate the usefulness of dynamic MRI (D-MRI) in establishing the activity of acute Charcot's foot and assessing the response to limb immobilization.
Matherials and Methods: 20 patients (M/F= 8/8, mean age 51.3 years) with acute Charcot's foot underwent MRI examination followed by limb immobilization. the Skin temperature difference (ΔT) was monitored on follow-up and MRI was performed every 2-4 months. MRI protocol included T1 and T2-weighted sequences,

and a dynamic study (Fast Spoiled Gradient Echo), after administration of a bolus of gadolinium (0.1 ml/Kg). The contrast uptake rate and Signal Intensity (SI) ratio on T2-weighted sequences were assessed.
Results: At baseline examination, the contrast uptake rate ranged between 50% and 294% and the SI ratio ranged between 1.5 and 10.3. The mean follow-up duration was 8.9 months (range, 2-26 months). Progressive decrease in contrast uptake rate was observed in 18/20 patients, reaching a value <40% at the latest examination . The correlation between SI ratio and contrast uptake rate modifications was poor, whereas contrast uptake rate and ΔT changes were concordant in 18/20 cases. Time required for healing was longer in patients with significantly higher contrast uptake rate at baseline MRI examination and in patients with type 1 diabetes.
Conclusions: MRI represents a non-invasive and well tolerated tool in the follow-up of acute Charcot's foot. D-MRI provides a quantitative, objective parameter, useful in the assessment of treatment outcome. Contrast uptake rate at presentation can predict duration and outcome of Charcot's foot.

9:30

USEFULNESS OF CERVICAL SPINE MRI IN PATIENTS FROM A RHEUMATOLOGY DEPARTMENT

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Objective
Our purpose was to assess the diagnostic value of cervical spine MRI in patients recruited from a rheumatology department.
Materials and methods
This retrospective study was done in a teaching hospital over a period of 30 months. We studied a group of 112 consecutive patients (range 17 to 85 years, mean 50). All patients were recruited from the rheumatology department and outpatient clinic. All patients had clinical symptoms potentially related to a cervical spine lesion. Cervical spine MRI (1.5 T) were performed in a single radiology department and analysed by senior radiologists. Clinical background and results were classified in 5 groups : degenerative disk disease (DDD), inflammatory, infectious, tumor and neurologic. The reports were analysed with emphasis on the agreement (concordance or discordance) between the clinical background and MRI results. A normal MRI was also classified as a discordance.
Results
MRI were performed with intravenous gadolinium injection in 46% of the cases.
The patients were referred for degenerative disk disease in 50%, inflammatory disease in 23%, neurological signs in 20%, infectious disease in 5% and tumor in 5%. Cervical spine MRI was normal in 20% (22/112). 80% (17/22) of these normal MRI were observed in patients referred for DDD.
In the inflammatory group 10 patients had rheumatoid arthritis with active lesions at C1-C2 level including 5 cases of spinal cord compression. Four patients had spondylarthropathies with spinal ossifications including 2 cases of spinal cord compression.
There was no agreement between the clinical setting and MRI results in 30% (17/56) of the DDD group, 40% (10/25) of the inflammatory group, 83% (5/6) of the

infectious group, 16% (1/6) of the tumor group, and 13% (3/23) of the neurologic group.
Conclusion
Most of the patients were referred for suspicion of degenerative disk disease. In this group, the discordance between the clinical symptoms and MRI results was relatively high (30%).
A spinal cord compression was frequently observed in patients referred for rheumatoid arthritis or a spondylarthropathy. The best agreement between the clinical setting and MRI results was observed in patients referred for tumors or neurologic symptoms.

9:40

PATTERN OF OSTEOARTHRITIS IN THE UPPER CERVICAL SPINE– A NEW GRADING SYSTEM AND ANALYSIS USING CT SCAN

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Background: In the elderly population over the age of 65 years, degenerative osteoarthritis is present in atleast 75% of persons in the subaxial facet joints. There are five joints in the upper cervical spine, viz two lateral atlantoaxial, two atlantooccipital, and one atlantoodontoid joint. Are they all uniformly involved? If not, what is the significance?
Material and Methods: Between July 1999 and March 2003, 185 patients had CT scan of the cervical spine for cervical spine injuries. Twenty-three out of 47 patients over the age of 70 years had odontoid fractures. We did a study of the CT scan pictures of these patients to analyse the type of fracture, the severity of osteoarthritis in each joint of the upper cervical spine. The severity was graded into none, mild, moderate, and severe using our new system based on the CT scan findings. Obliteration of the joint space was considered to be significant as it produces restriction of movement.
Results: Of the 23 patients with odontoid fractures eight showed degenerative changes in the atlanto-occipital joints on both sides, eight in the lateral atlantoaxial joints on both sides and twenty in atlanto-odontoid joint. All the patients had degeneration of the facet joints below the level of axis vertebra.
Ninteen of the 21 patients with Type II odontoid fractures showed obliterated joint space in the atlanto-odontoid joint and two in the lateral atlanto-axial joints on both the sides. Degenerative changes were absent in the atlanto-occipital and lateral atlantoaxial joints in 15 out of 21 patients. In the patient with Type III odontoid fracture, the atlanto-odontoid joint space was normal. In the patient with Type I fracture severe atlanto-odontoid degeneration with moderate atlantoaxial and atlanto-occipital degeneration was noted.
In the 13 patients with no odontoid fracture, obliteration of the joint space was found in six patients in the atlanto-odontoid joint, three patients in the lateral atlantoaxial joints on both the sides, four patients in the atlanto-occipital joints on both the sides, and 12 patients in the facet joints below the level of axis vertebra.
Statistical analysis showed that the atlanto-odontoid joint space obliteration was significant in patients with Type II odontoid fracture compared to those with no Type II odontoid fracture (Chi-square = 4.63; df = 1; $p<0.05$).

Conclusion: Significant atlantoodontoid osteoarthritis in the presence of normal lateral atlantoaxial joints increases the risk of sustaining a type II odontoid fracture.

9:50

PREVALENCE OF BONE MARROW EDEMA AND JOINT EFFUSION IN MODERATE TO SEVERE OSTEOARTHRITIS OF THE KNEE JOINT ASSESSED BY MRI

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Roemer FW, Toschke JO, Peterfy CG, Schoenharting M, Zaim S
Objective:
Aim of this investigation was to analyze prevalence of bone marrow edema and joint effusion in a patient population with moderate to severe osteoarthritis of the knee with a semiquantitative MRI scoring method.
Material and Methods:
In a total of 378 patients (76% women, mean age 63.0 years, mean disease duration 6.6 years) with osteoarthritis of the knee joint (Kellgren-Lawrence Grades 2 and 3)., MRI of the affected knee was performed. The MR protocol included fat suppressed T2 weighted pulse sequences in three planes. Bone marrow edema-like lesions were scored at 15 different locations. Based on this regional subdivision the medial and lateral femoro-tibial compartment comprised five, the patello-femoral compartment four of these regions. A 4-point grading score was used to describe the extent of bone marrow edema-like lesions (0 = no lesion, 1= < 25% of region, 2 = 25-50% of region, 3 = > 50% of region). Edema scores were summed for each knee compartment. Joint effusion was assessed as present or not present.
Results:
311 (=82.3%) patients showed bone marrow edema-like lesions in at least one knee compartment. Bone marrow edema-like lesions were found within the medial femoro-tibial compartment in 216 patients, within the lateral compartment in 67 patients and 132 patients showed lesions in the femoro-patellar joint. In 93 patients edema was seen in two compartments and 12 patients showed edema in all three compartments. The majority of severe edema-like alterations (edema score of > 5) was observed in the medial compartment (86/98 = 87.7%). 9.2% (9/98) of these severe changes were seen in the lateral and 5.1% (5/98) in the femoro-patellar compartment. More subtle changes (edema score < 5) were observed medially (132/317 = 41.6%) and laterally (127/317 = 40.1%) and to a lesser extent patello-femoral (58/317 = 15.6%). Joint effusion was seen in 240 (63.5%) patients. Only 19 patients with effusion showed no concomitant edema-like changes.
Conclusion:
The large majority of patients with moderate to severe osteoarthritis of the knee joint exhibits subchondral bone marrow edema-like alterations that can be detected by MRI. The medial femoro-tibial compartment is affected most commonly and shows also the more severe changes in regard to extent of the lesions. No edema-like alterations are seen only in a small percentage of patients with joint effusion.

10:00

INVESTIGATION OF OCCULT WRIST INJURY

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Introduction: Wrist injuries are common presentations at Accidents and Emergencies, of which distal radius fractures are by far the most common. Scaphoid injuries constitute about 60% of the carpal injuries. 35% occult wrist fractures are undiagnosed on 2nd visit radiography (50% distal radius/ulna). Moreover 30% patients with significant soft tissue injuries not diagnosed.
Aim: To compare efficiency, efficacy and cost-benefit of MRI (magnetic resonance imaging) and bone scans in the diagnosis of X-Ray negative wrist injuries.
Materials and methods: A prospective study was done in 46 wrists that did not have a fracture wrist detectable on plain X-ray. PD Fat Saturation Axial and Coronal MRI scans and bone scan were done on the same day within 5-7 days after the injury. Experts in MRI and Bone scan speciality independently reported the investigations. Clinical review was undertaken 24 hours following these investigations.
Results: We detected fractures around the wrist in 20 bone scans and 12 MRI scans. There was a non-correlation between MRI and bone scan in 14 Cases. There was correlation between bone scan and MRI in 22 cases. MRI identified 3 significant soft tissue injuries, which were not identified on bone scans. MRI findings showed superior correlation with clinical findings on re-examination following the scans and hence changed the management of 12 wrists. The cost of rapid sequence MRI was comparable to repeated X-rays and bone scan.
Conclusion: MRI had a high sensitivity and specificity in diagnosis of site of a fracture. MRI facilitates early management of soft tissue injuries. Early MRI following occult wrist injury prevents over treatment of an injury. Rapid sequence MRI also has an advantage of cost effectiveness, time saving and avoids radiation.

SATURDAY AM 10:40 to 11:40

Lecture Theatre 4

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10:40

INCIDENCE OF VERTEBRAL HEMANGIOMAS AT MAGNETIC RESONANCE IMAGING.

JR Webb[1], DP Beall[2]
[1] Tulsa X-Ray Laboratories, Tulsa, United States, [2] Oklahoma Sports Science and Orthopedics, Oklahoma City, United States

Purpose
The commonly cited incidence of vertebral hemangiomas on MRI is 8-11%, a number based on articles primarily from the pathology literature. In daily practice, vertebral

hemangiomas are commonly seen and dismissed as incidental using widely accepted MRI criteria. The purpose of the study was to determine the incidence of incidental vertebral hemangiomas found at lumbar spine imaging using these criteria and to determine whether this incidence correlated with the previously reported autopsy based incidence.
Materials and methods
54 consecutive outpatient lumbar spine MRIs were reviewed and the incidence of vertebral hemangiomas recorded. Standard accepted criteria were used to determine the presence of a vertebral hemangioma based on signal and morphology, including the presence of high signal intensity on both T1WI and T2WI and a mass-like appearance. Atypical vertebral hemangiomas, as well as lesions associated with endplate changes, fractures, marrow reconversion, basivertebral vessels, and other commonly accepted pitfalls were excluded. In addition, lesions with a soft-tissue component were also excluded.
Results
The incidence of vertebral hemangiomas in our series was 37%. This is larger than that previously reported in the literature by a factor of four.
Conclusions
There is a significant discrepancy between the reported incidence of vertebral hemangiomas and that found in our study. This discrepancy may be due to the autopsy basis of the original references. Based on our findings, either MRI is more sensitive than autopsy at detecting vertebral hemangiomas, or the current MRI criteria for determining vertebral hemangiomas are inaccurate and should be revised.

10:50

ANATOMIC DISTRIBUTION OF INCIDENTAL VERTEBRAL HEMANGIOMAS AT ROUTINE LUMBAR SPINE IMAGING

JR Webb[1], DP Beall[2]
[1] Tulsa X-Ray Laboratories, Tulsa, United States, [2] Oklahoma Sports Science and Orthopedics, Oklahoma City, United States

11:00

ERRONEOUS CLASSIFICATION OF OSTEOPAENIA IN CHILDREN WHO ARE SMALL AND UNDER-WEIGHT; THE IMPORTANCE OF USING APPROPRIATE AND DETAILED NORMAL REFERENCE DATABASES TO INTERPRET DXA SCAN DATA

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Dual energy X-ray absorptiometry (DXA) of lumbar spine is used in clinical assessment of the skeleton in children. DXA has the advantage of low radiation dose (1-5 microsievert), but being a 2D ‘areal’ density (g/cm2) of 3D bone structure it has

the limitation of being size dependent, a particular problem in growing children; in those who are small, bone mineral density (BMD) will be under-estimated.
There is also a paucity of appropriate reference data available in children, and those provided by the scanner manufacturers generally have to be used. However, these do not correct for the height and weight of the child. We used these databases for original interpretation of scan results in children who had attended the department.
A normal BMD reference database in children aged 5-18 years has been collected by our department; this includes Z scores for height, weight, BMI and BMD (calculating BMAD) measured by DXA. When these were available results of BMD of children who had attended in the past were reanalysed to compare categorisation using manufacturers' (DXA - Hologic QDR 4500) and our own reference databases, and the classification by each compared. Results of Z scores lying between +2 and -1.9 where normal; those at or below -2 were classified as osteopaenia.

Patients: 297 children aged 5 to 16.5 (mean 12.0) years (males: 153; females: 144) had been scanned. DXA lumbar spine: in 245 (82.5%) there was no change in classification of BMD by using the Hologic and locally derived reference databases. In 162 (54.5%) the classification was normal by both methods, and in 83 (27.9%) the classification was abnormal by both methods. In 8 (2.7%) there was a reclassification from normal to osteopaenia, and in 44 (14.8%) there was a reclassification from osteopaenic to normal. Children in the latter group were small (mean height Z score -1.63 (SD 1.61)) and light (mean Z score -0.98 (SD 2.00)). Those 83 children who were defined as osteopaenic by both reference databases were also small (mean height Z score -1.64 (SD 1.73)) and light (mean weight Z score -0.96 (SD 1.71)), reflecting the adverse effect that disease may have on growth and development of the skeleton.

In conclusion, the use of manufacturer's reference data will over-estimate (approximately 15% in this study group) the number of children classified as osteopaenic, if no correction is made for height and weight of the child. By using appropriately corrected reference data from normal children, children who are small and underweight, but otherwise normal, will not erroneously be categorised as osteopaenic.

11:10

SPLIT CORD MALFORMATION – VANISHED BONY SEPTUM, RARE AND UNUSUAL FEATURES

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Introduction: Diastematomyelia refers to a sagittal division of the spinal cord into two hemicords associated with the projection of an osseous, fibro-cartilaginous or fibrous spur. Pang et al., in 1992, postulated his 'Unified theory of embryogenesis for double spinal cord malformations' and recommended the term Split cord malformation (SCM) for all double spinal cords. He classified SCMs in to two types and stated that in Type I SCM, the hemi cords are always invested with individual dural sacs and the medial walls of the sacs always ensheath a rigid (bony or cartilaginous) midline spur. In a type II SCM, the hemi cords are always within a single dural sac and the midline septum is always of non-rigid fibrous or fibro

vascular tissues. There is never a type-I SCM with dual dural sacs that does not have a rigid midline bone or cartilage with in a medial dural sleeve, nor there is ever a type II SCM with a single dural sac and a 'naked' piece of bone or cartilage in the middle unlined by dura. We report a case with rare and unusual features which were not reported before.

Report: A 3 year old girl presented with a deteriorating scoliosis curve with out neurological deficit. Myelogram showed diastematomyelia with a bony spur at D7. Two stage anterior and posterior correction surgery was performed with out removing the bony spur. She represented with an area of numbness over her right great toe with otherwise normal neurology at the age of 10 years. CT myelogram showed split cord malformation with a bony septum at D7 and a bi-lobed spinal cord at the level of L2&L3. The cord is bi-lobed above the D7 disc but is not separate, and the cord comes back to a single cord at D10 vertebral level. Spinal cord was enclosed in a single dural sheath in its entire length. An intradural bony island was found behind L2. She again presented at the age of 27 with numbness in her right great toe with otherwise normal clinical examination. Repeat CT and MRI showed a fibrous septum in the place of previous bony spur at D7 and the bony island remained unchanged.
Discussion: In this patient, bony septum was present in a bi-lobed cord with a single dural sheath - an exception to Pang's classification and this bony septum has disappeared over a period of 16 years. This could be one of the reasons for the patients to remain asymptomatic or neurologically stable until later life and reinforces the idea of conservative management in asymptomatic or patients with non progressive symptoms, in light of the complications associated with prophylactic excision of bony spur. Presence of an innocent intradural bony island within the spinal canal is difficult explain.
Conclusion: This is the first case to be reported where a bony septum has disappeared in Split Cord Malformation. Further studies are needed to see whether removal of spur can be avoided even at the time of scoliosis surgery in patients with asymptomatic split cord malformation and this type of split cord malformation needs to be accommodated in the classification.

11:20

INTER-OBSERVER RELIABILITY IN THE RADIOLOGICAL ASSESSMENT OF SPINAL FUSION

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In spite of its disadvantages, assessment of spinal fusion is usually done radiologically using plain films.
In our study, patients were assessed radiologically on AP and Lateral radiographs at 0, 3, 6, 12 and 24 months after the procedure by 2 observers. The observers had to assess for continuity, gaps, coalescence, and consolidation. Facet joints were also assessed on the lateral films. Observations were recorded simply as yes or no.
Before the start of the study a discussion was held where the above terms were defined. Only posterolateral fusions were assessed in this study as it was felt that CT is probably a better tool to assess interbody fusion.

In this study a total of 22 patients (5 males and 17 females) underwent lumbar spine fusion. Age ranged from 29yrs - 66yrs. 16 single level (L4/5 – 3; L5/S1 – 10) and 6 multi-level fusions were performed. All patients had posterolateral fusion of which 10 had posterior lumbar interbody fusion (PLIF) as well. Of the group that had posterolateral fusion alone, 10 had instrumentation while 8 had Dynesys. Of the 10 that had PLIF as well, 6 had RAD 90 instrumentation while 4 had Dynesys. One instrumented posterolateral fusion was double level, 1 instrumented PLIF was double level, and 2 PLIFs with Dynesis were double level.
We here present the results of the films performed till 12 months.
At 3 months, union was noted to commence in 26 sides (14 right; 12 left) by observer 1 and in 35 sides (19 right; 16 left) by observer 2. Established union was detected in only one patient at 1 year. Overall there was excellent interobserver agreement with a Kappa value of >0.8. The kappa value for the assessment of facet joints on the lateral view was 0.44 at 3 months, increasing to 0.53 at 6 months and further to 0.64 at 12 months. The 24-month results are awaited.
The above results therefore confirm that though plain film assessment of spinal fusion has its disadvantages, if a proper defined classification system is used, fusion can be interpreted with good inter-observer correlation.

SATURDAY AM 10:40 to 11:40
Rhodes Trust Theatre

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10:40
A NEW METHOD FOR ANATOMICAL BASED THREE-DIMENSIONAL RADIOGRAPHIC ANALYSIS OF INDIVIDUAL HIP JOINT MORPHOLOGY

M Tannast[1], M Kubiak-Langer[2], F Langlotz[2], R Ganz[4], SB Murphy[3], KA Siebenrock[4]
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Purpose: Femoro-acetabular impingement (FAI) is a major cause for osteoarthritis of the hip. Treatment for FAI is hampered by the surgeons' and radiologists' inability to objectively assess the presence, location, and severity of the impingement and by the lack of objective methods for planning and executing any proposed treatment. A non-invasive radiographic method of assessing hip joints for the presence, location, and severity of FAI is essential for improved understanding, accurate diagnosis, and appropriate treatment recommendations.
Material and Methods: A non-invasive CT-based software (HipMotion©) for assessment of FAI was developed. It allows the anatomical based calculation of the hip range of motion (ROM), the exact location of the impingement zone and the

simulation of surgical maneuvers for FAI. Validation was performed with the help of a computer navigation system (BrainLAB, Munich, Germany). In a pilot clinical study, the ROM of 24 hips with FAI was compared to a control group out of 144 hips.
Results: The accuracy of HipMotion© was 0.7° ± 3.1° (-5.0° ± 5.6°) in a plastic bone setup (cadaver setup). The reliability and reproducibility was almost perfect (Intraclass correlation coefficient ICC > 0.87) for all dimensions except for external rotation (ICC 0.48). Patients with FAI had a significantly decreased flexion, internal rotation and abduction in comparison to normal hips ($p < 0.001$). The impingement zones were analyzed for the different types of impingement and were located at the anterosuperior part of the acetabulum.
Conclusions: HipMotion© is a useful tool for non-invasive radiographic assessment of impingement hips, analysis of ROM, and simulation of surgical treatment for FAI. This computerized study reproduces for the first time the intraoperative clinical findings and support the pathphysiological concept of FAI. The system is limited to concentric joints and is not applicable to hips with a shallow acetabulum. In addition, it does not take into consideration the soft tissue tension. However, since the restricted motions (flexion and internal rotation) in FAI are due to bone-to-bone impingement, this does not jeopardize results of this study. This computer-assisted method allows a more detailed individual three-dimensional radiographic and kinematical analysis of hip joints for a better understanding and evaluation of pathomorphologies of the acetabular rim.

10:50

TEXTURE ANALYSIS OF SOFT-TISSUE TUMORS FOR DISCRIMINATION OF BENIGN AND MALIGNANT LESIONS

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PURPOSE: To investigate the value of texture analysis of MR images for characterization of soft tissue tumors.
MATERIALS AND METHODS: MR examinations of 58 patients with soft tissue tumors, who had undergone biopsy, were included in the retrospective study. The MR examinations, obtained at 1.0 Tesla, included T1-weighted, T2-weighted, and STIR images. 10 patients were randomly selected from the patient population and were used as testing data set, while the remaining 48 patients were used as analysis data set. According to the histological diagnosis, patients from the analysis data-set were assigned to either group 1 (benign) or group 2 (malignant). For each MR sequence, two images clearly depicting the tumor were selected, and regions of interest (ROI) were drawn inside the tumor. The ROIs were then analyzed with the texture analysis program MaZda, which calculated texture features derived from the image histogram, co-occurrence matrix, run-length matrix, absolute gradient, autoregressive model and wavelet transform. The 10 texture features with the highest discriminative power for separation of benign and malignant lesions were identified using Fisher coefficients and POE+ACC (probability of classification error and average correlation coefficients). In the next step, these parameters were used for automatic classification of images from the test data set using a k-NN (nearest neighbour) classifier. To determine the success of computer-assisted separation of benign and malignant lesions by means of k-NN classification, the percentage of misclassified cases was assessed.

RESULTS: STIR images allowed best discrimination of benign and malignant lesions, especially if using texture features selected by the Fisher method (rate of misclassification: 5%). The majority of these features was derived from the first order grey-level histogram. While T1-weighted images provided adequate results (rate of misclassification: 25-30%), results from T2-weighted images were poor (rate of misclassification: 40%).
CONCLUSIONS: Texture information from STIR images allowed successful discrimination of benign and malignant soft tissue tumors. Features derived from the grey-level histogram seem to be particularly valuable in this regard. More testing is needed to determine if this experimental method of tissue classification is suitable for clinical routine.

11:00

LIMB DEFORMITY CORRECTION IN THE 21ST CENTURY. IMAGING THE LOWER LIMB.

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Pre-operative planning for limb deformity correction involves detailed imaging of the lower limb to define the level, magnitude and direction of deformity. This is then used to plan the correction by defining the centre of rotational alignment (CORA). The method as described by Paley and Hertzenberg involves the use of orthogonal radiographs of the lower limbs using long cassettes (130 cm) taken from a distance of 305 cm to minimize magnification. This method requires special equipment, trained radiographers and multiple doses of radiation even when each radiograph was perfectly positioned first time every time.
We present a work in progress replacing the radiographs with a “virtual 3D” CT dataset of the lower limb which we hope will improve the ability to pre-operatively plan deformity correction, but at a lower cost in terms of skill, equipment and dose.
Whole limb CT is too costly in terms of time and radiation dose for this to be suitable. New multislice CT systems allow a single coherent study to include segments of unscanned data. Thus it is possible to run a single series through a lower limb to include the articular surfaces, but excluding the diaphyseal segments (gaps). This reduces the radiation exposure to the patient. Such data when entered into suitable DICOM image manipulation software allows the Radiologist or Surgeon to measure and assess the deformity with great precision. Such software is available on the diagnostic radiology workstations but is also available for personal computers, allowing the Surgeon to perform preoperative planning in a numerical modeling setting. Allowing the elements of length, rotation, translation and angulation of the deformity to be measured and corrective surgery tested on the mathematical model .
We have compared the measurements taken from a deformity model using this new CT approach and compared it to standard radiographs and found that the above method is no less accurate. Rotational deformities are easier to estimate. However the advantage of our method is that the dataset can be manipulated to determine other technical aspects of deformity correction such as calculating the mounting parameters of the Talyor Spatial Frame.
We present worked examples of the methodology showing how this technique improves deformity appraisal .

11:10

EFFECT OF MRI ON KNEE ARTHROSCOPY RATES AND PATIENT OUTCOME ON PATIENTS WAITING LISTS: A RANDOMIZED CONTROLLED TRIAL.

DR PAULA J RICHARDS, DR S BRIDGMAN, G WALLEY, PROFESSOR G MACKENZIE, PROFESSOR I MCCALL, PROFESSOR N MAFFULLI.

P J Richards[1], S Bridgman[2], G Walley[2], G Mackenzie[2], I McCall[2], N Maffulli[2]
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Objectives To show if MRI can reduce arthroscopy rates and/or improve patient outcome in patients waiting for knee arthroscopy for mechanical symptoms in an English NHS tertiary referral centre.
Design: Prospective longitudinal randomised controlled trial.
Participants: Of 504 eligible patients, 80 had had an MRI or a knee arthroscopy within a year, 52 declined and 115 could not be MRI'ed in time so were excluded. 252 patients waiting an average 46/52 for a knee arthroscopy, had a knee MRI within a week, reported by an experienced musculoskeletal radiologist following their pre-operative assessment clinic visit, and were randomised from 4.6.01 to 19.3.03. In 125 cases the MRI report was seen by their surgeon, and in 127 the report was not seen.
Method: 1T Siemens Magnetom Impact: sagittal T1 and GE T2, coronal STIR, Axial FS PD ± DESS 3D.
Outcome measures: Arthroscopies avoided; SF36; EuroQol-5D; Knee Injury and Osteoarthritis Score; Knee Society Score; range of knee motion; pain; patient satisfaction; complications; and diagnostic confidence, at time 0, 6/52, and 6/12. This was a pragmatic study with 5 experienced orthopaedic surgeons regularly scoping knees in an NHS tertiary referral centre, using their usual treatment practices, which were recorded.
Results: There were 171 men and 81 women of mean age 43.47, mostly with chronic (n=219) and 33 acute symptoms. There was no significant difference between groups in the proportion of arthroscopies avoided $P<0.0001$ (6/125, 4.8%, and 7/127, 5.5%), nor in a range of secondary outcomes. The two groups were demographically equivalent. Most patients (88%) had more than one intra-articular abnormality. According to Bui-Mansfields criteria (AJR 1997;168:913-8) 30/252 (12%) were potentially avoidable, but none of the 11 complete ACL tears were arthroscopically repaired. The subsequent interobserver agreement was 99.6% with an independent experienced musculoskeletal radiologist.
Discussion and Conclusion: Knee MRI after a pre-operative assessment visit had no impact on arthroscopy rates or patient outcomes, inspite of good quality MRI, in an English tertiary referral centre.

11:20

VALUE OF MAGNETIC RESONANCE IMAGING IN THE DIFFERENTIATION BETWEEN MALIGNANT PERIPHERAL NERVE SHEATH TUMORS AND NON-NEUROGENIC MALIGNANT SOFT TISSUE TUMORS

S.R.G. Heyman, B.H. Van herendael, G. De Temmerman, F. Vanhoenacker, G.L. Bloem, A.M. De Schepper
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Purpose: To assess the sensitivity and specificity of MRI-criteria in the differentiation between malignant peripheral nerve sheath tumors (MPNST) and non-neurogenic malignant soft tissue tumors (non-MPNST).
Materials and Methods: MRI-examinations of 105 patients with histologically proven malignant soft tissue lesions (35 MPNST and 70 non-MPNST) were retrospectively reviewed unaware of the pathological diagnosis. Using a standardized protocol the tumors were evaluated for multiple parameters regarding morphology and appearance on different sequences before and after Gd-chelate contrast administration (location, distribution, definition, homogeneity, size, shape, relationship to bone and neurovascular bundle, intralesional hemorrhage, necrosis, perilesional edema, lymphangitis and signal intensities). Results were compared using a chi-square or Fisher's exact test.
Results: MRI findings suggestive of MPNST ($p < 0,05$) were intermuscular location, location on the course of a large nerve, nodular morphology and overall non-homogeneity on T1-weighted images, T2-weighted images and T1-weighted images after Gd-chelate contrast injection. MRI findings in favor of non-MPNST were intramuscular location, ill-delineated appearance of more than 20% of the lesion's circumference and presence of intralesional blood vessels, perilesional edema and lymphangitis. There is no significant difference for degree and pattern of enhancement after gadolinium contrast injection, nor for presence of bone involvement or cysto-necrotic areas.
Conclusion: MRI is a useful tool in differentiating between MPNST's and non-neurogenic malignant soft tissue tumors, which allowed us to define a MRI-prototype of MPNST.

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10:40
RETROPHARYNGEAL TENDINITIS: A CAUSE OF ATRAUMATIC NECK PAIN

J Gelineck, M Salomonsen, C Hviid
Aarhus University Hospital, Aarhus, Denmark

Purpose: To present on cervical spine radiographs and MR imaging a characteristic prevertebral soft tissue swelling and clinical features of this rare disease.
Patients and methods: Six patients suspected of retropharyngeal tendinitis were examined clinically and with radiographs; one male and five females, aged 22 - 61 years (mean 38 years). They all presented with acute serious atraumatic neck pain and slight swelling problems in a chiropractic clinic. Neck pain had started one – two days

previous to examination. All suffered from severe progressive upper neck pain, which was exacerbated by swallowing and motion of the neck. One patient was examined in 1997 one in 2000 and one in 2003. The last three patients attended the clinic within one month and were in addition examined with MR imaging.
Results: All patients had retropharyngeal soft tissue swelling on lateral radiographs. Anterior-posterior diameter of this swelling was 7-14 mm (mean 9.6 mm). In addition three had a well-defined ovoid calcification anterior to C2. At MRI all had intense, well-defined oedema on axial and sagittal STIR corresponding to the longus colli muscle between C1 and C5. One had only oedema between C1 and C3. No patients had oedema outside this muscle.
All patients were treated with high doses of non-steroidal anti-inflammatory drugs for one week and the pain disappeared after 3-6 days.
Discussion and conclusion: Retropharyngeal tendinitis or acute calcific retropharyngeal tendinitis is a calcific tendinitis of the tendon of the longus colli muscle. It is a foreign body inflammatory reaction to deposited crystals of hydroxyappatite in the tendon of this muscle. Three patients showed no calcification on plain film. CT has advantages over radiography in showing these calcifications. We did not perform CT examinations on these patients.
Differential diagnoses include retropharyngeal abscess, meningitis and trauma, but the calcification and soft tissue swelling are characteristic of this condition. It is of importance to primary care providers such as GP, physiotherapists, chiropractors and doctors at casualty department as well as for radiologist to know the features of retropharyngeal soft tissue swelling and calcification on plain film, but it is also of importance to know the diagnostic criteria on MRI because MRI is becoming the first choice in suspected acute spinal disease.

10:50

MRI FEATURES OF MUSCLE ABNORMALITIES IN DIABETES COMPARED WITH OTHER DIVERSE ETIOLOGIES

Fuldem Yildirim Donmez, Frieda Feldman, Ronald Staron, Edward Milman, Qiang Sun
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Purpose: To demonstrate MRI findings of muscle pathologies in long-standing diabetic patients by comparing with other etiologies.
Method and Materials :Symptomatic lower extremities of 10 patients with diabetes were studied with radiographs, ultrasound and MRI which utilized 1.5 T (Philips, GE) magnets with SE T1W (with and without gadolinium), T2W FSE fat saturated and inversion recovery sequences. Ten additional patients with comparable clinical complaints related to other systemic diseases including sickle cell disease, lupus and intramuscular metastases were similarly imaged and results compared with final diagnoses of all patients based on histologic examination of muscle biopsy and salient laboratory and clinical findings.
Results: Three main types of lower extremity muscular abnormalities including infarcts, focal abscesses and pyomyositis were prevalent in diabetics and exhibited characteristic MRI findings. These will be illustrated, discussed and compared with those due to the other above-noted systemic diseases.
Conclusion: Intramuscular pathologies of diabetes can be differentiated from one another based on several characteristic MRI findings. History, clinical and laboratory

findings also aid in supporting MRI diagnoses in the face of occasionally overlapping patterns due to other etiologies.

11:00

MRI AS A DIAGNOSTIC TOOL FOR UNUSUAL PRESENTATION OF OSTEOARTICULAR TUBERCULOSIS

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King's College Hospital, London, United Kingdom

Purpose:
The varied clinical presentation of osteo articular tuberculosis makes the diagnosis an enigma. This article underlines the fact that osteoarticular tuberculosis can present in the most atypical pattern. The report also emphasizes the high index of clinical suspicion and the low threshold for MRI scan and tissue biopsy for establishing diagnosis.
Materials and Methods:
Forty four year old Asian pharmacist presented with ankle pain of 18 months duration. He could weight bear on the affected foot, had no loss of weight, had normal appetite and no constitutional symptoms related to any of his other systems. Clinical examination revealed very little abnormal findings. There was minimal localised tenderness over the medial malleolus and a 2 x 2 cm area of skin overlying this malleolus was hyper pigmented. There was no effusion into the joint, there was no tenderness across the ankle joint, movements at this joint was marginally restricted as when compared to the normal side. Routine haematological and radiological investigations did not reveal any abnormalities.
Results:
With the level of suspicion being raised, we investigated him further with an MRI scan. Coronal fat saturated T 2 weighted MRI scan of ankle showed a well-defined signal lesion in the medial malleolus consistent with osteomyelitis.The patient underwent debridement and saucerization of the lesion. Operative findings showed that the lesion was well contained in the malleolus and that the ankle joint was not involved. Histopathological studies showed evidence of granulomatous inflammation with central caseous necrosis.
Conclusions:
Osteoarticular tuberculosis continues to be a significant worldwide problem even in the 21st century. Previous studies have noted that a considerable delay in diagnosis, often as long as 12 to 18 months is common and likely occurs due to the insidious presentation of the disease and to a low index of suspicion for the diagnosis.
The case highlights the fact that osteoarticular tuberculosis has an unpredictable mode of clinical presentation and emphasises the need for high index of suspicion and low threshold for MRI to successfully diagnose this curable entity.

11:10

THE BIRMINGHAM EXPERIENCE OF PSOAS ABSCESSES – ARE THEY ALL TUBERCULOUS?

J Poels, G M Allen, D Tattersall
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Psoas abscesses classically occur secondary to tuberculous discitis, although pyogenic causes are recognised. With the resurgence of TB we decided to look at our experience.
Method
We retrospectively reviewed the images and organisms obtained from the psoas abscesses seen in our departments over a 2 year period. (13 in all) to see whether TB was the most common organism and ascertain whether they arose from other sites than the disc.
Results
Seventeen percent were Tuberculous in origin with 75% from pyogenic causes. Most arose from the back (50%) but other sites included the sacro-iliac joints and the hip.
Conclusion
Even with the increase in TB in the general population, the psoas abscess is still more likely to be pyogenic in origin.

11:20

HIGH RESOLUTION MUSCULOSKELETAL ULTRASOUND IMAGING IN GOUT

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Purpose: To describe the high resolution musculoskeletal ultrasound findings in gout.
Material and Methods: A prospective review of the musculoskeletal ultrasound findings of patients with tophaceous gout over the last five years was performed. All patients had crystallographic analyses of tissue aspirate that confirmed monosodium urate crystals in the specimens, hydroxyapatite and calcium pyrophosphate dihydrate crystals were not found.

Results: Gouty deposits were seen in various locations in the body including the hand, foot, ankle, elbow and knee. The tophi were juxta-articular in location and appeared mainly hyperechoic. In chronic cases, the tophi were more heterogeneous in character but predominantly hypoechoic. Acoustic shadowing was more commonly seen in chronic cases consistent with calcium deposition which was evident on plain radiograph. Cortical bone erosions with overhanging edges could be seen adjacent to some tophi. Variable hyperaemia was noted.
Conclusion: Ultrasound has an important role in the diagnosis of gout especially in the early stages where the clinical features may be unclear. In the appropriate clinical setting, the detection of tophi in the typical juxta-articular location with adjacent bone erosions on ultrasound that may not be evident on plain radiograph favours gout. Diagnosis can be confirmed by crystal analysis of aspiration done under ultrasound guidance.

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13:00

LUMBAR DISCOGRAPHY – CORRELATION WITH CLINICAL EXAMINATION AND MRI

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Objective: To evaluate the correlation of lumbar discography with clinical examination and MRI
Materials and Methods: Discography followed by a CT scan was performed in a series of thirty consecutive patients with incapacitating low back pain and suspected discogenic pain based on clinical examination and MRI findings. Provocative pain response of significant intensity and familiar quality which correlated with the time of injection and concordant with the patient's usual symptom complex was considered as a positive test.
Results: Ten disc levels were clinically suspected to be symptomatic. Fifty abnormal discs were identified on MRI. All of the ten clinically suspected disc levels were abnormal on MRI and only two of them were positive on discography. Out of the fifty abnormal discs on MRI, pain provocation was positive at nineteen levels (38%) and negative at thirty one levels (62%).Out of the fifteen normal discs in MRI, pain provocation was positive at one level (7%) and negative at fourteen levels (93%).Thus the sensitivity, specificity, positive predictive value and negative predictive values of the MRI in detecting the symptomatic discs are 95%, 31%, 38%, and 93% respectively. MRI was 30% accurate in predicting normality or abnormality as determined by discography and was found to have a false-positive rate of 68% and a false-negative rate of 5%. No abnormal lumbar disc signal pattern could be identified that specifically indicated whether a disc would be painful on discography. There were no complications in our study. A decision was made to operate in15 patients based on the discography result.
Conclusions: Identification of a symptomatic disc clinically, is possible only in a small percentage of patients. MRI with a high sensitivity and a low specificity forms a good screening tool to detect the abnormal levels. Although the discs with abnormal signal intensity, loss of height and bulging are likely to produce pain, the validity of these signs in predicting discogenic pain is restricted. Discography is useful to distinguish whether an abnormal disc on MRI, is actually the source of pain. Combined information obtained from clinical examination, MRI and discography helps in decision making in the management of discogenic pain.

13:10

ULTRASOUND-GUIDED SACROILIAC JOINT INJECTION A CADAVER STUDY

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PURPOSE:
To assess the feasibility of ultrasound (US) guided needle insertion at three different puncture sites for intraarticular injection of the sacroiliac joint (SIJ).
MATERIALS AND METHODS:
Eleven human cadavers with 22 SIJs were investigated. US was performed with a 2.5 – 6.0 MHz curved array transducer. Three different puncture sites for US guided needle insertion, using a 21-gauge needle, were defined: 1st level: spinous process of L5; 2nd level: posterior sacral foramen 1; 3rd level: posterior sacral foramen 2. Computed tomography (CT) was used to evaluate needle placement, to guide needle repositioning in case of US failure and finally to assess intraarticular contrast application. The success rate for US guidance was calculated.
RESULTS:
US guided needle insertion showed a success rate for the 1st level of 4.5% (1/22), for the 2nd level of 54.5% (12/22), and the v3rd level of 90.9% (20/22). CT guided needle repositioning was possible at the 1st level in 1 SIJ (4.5%), at the 2nd level in 5 SIJs (22.7%), and at the 3rd level in 1 SIJ (4.5%). Intraarticular contrast administration confirmed correct US guided intraarticular needle placement in 33/66 SIJs (50%), and image guided needle placement was overall feasible in 40/66 SIJs (60.6%). US guided needle insertion was found to show a significantly higher success rate for the 3rd level when compared with the 1st and 2nd level ($p<0.02$).
CONCLUSION:
US guidance for needle insertion for SIJ injection is feasible and demonstrates the highest success rate (90.9%) at the 3rd level.

13:20
CT GUIDED BIOPSY OF BONY PELVIC TUMOURS

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Pictorial review correlating CT guided biopsy tracts for bony pelvic tumours with final surgical incisions based on the Enneking criteria of staging.
The bony pelvis and its surrounding soft tissues are a common site for musculoskeletal tumours. Bony pelvic tumours resections are based on the basic oncological principles and tend to adapt the classification proposed by Enneking 1983 centred around the resected region of the innominate bone – Type 1 (ilium), Type 2 (periacetabular), Type 3 (pubis) with resection of the ilium and sacral alar considered an extended Type 1 or Type 4.
Biopsy is a key step in the diagnosis of bone and soft tissue tumours. CT guided biopsies are commonly performed for musculoskeletal tumours. Concern exists about the possibility of tumour seedling, particularly chondrosarcomas, following biopsy (and resection) and biopsies should be performed along a track which can be incorporated into the final surgical incision if indicated.
The upper and lower limbs have very well defined compartmental anatomy but no such compartmental anatomy exists for the pelvis. Furthermore, owing to the anatomy of this region resections are difficult to perform under optimal haemostatic conditions. Most textbooks talk about the utilitarian pelvic incision (posterior inferior iliac spine extending along the iliac crest to the anterior superior iliac spine where it separates into two arms – one along the inguinal ligament to the symphysis pubis and

the second turns distally over the anterior thigh for about one third the length of the thigh and then curves laterally just posterior to the shaft of the femur below the greater trochanter) that may be used for hemipelvectomy. This incision is adapted for pelvic osseous tumours according to the Enneking criteria. The CT guided biopsies of pelvic tumours performed at our institution within the last 18 months were reviewed. We found the site for biopsy was dependant on the anatomical location of the pelvic tumour and the approach to be used by the surgeon for definitive surgery which did not always correspond to the commonly quoted utilitarian pelvic incision. We demonstrate the incisions used for pelvic surgery according to the Enneking classification, outlining the surgical and hence CT guided approach for these lesions.

13:30

ULTRASOUND GUIDED ANTERIOR GLENOHUMERAL JOINT INJECTIONS

DR.K TAN, DR.M BRADLEY

KT Tan, MJ Bradley
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Background
Injection of the glenohumeral joint is one of the commoner procedures in musculoskeletal radiology. Although the usefulness of X-ray glenohumeral arthrography has declined considerably in recent times with the advent of computed tomography, ultrasonography and magnetic resonance imaging, intra-articular injection of contrast media is still often used in conjunction with these procedures. In addition, the injection of steroids and/or local anaesthetic into the glenohumeral joint is often used as a treatment for degenerative or inflammatory arthropathies.
Many different techniques for fluoroscopically-guided glenohumeral joint injection have been described. In general, there are two approaches to the glenohumeral joint which are in common use clinically. The first advocates the injection of the glenohumeral joint from a posterior approach[i]. In this approach, the needle is advanced into the joint space from the inferomedial aspect of the humeral head within the boundary of the anatomical head, with the patient supine. The second utilises an anterior approach, whereby with the patient supine and the shoulder slightly externally rotated, a needle is introduced lateral to the medial aspect of the humeral head[ii].
Both of these approaches appear to be safe and easy to perform. However, the dependence on fluoroscopic guidance means that a specialised room is required for the procedure. In addition, the use of fluoroscopy involves irradiating the patient.
Aims
To evaluate the use of anterior ultrasound-guided glenohumeral joint injection
Methodology
10 consecutive patients attending the Radiology Department at Southmead Hospital for glenohumeral joint injection had their procedure done under ultrasound guidance from an anterior approach.
Results and Conclusion
Preliminary results show that the use of the anterior ultrasound guided glenohumeral joint injection is feasible and is a safe alternative to fluoroscopy. We are currently evaluating its use in a larger population of patients.

13:40

EFFECTIVENESS OF INTRAARTICULAR IMAGE GUIDED STEROID INJECTION IN HIP OSTEOARTHRITIS

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[1] Leeds Teaching Hospitals, Leeds, United Kingdom, [2] University of Leeds, Leeds, United Kingdom

Purpose: To assess the effectiveness of symptom and functional improvement after fluoroscopically guided intraarticular steroid injection in hip osteoarthritis.
Methods and Materials: After institutional ethics approval 120 consecutive patients (90 women, 30 men, median age 64 years) referred for intraarticular steroid hip injection were prospectively included. Demographics recorded included body mass index (BMI) and WOMAC Likert scores at baseline as well as conventional radiographic grade (Kellegren and Lawrence scoring) and ultrasound capsular thickness (normal, mild, moderate and severe). All injections were performed fluoroscopically using 40 mg (n=75) or 80mg (n=45) of methylprednisolone and 4mls of 0.5% marcaine. Repeat WOMAC scores were obtained at 6 and 12 weeks after injection. Analyses were performed on percentage change scores from baseline for each of the 3 WOMAC subscales (pain, stiffness, function) using Friedman's analysis (95% confidence limits). Predictors of a positive clinical response (greater than 15 % reduction in baseline WOMAC score) were then analysed for significance in those who where responders compared to non responders, using Mann-Whitney U test.
Results: There was a significant improvement for pain for both doses at 6 weeks (p=0.002) but this was only maintained for the 80mg dose at week 12. Both doses maintained a significant improvement in stiffness from baseline at 12 weeks but the 80mg score was significantly better than the 40mg score (p=0.047). Only the 80mg dose showed a significant improvement in function over 12 weeks (p=0.001) with the 40mg dose showing a trend which was not statistically significant. The only clinically effective (>15%) improvement occurred with the 80mg dose and function at 6 weeks (19.25% improvement). Imaging severity did not relate to the severity of baseline symptoms or subsequent response. BMI was the only predictor of response with a lower BMI increasing the chance of response.
Conclusion: The results of this prospective study demonstrate that intraarticular steroid injections at a dose of 80mg provide significantly improved function and stiffness compared to 40mg in patients with hip osteoarthritis. However neither dose produces a clinically significant improvement of greater than 6 weeks duration.

13:50

ULTRASOUND GUIDED DRY NEEDLING AS A TREATMENT FOR PATELLAR TENDINOPATHY – A NEW TECHNIQUE

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Royal Devon and Exeter Hospital, Exeter, United Kingdom

Purpose
Patellar tendinopathy is a relatively common cause for anterior knee pain. Satisfactory treatment options include prolonged rest, which has a negative impact on sport and leisure pursuits. Also conservative options are not always successful. We describe a

new percutaneous technique performed under image guidance which allows early resolution of symptoms and return to activity.
Materials and Methods
Over a period of one year six patients, presenting with patellar tendinopathy, consented to treatment with this new technique. The technique involves a dry needling procedure under ultrasound guidance directly into the area of cystic tendinopathy.
Results
Five out of the six patients showed excellent clinical response and returned to normal activity within two to three weeks. One patient had a good response initially but needed arthroscopic intervention due to recurrence of symptoms.
Conclusion
This new technique shows encouraging result and should be considered for this relatively common condition.

14:00

POSTERIOR ANKLE IMPINGEMENT IN PROFESSIONAL SOCCER PLAYERS AND EFFECTIVENESS OF IMAGE GUIDED THERAPY.

P Robinson[1], S Bollen[2]
[1] Leeds Teaching Hospitals, Leeds, United Kingdom, [2] Bradford Royal Infirmary, Bradford, United Kingdom

Aims: Posterior ankle impingement is not uncommon in professional soccer players and can be resistant to non surgical treatment.
Inversion injury in neutral can produce posterolateral capsular and ligamentous injury precipitating subacute posterior impingement. Image guided injection of steroid and anaesthetic is an effective treatment for this condition.
Methods: 10 consecutive professional soccer players with clinical features of posterior impingement subsequent to an inversion injury in neutral were evaluated. All underwent MRI prior to ultrasound guided injection of steroid and anaesthetic into the posterolateral ankle. All players were followed up at 4 weeks and then 6 monthly.
Results: MRI showed marked posterolateral synovitis and hypertrophy involving the posterior talofibular ligament in all patients. Other features included os trigonum and disrupted synchondrosis (n=2), marrow oedema (n=7) and posterior intermalleolar ligament thickening (n=7). All patients became pain free following injection and had returned to their previous level of play by 3 weeks. Players without an os trigonum remained pain free at followup (median 31 months). The 2 players with an os trigonum had recurrent symptoms, at 4 and 6 months respectively, with successful repeat injection performed.
Conclusions: Inversion of the ankle in neutral can produce posterior talofibular ligament and capsule injury with subsequent development of posterior soft tissue impingement. These results demonstrate a role for ultrasound guided steroid and anaesthetic injection into posterolateral capsular abnormality. The procedure was well tolerated and allowed a rapid return to previous athletic activity in all cases.

14:10

CONTRAST ENHANCED ULTRASOUND WITH SECOND GENERATION CONTRAST AGENT (SONOVUE) IN PROFESSIONAL ATHLETES MUSCLE STRAINS REPARATIVE PROCESSES

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PURPOSE
The aim of this study was to assess the role of contrast enhanced ultrasound with second generation contrast agent in grading muscle strains reparative processes.
MATERIALS AND METHODS
30 selected professional athletes (age range 18-34 years) with muscle strains (triceps, biceps femoris, semimembranosus, semitendinosus, adductor longus, rectus femoris) had an US conventional examination (Esaote Technos MPX with linear high frequency probe) within 72 hours from trauma. In all cases the same lesions were subsequently studied by two contrast enhanced US examinations (20 days after trauma and 40 days after trauma) after administration of Sonovue .
RESULTS
At first contrast enhanced US was observed in all cases increased microcirculation due to reparative active granulation tissues.
The second contrast enhanced US revealed in 21/30 cases reduction of microcirculation due to scar's stabilization (in one case was also found calcification into the lesion) and in 9/30 cases presence of persistent very vascularized tissues; thus in 9/30 cases were required another US examination (60 days after trauma) and the postponement of the renewal of sport activity.

CONCLUSIONS
Contrast ultrasound with second generation contrast agent in professional athletes with muscle strains is useful in therapeutic planning. This method enables to grade lesion reparative processes and to choose timing of renewal activity, limiting risk of relapse lesions and complicating diseases.

14:20

INITIAL EXPERIENCE OF ULTRASOUND GUIDED INTRAMUSCULAR BOTULINUM TOXIN INJECTION FOR THE TREATMENT OF DYSTONIA

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[1] Department of Radiology,York Hospital, York, United Kingdom, [2] Department of Neurosciences, York Hospital, York, United Kingdom

Purpose: Dystonia are characterised by sustained muscle contractions causing repetitive movements or abnormal postures. Local injection of botulinum toxin (BTX) has been found to be an effective means of treating movement disorders in dystonia.
It is normal practice to assess abnormal muscle contraction by clinical means. The placement of injections is based on palpation of surface anatomy or, less commonly, using electromyograhic guidance. The objective of this study was to evaluate the possible advantages of ultrasound to assess muscle contraction and placement of BTX injection in patients with movement disorders.

Materials and Methods: Retrospective review of consecutive ultrasound guided BTX injection between 2001-2005.
Results: During the study period, 11 patients (male: female 4:7, range 20-85yrs, mean 46.6 yrs) underwent ultrasound guided BTX injection. The procedure was performed 25 times (2 patients n=4, 2 patients n=3, 3 patients n=2, bilaterally n=1) in 11 patients. In all cases the muscles causing the dystonic movements were identified by ultrasound, the placement of the injection needle and injection into the muscle were observed during real time. Total dose of botulinum toxin injected under ultrasound guidance ranged from 15 to 1000 IU. After a mean follow up of 20.5 months all patients except one reported subjective improvement of symptoms following BTX injection.
Conclusion: Visual identification of involved muscles and optimal needle placement are the key features of ultrasonographic-guided injection thus avoiding lack of response due to incorrect site of injection. The advantages of ultrasound to assess abnormal muscle appearance and patterns of disorganised muscular contraction and to guide injection will be discussed. Ultrasound guided BTX injection is a promising, easy and relatively safe treatment for muscular dystonia.

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Rhodes Trust Theatre

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13:00
POSITIONAL, UPRIGHT MRI IMAGING OF THE LUMBAR SPINE MODIFIES THE MANAGEMENT OF LOW BACK PAIN AND SCIATICA.

FW SMITH, M SIDDIQUI
University of Aberdeen, Aberdeen, United Kingdom

With the ability to image the lumbar spine using MRI in the upright position, comes the question. Does this method of spinal imaging influence patient management?
Twenty five patients referred for MRI of the lumbar spine following at least one prior, “normal” MRI examination within six months of referral have been reviewed. 14 men and 12 women aged between 38 and 67 years of age were scanned using a 0.6T “Upright” MRI Scanner (FONAR New York). Each patient was scanned supine, standing erect and in the seated position. In the seated position images were made with the back in neutral, flexed and extended. Thus a series of five different positions were available for scrutiny. Sagittal T2 and Axial T2 weighted sections were made through the lower five intervertebral discs in each position.
In twelve cases, no significant abnormality was seen in any of the five postures. In thirteen, abnormalities were demonstrated in one or more of the seated postures that were not evident in the conventional supine examination. In three cases lateral disc herniation was only seen in the seated position. In six cases the presence of a hypermobile disc at one ore more level was demonstrated. In two cases previously unsuspected grade 1 spondylolisthesis was show and in two cases significant spinal canal stenosis was seen in the seated extended position.

In 50% of these cases who had previously been investigated for sciatica, a surgically remediable lesion was found. Each of the thirteen patients has undergone appropriate surgery and six months post surgery remain symptom free.

13:10

POSITIONAL, UPRIGHT MRI IMAGING OF THE LUMBAR SPINE FOR THE INVESTIGATION OF POST OPERATIVE PAIN FOLLOWING SPINAL SURGERY DEMONSTRATES ABNORMALITIES NOT FULLY APPRECIATED ON CONVENTIONAL SUPINE MRI.

FW SMITH
UNVERSITY OF ABERDEEN, ABERDEEN, United Kingdom

Imaging the lumbar spine using MRI in the upright position and to acquire images in full flexion and extension enables a better display of spinal instability in post operative patients.
Twelve patients referred for MRI of the lumbar spine for the investigation of post spinal operative pain have been reviewed. 7 men and 5women aged between 40 and 72 years of age were scanned using a 0.6T "Upright" MRI Scanner (FONAR New York). Each patient was scanned supine, standing erect and in the seated position. In the seated position images were made with the back in neutral, flexed and extended. Thus a series of five different positions were available for scrutiny. Sagittal T2 and Axial T2 weighted sections were made through the lower five intervertebral discs in each position.
In four cases, no significant abnormality was seen in any of the five postures. In eight, abnormalities were demonstrated in one or more of the seated postures that were not evident in the conventional supine examination.
One patient following unilateral laminectomy and discectomy was found to have spinal instability secondary to damage to the interspinous ligaments. Three patients had undergone ligament stabilisation and four had had postero-lateral instrumented fusion of the lower lumbar spine. All seven showed varying degrees of hypermobility at the transitional intervertebral disc above the stabilisation/fusion level. In one case this was so severe as to cause almost complete occlusion of the spinal canal in the flexed and extended positions.
The ability to image the lumbar spine in different physiological weight bearing positions yields important information about spinal stability in the post operative spine.

13:20

ACUTE VERTEBRAL COMPRESSION FRACTURES: IS QUANTITATIVE DIFFUSION WEIGHTED IMAGING (DWI) A RELIABLE TOOL FOR TISSUE CHARACTERIZATION

A.M. Herneth, K.M. Friedrich, W. Matzek, C. Weidekamm, C. Krestan, H. Imhof
Medical University Vienna, Vienna, Austria

Purpose:
To differentiate benign from pathologic vertebral compression fractures using quantitative Diffusion Weighted Imaging (DWI) for tissue characterization.

Materials and Methods:
The spines of 31 patients with known or suspected vertebral metastases were investigated on a 1.0 Tesla MRI unit. T1 weighted Spin Echo, T2 weighted Turbo Spin Echo, Short Tau Inversion Recovery (STIR) and navigated diffusion-weighted, interleaved Echo Planar Imaging with fat saturation (DW-EPI; b-values, 440 and 880 sec/mm^2) were available in all patients. Quantitative diffusion measurement was achieved by calculating the Apparent Diffusion Coefficient (ADC) on a pixel-by-pixel basis from 31 normal vertebrae and 27 vertebral metastases. 15 of these 31 patients presented with vertebral compression fractures (benign: n=11; pathologic: n=9).
Results:
The mean ADC of vertebral metastases ($0.68\pm0.22x10^{-3}$mm²/sec) is significantly ($p<0.0001$) lower than the mean ADC of normal vertebrae ($1.66\pm0.33x10^{-3}$mm²/sec). The 95% confidence intervals of the ADC in vertebral metastases ($0.56\text{-}0.84x10^{-3}$mm²/sec) and normal vertebrae ($1.43\text{–}1.89x10^{-3}$mm²/sec) show no overlap. Vertebral compression fractures present with analogous ADCs with regard to their nature. The mean ADC in pathologic vertebral compression fractures ($0.69\pm0.28x10^{-3}$mm²/sec) is significantly ($p<0.0003$) lower compared to the ADC of benign vertebral compression fractures ($1.59\pm0.41x10^{-3}$mm²/sec). The 95% confidence intervals for these two types of fractures are $0.41\text{-}0.84x10^{-3}$mm²/sec and $1.17\text{-}1.92x10^{-3}$mm²/sec, respectively.
Conclusion:
Quantitative DWI is a potential tool to differentiate benign from pathologic vertebral compression fractures.
Quantitative DWI seems to be a non-invasive technique for tissue characterization

13:30

HIP^{2}NORM©: TILT AND ROTATION CORRECTION OF THE ACETABULAR RIM ON AN ANTEROPOSTERIOR PELVIC RADIOGRAPH

M Tannast[1], G Zheng[2], C Anderegg[2], K Burckhardt[3], F Langlotz[2], R Ganz[1], KA Siebenrock[1]
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Purpose: On an anteroposterior pelvic radiograph, the contour of the acetabular rim can vary considerably with pelvic tilt and rotation. Correct interpretation of the configuration of the acetabar rim is important for reliable diagnosis of femoro-acetabular impingement and developmental dysplasia of the hip. It could be shown that acetabular retroversion on an anteroposterior pelvic radiograph can not only be caused by an escessive anterior wall; it can also be due to an increased pelvic tilt. The purpose of this study was to develop and validate a computer software (Hip^{2}Norm©) that compensates for pelvic malpositioning during the acquisition of pelvic radiographs and that allows performing more accurate measurements of radiographic parameters for describing the adult human hip joint morphology in a standardized 'neutral' orientation.
Methods: Estimation of tilt and rotation is achieved with the help of linear distances on an anteroposterior and one additional lateral pelvic radiograph. Calibration of these distances was performed by means of 20 cadaver pelves. External validation of the software was achieved on 10 cadaver pelves (20 hips) with wire-marked acetabular

rims of which x-rays were taken in arbitrarily orientation of the pelvis. The amount of femoral head coverage was determined with the developed software and was compared to 3D-CT-based measurements for the neutral orientation as a golden standard. In addition, a theoretical analysis of the feasibility of the linear tilt/rotation indicators was performed using the principle of error propagation according to a previously described scheme.
Results: A highly linear correlation was found for the change of the tilt/rotation indicators and ($R^2 = 0.99$). In this cadaver series, the pelvic inclination angle could be estimated with the help of this distance with an accuracy of 2° ± 5.6° (range, -5° – 13°) for men and 2.2° ± 4.2° (range, -5° – 11°) for women. The total acetabular coverage could be determined with an accuracy of 0.4% ± 2.1% (range, -3.3% – 3.5%). The analysis of an anteroposterior pelvic radiograph with Hip^{2}Norm© lasts two minutes and reveals all the important radiographic hip parameters independent from individual tilt and rotation.
Conclusion: This computer-assisted method enables the elimination of the influence of individual posture when interpreting morphologic differences on an AP pelvic radiograph. It provides the radiologist with more accurate anatomically based measurements and allows reliable quantitative definition of femoral head coverage. The software is limited to more or less spherical hip joints and to AP pelvic radiographs acquired with a standardized imaging technique. Introducing the easily applicable software and its standardization in clinical routine will lead to a substantial benefit in understanding hip pathomorphologies and will provide a more accurate radiographic evaluation of surgical interventions for the correction of acetabular rim pathologies.

13:40

HIGH-RESOLUTION MR IMAGING OF PARASPINAL MUSCLE INJURY FOLLOWING MINIMALLY INVASIVE AND CONVENTIONAL OPEN POSTEROLATERAL LUMBAR FUSION

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Stanford Medical Center, Stanford, United States

Purpose: To use MRI to evaluate and compare paraspinal muscle damage resulting from minimally invasive and conventional open posterolateral spinal fusion.
Materials and methods:
Four patients with a minimally invasive Endius Atavi fusion, and 4 patients with an open single level posterolateral lumbar spinal fusion were imaged approximately 6 months post-surgery in a 1.5T GE scanner. Axial T1w-SE, T2w-FSE, fat-saturated T2w-FSE and coronal T2 FSE sequences were obtained. Edema and atrophy within multifidus (MF) were scored on a visual scale of 0 to 3. An axial dual spin-echo sequence was used to measureT2 relaxation times in the 3 individual bundles of MF at each intervertebral level. Line scan diffusion-weighted imaging was used to determine quantitative differences (ADC) in muscle damage from the two surgical techniques.

Results:
There was a striking visual difference in overall muscle edema between the open and minimally invasive group, and the visual estimate of edema at each site on axial images correlated well with the corresponding T2 values ($r = 0.74$, $p < 0.0001$). The mean T2 relaxation time at the level of fusion was 90ms (± 23.3) in the open group,

and 47ms (± 8.4) in the minimally invasive group (p = 0.013). The mean ADC was 1626 (± 132) x 10^{-6} mm^2/s, compared to 1357 (± 104) x 10^{-6} mm^2/s (p = 0.0184) respectively.
In most patients, edema was seen in a chevron configuration on coronal images, following the anatomy of MF fibers. Edema, T2, and ADC measurements were analyzed in this distribution, and the results were statistically significant. The mean T2 was 99ms (± 20.5) in the open group and 51ms (± 8.9) in the Atavi group (p = 0.005), with a mean ADC of 1656 (± 119) x 10^{-6} mm^2/s and 1332(± 100) x 10^{-6} mm^2/s respectively (p=0.0059).

Conclusion :
Spinal fusions do not always have a satisfactory outcome, and one contributing factor is postulated to be the dissection and retraction of paraspinal muscles needed to perform a standard posterior instrumented spinal fusion. Minimally invasive techniques have recently been developed to minimize such damage. The T2 relaxation time is a quantitative measure of edema within the muscle, and has been shown to correlate with the severity of muscle damage. The mean T2 and ADC measurements were significantly lower in the Atavi group, suggesting that less muscle damage occurs using a minimally invasive approach.

13:50

ARTHRITIS AND OSTEOARTHRITIS IMAGING IN VERTEBRAL FACET JOINTS

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Purpose was to evaluate the impact of crossectional imaging of vertebral facet joints.
Methods and study design: plain film, CT, HRCT and MRI studies of vertebral facet joints were compared.
Results: Vertebral facet joint investigations (radiography versus HRCT) were compared. In the first group (25/100) of patients lumbal pain syndrome existed. In 12/25 patients only disc degeneration was present, and related degenerative facet joint lesions. Conventional radiography did not document any changes in 8/12 cases. In 4/12 cases doubtful suspicion of discrete lesions were described. In 7/25 cases marked irregularities of the articular surfaces were evident. In 8/25 patients, hypertrophic osteoarthropathy (osteophytes) were present. Other types of calcifications we found in cases of DISH patients. Their ligamental calcifications were spur-like with longer bony bridge formations. In the second group of patients (25/100) with SNSA diagnosis 16/25 had HRCT detected lesions. In the third group IBD patients had Crohn's disease (15/25), ulcerative colitis (2/25), malabsorption (7/25) and 1/25 low-grade lymphoma. Erosive lesions were obvious in 5/25 Crohn's disease patients however, none of the lesions were detected on radiography. Calcifications in combination with intra-articular erosions were detected in 3/25 cases and all of these patients were suffering from Crohn's disease. In 7/25 patients, calcification occurred without erosions. Bone scan gave positive results in 7/25 patients, but 5/7 without overlapping with HRCT. The forth group was control (n=25), randomly selected

patients with other types of diseases. None of these patients had any erosive facet joint lesions.
Conclusion: CT morphology offers differential diagnosis in between arthritis and OA. MRI shows actual synovitis.

14:00

FACET JOINT INJECTIONS – A RANDOMISED CONTROLLED TRIAL ON IMAGING AND ITS OUTCOME

P Lakshmanan, A Jones, H Dapke, S Ahuja, PR Davies, K Lyons, J Howes
University Hospital of Wales, Cardiff, United Kingdom

Introduction: Local steroid injection is commonly performed as a treatment for facet joint arthritis in the lumbosacral spine. The injection is performed under image guidance for which some surgeons utilise antero-posterior (A-P) imaging only while others prefer oblique imaging. The entry point and the direction of the needle entering into the facet joint are different in these techniques. Further the difficulties encountered in both the techniques are different.
Purpose: The aim of this study is to find out the difference in the functional outcome in patients who received the facet joint steroid injection by A-P imaging and those who had the injection by oblique imaging.
Material and Methods: A prospective randomised controlled trial was performed by randomly allocating the 20 patients who were diagnosed to have facet joint arthritis clinically and by magnetic reasonance image scans, and who were then placed in the list for facet joint injections. Ten patients in Group I received the facet joint injections with A-P imaging while 10 patients in Group II received the facet joint injections with oblique imaging using image intensifier. All the patients received 40mg of methylprednisolone acetate with 1mL of 1% lignocaine and 1mL of 0.5% bupivacaine to each joint. The duration of the entire procedure was noted. Short Form-36 (SF-36) questionnaire was used before the procedure and at six weeks after the procedure to assess the functional outcome.
Results: All the patients were followed up for a period of six weeks. The mean age was 51.3 yrs in Group I and 48.3 yrs in Group II. The male to female ratio was 3:7 in Group I and 2:5 in Group II. One patient in Group I had the facet injections at only one level while it was in two patients in Group II (L4/5 or L5/S1). Further one patient in Group I and one in Group two had unilateral facet joint injections at two levels. All the other patients had bilateral facet joint injections at two levels (L4/5 and L5/S1). One patient was excluded from the study as the A-P image obtained was very poor and that an oblique image had to be performed to visualise the facet joint because of obesity. The mean duration of the procedure was 18.33 min (10-25 min) in Group I and 22 min (10–35 min) in Group II (p=0.14, 95%CI -8.5 to +1.4). The patient function score improved from a mean of 20.0% to 32.5% after the injection in Group I, and from 30.0% to 41.0% in Group II. The pain score improved from a mean of 33.3% to 47.2% in Group I, and from 35.6% to 44.4% in Group II. The difference in physical function score (p=0.85, 95% C.I. -15.29 to +18.29), and pain score(p=0.71, 95% C.I. -24.21 to +34.22) between the two groups were not statistically significant.
Conclusions: There is no difference in the functional outcome of patients treated by facet joint injections using A-P or oblique imaging. There is no significant difference in the duration of the procedure as well between the two techniques. However, with

experience we found that it may be difficult to visualise the facet joint clearly by A-P imaging alone in obese individuals.

14:10

COMPARATIVE STUDY OF POST-OPERATIVE AND SPONTANEOUS PYOGENIC SPONDYLODISCITIS

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[1] Hôpital Cochin, Paris, France, [2] Hôpital Beaujon, Clichy, France

Objectives. Post-operative spondylodiscitis are poorly characterized, partly owing to their rarity. The aim of this prospective study was to compare the clinical, biological, bacteriological and imaging features of post-operative and spontaneous spondylodiscitis.
Methods. A multidisciplinary spondylodiscitis cohort follow-up study was conducted between February 1999 and June 2003 in a 500-bed teaching hospital. All patients hospitalized in internal medicine, orthopedic and neurosurgery wards with a culture proven diagnosis of pyogenic spondylodiscitis were included. Clinical and bacteriological data were collected. All patients underwent computed tomography and/or magnetic resonance imaging of the spine.
Results. 16 patients had spontaneous spondylodiscitis (SS) and 7 patients had post-operative spondylodiscitis (POS). Patients with POS tended to be younger (52 versus 69 y), with less frequent underlying diseases (29% versus 75%) and more prolonged interval between symptom onset and diagnosis (16 versus 3.4 weeks) than patients with SS. Blood cultures were positive in 14% and 81% of cases in the POS and SS groups, respectively, and invasive diagnostic procedures were therefore necessary in 86% of patients with POS and 19% of patients with SS (p=0.005). Staphylococci were the more frequent isolates in both groups but were more frequently coagulase-negative in POS patients than in patients with SS (p=0.01). Vertebral edema tended to be more frequent in POS and was located more posteriorly than in SS (p=0.023).
Conclusions. POS are associated with specific clinical, microbiological and imaging features possibly related to pathophysiologic characteristics. Knowledge of these characteristics should help reduce the current delay in the diagnosis of POS.

14:20

EVALUATION OF OSTEOPOROSIS OF THE ODONTOID PROCESS USING REFORMATTED CT SCANS

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University Hospital of Wales, Cardiff, United Kingdom

Background: Type II odontoid fractures are the commonest upper cervical spine injury in the elderly, following minor falls. Structural heterogeneity within the axis with deficiency of bone mass in the base of the odontoid process has been attributed for these fractures.
Aims: To grade the severity of osteoporosis of the odontoid process, and analyse whether osteoporosis at the dens-body junction is directly related to the occurrence of odontoid fractures in the elderly.

Material and Methods: We studied the reformatted CT scan images of 36 patients over the age of 70 years who had cervical spine injuries following minor trauma. In all these patients the severity of osteoporosis at the dens-body junction, and in the peg and body of axis were evaluated. The osteoporosis was graded into none, mild, moderate and severe. Statistical analysis was performed using Pearson's Chi-square test to find the significance of osteoporosis at the dens-body junction in producing Type II odontoid fractures in the elderly.

Severity	Trabeculae	Cortical thickness	Holes
None	Normal	Normal	Absent
Mild	Decreased	Normal	Absent
Moderate	Decreased/ Absent	Decreased	<50% transverse diameter
Severe	Decreased/ Absent	Decreased	>50% transverse diameter

Results: Type II odontoid fractures was seen in 21 patients. Eleven of the 21 patients with Type II fractures and eight of the 15 patients with no Type II odontoid fractures had significant osteoporosis at the dens-body junction. Five patients with Type II fracture and eight patients with no Type II fractures had significant osteoporosis at the dens and body of axis. Statistical analysis showed that the osteoporosis at the dens-body junction was not significant in patients with Type II odontoid fracture compared to those with no Type II odontoid fracture (Chi-square = 1.1; df = 3, p = 0.78).
Conclusions: Reformatted CT scan is useful in evaluating osteoporosis of the odontoid process. Eventhough osteoporosis is one of the factors that increase the incidence of Type II fractures of the odontoid process in the elderly, it is not a direct aetiological factor.

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13:00
MOTION COMPENSATED VIEWING OF 4D KINEMATIC MR JOINT STUDIES

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The contrast properties of MRI allow the assessment of soft tissue in normal and abnormal joint motion. Fast two-dimensional (2D) scanning of moving joints may also provide high temporal resolution of 200ms to 1s per frame, but is limited to a single, predefined slice. Even when using a device to restrain the joint, single slice imaging suffers from through-plane motion of the anatomy of interest. Recent advances in MRI allow fast acquisition of series of static 3D images in 30s to 2min per image. This 4D data has the advantage, that after acquisition image processing and visualization techniques can be used to reformat the images to any view and to reduce

through-plane motion and undesired gross motion superposing relevant joint movement.
We have implemented a viewer for 4D kinematic MRI joint studies. The application allows to interactively define an anatomical structure, for which undesired motion is compensated, and to select the viewing plane retrospectively. The result is rendered as a cine loop. The cine display is updated immediately after each user interaction, which greatly facilitates the inspection of the data set.
In a preprocessing step, motion of the anatomy through all acquired 3D images is estimated using an image registration algorithm. During viewing, the anatomy to be stabilized is defined interactively in one of the 3D images by placing 3 to 5 reference points. Using the motion estimation result, the trajectories of these reference points are derived. Then a series of 3D coordinate systems is constructed that minimizes the displacement of the reference points between the different 3D images. Finally, the user can select a viewing plane for the cine display. During display, the plane is updated in real-time using the corresponding coordinate system that compensates the movement of the selected object.
For evaluation of the presented method, series of 3D datasets were obtained using a T1-weighted gradient echo sequence for 6 to 7 different positions of the shoulder, ankle and knee without using any physical stabilization device. Various user-defined structures were investigated, for example the space between acromion and humerus, the upper arm with glenoid fixed, the PCL with femur fixed and the patella also with femur fixed. In all cases the selected anatomy was sufficiently stabilized, preventing visible in-plane and through-plane motion in the cine display. The movement of the joints was easier to perceive than in the original uncompensated sequences.

13:10

MRI OF STRESS REACTION OF THE DISTAL HUMERUS IN ELITE TENNIS PLAYERS

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[1] Royal National Orthopaedic Hospital, London, United Kingdom, [2] Victoria House Medical Imaging, Melbourne, Australia, [3] Melbourne Orthopaedic Group, Melbourne, Australia

Purpose: In upper-limb dominated sports, a bone stress injury should be considered as a cause of acute, or chronic pain, in the upper limb. Stress injuries in tennis players usually involve the shoulder, forearm, wrist, and hand in the upper limb, and the tibia and metatarsals in the lower limb. We describe the MRI appearances of stress reaction in the distal humerus in eight elite tennis players, in whom symptoms prevented continuing participation on the professional tennis circuit.
Materials and Methods: Eight professional tennis players presented consecutively to the medical team covering the Australian Open tennis championships in 2002 and 2003. All the patients described pain in the mid and distal humerus of the dominant limb when serving, with the pain extending into the post-match period. Each patient underwent MRI of the affected limb using a 1.5T MRI scanner Axial proton density, and coronal and axial short tau inversion recovery (STIR) sequences were used. The scans were evaluated for morphology and signal intensity of the humeral cortex, periosteum and bone marrow. The extent of marrow oedema was classified as mild (0-25%), moderate (25-75%), or severe (75-100%) according to the maximal cross-sectional area of abnormal marrow signal on axial scans. The dominant limb of

twenty normal volunteers, and ten other professional tennis players was scanned to provide controls.
Results: There were four males and four females, mean age 24 (ranges 18-29 years). All eight players had various levels of bone marrow oedema on the STIR images in the distal humerus, which extended over a distance of 10.16cm on average (range 6 to 15 cm). Periosteal reaction was seen in three of the eight cases. In the control group of professional tennis players, 9/10 had normal MR appearances, whilst one demonstrated patchy low-grade high signal in the mid-humeral shaft. In the twenty normal volunteers, no abnormalities were found on MRI.
Conclusion: Stress injury to the distal humerus is a cause of chronic arm pain in the elite tennis player and can be reliably diagnosed on STIR MRI.

13:20

IMAGING FINDINGS OF RECTUS ABDOMINIS MUSCLE STRAIN IN ELITE TENNIS PLAYERS

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Objective: Our objective was to describe the imaging findings of rectus abdominis muscle strain in tennis players.
Methods: Over a two year period, eleven elite tennis players and one professional rugby player were referred for sonographic evaluation of anterior abdominal wall pain and muscle spasm. There were nine men and three women with ages ranging from 15 to 28 years. All patients were evaluated by a specialist musculoskeletal radiologist using a 5-12mHz linear probe (HDI machine, ATL). Seven of the twelve patients underwent MR imaging at the request of the referring physician.
Results: The onset of symptoms occurred during sporting activity and involved the contralateral side to the dominant (racquet) arm in all cases. Hypertrophy of the rectus abdominus musculature was observed on the contralateral side to the racquet arm in the tennis players.
At sonography, disruption of the normal echogenic fibrillar pattern with fluid filled clefts was identified most commonly involving the deep surface of the rectus abdominus belly. The size of tears ranged from 6mm to 72mm in craniocaudal length. MR imaging did not provide further additional information in the assessment of these cases.
Conclusion: Asymmetrical hypertrophy of the recti is seen in elite tennis players. The muscle belly hypertrophies on the side opposite the dominant arm and is subject to muscle tears in its lower third. Imaging can be used to demonstrate these injuries.

13:30

RAPID WEIGHT-LOSS AND BODY COMPOSITION IN WRESTLERS

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PURPOSE
Wrestlers are used to loose 3-13% of their weight in order to reach defined lower weight categories. In Finland they use a rapid weight-loss (RWL) method that includes restricted food and fluid intake together with dehydration through exercise and sweating in hot sauna. The aim of the study was to investigate changes in body composition of male wrestlers trying to reach their goal weights.
MATERIALS AND METHODS
We investigated 18 Finnish wrestlers participating in the Finnish Championship Games. Their body composition was evaluated three weeks and one day before the tournament. Between these two measurements a RWL program was completed. The second evaluation was done simultaneously with the official weigh-in. The evaluation was made with dual-energy x-ray absorptiometry (DXA) (Lunar GE Medical Systems). The evaluation included body weight (BW), fat mass (FM), percentage fat (F%), lean body mass (LBM), bone mass (BM) and bone mineral density (BMD). At the same time blood samples were taken in order to investigate the degree of dehydration.
RESULTS
All the wrestlers reached their goal weights. The average weight loss was 5.7 kg. Maximal change occurred in LBM in which the average loss was 4,8 kg. In FM the loss was 0,9 kg. However, F% also decreased. 16,5% of the weight loss was fat and 83.5% of the weight loss was lean. Blood tests showed obvious dehydration.
CONCLUSION
The RWL program used in this study was effective in causing rapid loss of weight. Significant decreases were found in BW, FM, F% and LBM in male wrestlers during a RWL program. No significant changes were found in BM or BMD. On the basis of the blood tests the wrestlers clearly suffered from dehydration. Because FM contains less water the decrease in FM mostly reflects its actual change. Changes in LBM which contains more water are evidently due to dehydration. The used RWL method did not affect either BM or BMD.

13:40

MRI OF THE LATERAL ANKLE LIGAMENTS: VALUE OF THREE-DIMENSIONAL ORIENTATION FOR FULL-LENGTH VISUALIZATION

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PURPOSE: To determine the three-dimensional (3D) course of the lateral ankle ligaments with MRI.
MATERIALS AND METHODS: Twenty healthy volunteers without previous injury to the ankle were included in the study. With the right ankle in the normal anatomic position stabilized in a splint with velcro fastening, coronal T2-weighted spin-echo sequences (TSE) were obtained using a 1.0 Tesla MR scanner. The three-dimensional orientation was determined by placing paths through the ligaments and by measuring the angles between tangents corresponding to the 3D paths and the three main imaging planes.
RESULTS: Using the arithmetic means of the calculated angles for image reformation, full-length visualization of the lateral ligaments of the ankle was achieved in all cases. The mean angles deviating from the axial imaging plane were

18.0 degrees for the anterior talofibular ligament, 52.3 degrees for the calcaneofibular ligament and 28.2 degrees for the posterior talofibular ligament.
CONCLUSIONS: MRI enables the exact determination of the three-dimensional orientation of the lateral ankle ligaments, which are very commonly injured. Changing the orientation of the imaging planes according to the calculated angular deviations allows full-length visualization of the ligaments and is the basis for optimal imaging of the lateral ankle ligaments.

13:50

ANTERO-LATERAL ANKLE IMPINGEMENT: FINDINGS AND DIAGNOSTIC ACCURACY WITH ULTRASOUND IMAGING

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PURPOSE: To prospectively evaluate the findings and diagnostic accuracy of ultrasound in anterolateral ankle impingement (ALI) with clinical and arthroscopic correlation.
METHOD AND MATERIALS: Seventeen male footballers with chronic anterolateral ankle pain were referred for ultrasound with a clinical diagnosis of ALI (n=8) or a control condition (n=9). Ultrasound was performed prior to arthroscopy by a musculoskeletal radiologist using a high resolution ATL HDI 5000 (5-12MHz) scanner. Arthroscopy was performed by a foot and ankle surgeon under general anaesthesia. Assessment included the anterolateral gutter for abnormal synovial tissue (synovitic lesion), lateral ligament integrity, tibiotalar joint and osseous spurs of the distal tibia and talus. Arthroscopic appearances were correlated with ultrasound findings.
RESULTS: Ultrasound examination detected a soft tissue mass in the anterolateral gutter in all 8 footballers with clinical ALI (100%) and 2 control patients (22%). Arthroscopic confirmation of anterolateral synovitis and fibrosis was present in all 10 cases (100%). The synovitic lesion was seen at ultrasound as a nodular soft tissue mass of mixed echogenicity within the anterolateral gutter which extruded anteriorly with compression of the distal fibula and tibia. No increased blood supply was present with doppler imaging. The synovitic lesion measured >10mm in footballers with clinical ALI and <10mm in the control group. Additional ultrasound findings in patients with synovitic lesions included anterior talofibular ligament injury (n=10) [absent (n=7), thickened (n=2), attenuated (n=1)], osseous spurs (n=4) and tibiotalar joint effusion (n=6). Anterolateral synovitic tissue was accurately identified at ultrasound in the absence of an effusion (n=4). No synovitic lesion was detected at ultrasound or arthroscopy in the remaining 7 control patients [lateral ligamentous complex injury (n=4), osteochondral fracture (n=2), intra-articular bodies (n=1) and osteoarthritis (n=1)].
CONCLUSIONS: Ultrasound is accurate in detecting synovitic lesions within the anterolateral gutter, demonstrating associated anterior talofibular ligament injuries and differentiating soft tissue from osseous impingement. Doppler studies suggest synovitic lesions are composed of fibrosis and scar tissue rather than active synovial inflammation. Synovitic lesions in two control subjects suggest abnormal anterolateral soft tissue does not necessarily imply the presence of clinical ALI which may be determined by the size of the synovitic mass. Ultrasound findings with clinical correlation can be used to direct arthroscopic examination and surgical debridement.

14:00

ANALYSIS OF PENNATION ANGLES OF MUSCLES WITH HIGH RESOLUTION ULTRASOUND (HR-US) IN TRACK AND FIELD ATHLETES

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Purpose: To evaluate the pennation angles of lower limb muscles (vastus lateralis and medial head of gastrocnemius) in trained track and field athletes with HR-US to investigate whether the arrangement of muscle fascicles is related to different muscle activities (aerobic vs. anaerobic).
Material and Methods: Thirty-six track and field athletes trained in anaerobic (100-meters runners) and aerobic (marathon runners) muscle activities were evaluated at the end of their training session. In each subject, HR-US evaluation of the vastus lateralis (VL) and the medial head of the gastrocnemius (MHG) was performed on both limbs by means of a high-resolution broadband linear array transducer (12-5MHz). Muscle pennation angles were calculated on scanning planes oriented along the long axis of the muscle.
Results: Athletes performing anaerobical training showed greater fascicle angles (VL, mean 23°; MHG, mean 24°) than the aerobically trained ones (VL, mean 16°; MHG, mean 18°).
Conclusion: HR-US evaluation of pennation angles is an easy technique to achieve information on the architecture of muscles. Our data indicate a significant difference of orientation of muscle fascicles between trained aerobic and anaerobic athletes.

14:10

OBLIQUE MR IMAGING OF THE ANTERIOR CRUCIATE LIGAMENT BASED ON ITS THREE-DIMENSIONAL ORIENTATION
THREE-DIMENSIONAL ORIENTATION

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PURPOSE: To investigate the three-dimensional (3D) course of the ACL, and use this information for oblique full-length imaging of the ligament.
MATERIALS AND METHODS: 25 healthy volunteers with no history of knee injury were included and were divided into two groups. While group 1 consisted of 20 volunteers, and was used for determination of the three-dimensional orientation of the ACL, group 2 consisted of 5 volunteers, and was used to test the value of results from group 1 for full-length imaging of the ACL. Axial proton-density weighted MR images of the left knees of volunteers in group 1 were obtained at 1.5 Tesla, and coronal and sagittal reformations were created. Using markers, 3D paths along the course of the ACL were constructed and visualized in all three imaging planes. Tangents were applied to the 3D paths in each imaging plane, and angles between these tangents and three reference lines were measured. Reference lines were: for the axial imaging plane, a line connecting the posterior edges of the femoral condyles (RFL-1); for the coronal imaging plane, a line through the intercondylar joint space of the knee (RFL-2); for the sagittal imaging plane, a line connecting the anterior and

posterior edge of the medial tibial condyle in its mid-position (RFL-3). The calculated angles from group 1 were then used for oblique T2w MR imaging of volunteers' knees in group 2, and the average number of slices depicting the ACL in its entirety was calculated to determine the diagnostic value of each oblique plane.
RESULTS: On axial MR images, the mean angle between the ligament and RFL-1 was 73.6 degrees. On coronal and sagittal reformations, the mean angles were 78.7 degress to RFL-2 and 71.0 degrees to RFL-3, respectively. Thus, two oblique sagittal and one oblique coronal MR imaging planes were used for imaging of the knees of volunteers in group 2. On average, full length visualization of the ACL was demonstrated by 1.4 images using the sagittal oblique plane prescribed off RFL-1, and by 2.4 images using the sagittal oblique plane prescribed off RFL-2. Respectively, 1.4 oblique coronal images, prescribed off RFL-3, depicted the ACL in its entirety.
CONCLUSIONS: Knowledge of the three-dimensional orientation of the ACL can improve full-length MR imaging of the ACL. Best results were achieved using a sagittal oblique imaging plane prescribed off coronal images, angled at 80 degrees from a reference line through the intercondylar joint space.

14:20

ASSESSMENT OF ACROMIAL SHAPE WITH MRI: INFLUENCE OF SLICE POSITION ON DIAGNOSTIC VALUE AND COMPARISON WITH CONVENTIONAL RADIOGRAPHS

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PURPOSE: It was the aim of this study to determine the value of different MRI planes independently and in combination for assessment of acromial shape and compare them to conventional radiographs.
MATERIALS AND METHODS: 61 patients with subacromial impingement syndrome, who had undergone acromioplasty after failure to respond to conservative treatment, were included. Parasagittal T2-weighted MR images and outlet view radiographs of the affected shoulders were acquired preoperatively. In the next step, three-dimensional models of all acromions were constructed from the MR images, and the Bigliani type of acromion depicted by these models was determined. Results were compared with the acromial type assessed during acromioplasty. To provide a reliable reference for further processing and correlation, we used only those 56 acromions with agreement on acromial shape between intraoperative findings and 3D models. Acromial shape was then determined for three MRI slice positions (S-1, lateral acromial edge; S-2, just lateral of acromioclavicular joint; and S-3, lateral portion of acromioclavicular joint), for a combination of S-1 and S-2, and for the radiographs.
RESULTS: Kappa coefficients were 0.36 for S-1, 0.41 for S-2, and -0.10 for S-3. For the outlet view radiographs, the kappa coefficient was 0.55, showing better correlation than any single slice position. Best results, were achieved with a combination of S-1 and S-2, with a kappa coefficient of 0.66.
CONCLUSIONS: For determination of acromial shape, outlet view radiographs are superior to any single MRI slice position, but inferior to a combination of two MRI slices (S-1 and S-2). If a single MRI slice is being used, the slice position just lateral to the acromioclavicular joint is recommended. The slice position at the lateral

acromial edge on the other hand is especially useful for diagnosing a hooked acromion.

Saturday 9th July at 14:30 in Edmond Safra Lecture Theatre

HIGHRESOLUTION MRI AND CONVENTIONAL MRI COMPARED TO ARTHROSCOPY IN PATIENTS WITH A SUSPECTED MENISCAL TEAR

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[1] Radiology, Vienna, Austria, [2] Trauma Surgery, Vienna, Austria

Purpose: To evaluate the diagnostic performance of highresolution MRI compared to conventional MRI of the knee with arthroscopical findings in patients with the clinical suspicion of a meniscal tear
Material and Methods:
19 patients (9 female, 10 male) from the department of trauma surgery were included into the study so far. Inclusion criteria was a suspected meniscal tear (or re-tear) and a planned arthroscopy of the knee joint. MRI exams were performed on a 1.0 T MRI scanner (T10 -NT, Philips Medical Systems, Best Netherlands) with 2 different protocols: Standard MRI with a knee coil; sagittal PD-TSE-sequence; FOV 200mm, Matrix 512x512, slice 3mm, TR: 2500ms, TE: 11ms., reconstructed voxel size: 0.39 x 0.39 x 3mm, high resolution MRI with a dedicated surface coil: FOV 160mm, Matrix 512x512, TR: 1200ms, TE: 10ms, 0.31x0.31x3mm, reconstructed voxel size 0.31x0.31x3mm. The high resolution protocol was applied at the symptomatic compartment (medial or lateral). The menisci were evaluated by 2 musculoskeletal radiologists independently and blinded on the basis of an adapted score (0=normal meniscus, 1=intrameniscal, hyperintense signal, 2= discontinuity of the surface, 3= fragmentation).
Athroscopy with evaluation of the menisci was performed by an experienced trauma surgeon and documented by videotaping.
Results:
12 of the 19 patients included into the study underwent arthroscopy and all revealed a meniscal tear. The correct diagnosis of a meniscal tear was between 75% and 83.3% for the standard MRI and 83.3% for the high-resolution MRI-exam. The kappa-value between Rater 1 and 2 was .75 for the standard MRI and ns for the high-resolution MRI. For the adapted score kappa-values were between .707 for rater 1 and .736 for rater 2.
Conclusion:
Our preliminary data suggest, that high resolution MRI of the menisci could lead to an improved diagnosis of meniscal tears, with a good interobserver agreement for both MRI-protocols. However more patients have to be entered into the study to draw a final conclusion.

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