RC213

Pediatric Series: MSK

Monday, Nov. 30 8:30AM - 12:00PM Location: N230

MK MR PD

ARRT Category A+ Credits: 3.50
AMA PRA Category 1 Credits ™: 3.25

Participants
Andrea S. Doria, MD, Toronto, ON (*Moderator*) Consultant, Bayer AG; Consultant, Novo Nordisk AS; Consultant, Baxter International Inc
Tal Laor, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
Siddharth P. Jadhav, MD, Houston, TX (*Moderator*) Nothing to Disclose
Sarah D. Bixby, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

RC213-01 Magnetic Resonance Imaging of Children with Juvenile Idiopathic Arthritis

Monday, Nov. 30 8:30AM - 8:50AM Location: N230

Participants
Tal Laor, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the nomenclature and criteria for the diagnosis of juvenile idiopathic arthritis (JIA) in children. 2) To recognize the sites in children commonly affected by JIA. 3) To illustrate the spectrum of abnormalities identified with magnetic resonance imaging in children with JIA.

ABSTRACT

RC213-02 Predictive Value of Magnetic Resonance Imaging in Clinically Inactive Juvenile Idiopathic Arthritis?

Monday, Nov. 30 8:50AM - 9:00AM Location: N230

Participants
Charlotte M. Nusman, MSc, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Robert Hemke, MD,PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Cristina Lavini, DPhil, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Dieneke Schonenberg-Meinema, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marion Van Rossum, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Koert M. Dolman, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Merlijn van den Berg, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Taco Kuijpers, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mario Maas, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mirkamal A. Tolend, BSc, Toronto, ON (*Presenter*) Nothing to Disclose

PURPOSE

The value of subclinical synovitis on magnetic resonance imaging (MRI) in clinically inactive patients with juvenile idiopathic arthritis (JIA) is yet to be unraveled. This study was performed to determine whether (dynamic) contrast-enhanced MRI parameters of a previously affected target joint in patients with clinically inactive JIA can predict a flare of joint inflammation during 2-year follow-up.

METHOD AND MATERIALS

Thirty-two JIA patients with clinically inactive disease at the time of MRI of the knee were prospectively included. Dynamic contrast-enhanced (DCE) MRI provided both descriptive measures and time-intensity-curve shapes, representing functional properties of the synovium. Conventional MRI outcome measures included validated scores for synovial hypertrophy, bone marrow edema, cartilage lesions and bone erosions. During a 2-year period the patients were examined at regular time points and clinical flares were registered.

RESULTS

MRI analysis revealed synovial hypertrophy in 13 (39.4%) of the clinically inactive patients. Twelve patients (37.5%) had at least one flare during 2-year clinical follow-up. Median time-to-flare was 0.68 years (IQR 0.18-1.97) and 50% of the flaring patients did so within the first 6 months (Figure 1). Persistently inactive and flaring patients differed significantly in the maximum enhancement of the DCE-MRI ($p<0.05$), whereas no difference was found between these two groups in any of the baseline scores of conventional MRI.

CONCLUSION

Our prospective clinical follow-up study indicates that the assessment of 'maximum enhancement' upon DCE-MRI may be able to predict a clinical flare within 2 years in inactive JIA patients. In the future, functional imaging biomarkers, such as DCE-MRI can be combined with serum markers or gene profiling data, leading to the construction of a predictive model to more precisely decide about treatment strategies in any individual patient.

CLINICAL RELEVANCE/APPLICATION

The presence of a relatively high maximum enhancement on dynamic contrast-enhanced MRI of the knee in clinically inactive patients with juvenile idiopathic arthritis indicates a risk of flaring.

RC213-03 Periosteal Entrapment in Salter-Harris Injuries: Too Much on the Plate

Monday, Nov. 30 9:00AM - 9:10AM Location: N230

Participants
Peter H. Van Geertruyden, MD, Fort Belvoir, VA (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Presenter*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Timothy G. Sanders, MD, Keswick, VA (*Abstract Co-Author*) Nothing to Disclose
Jana M. Crain, MD, Atherton, CA (*Abstract Co-Author*) Nothing to Disclose
Brendan T. Doherty, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To present a series of Salter-Harris injuries with periosteal entrapment, to better understand incidence and distribution, appearance and potential complications with regard to healing.

METHOD AND MATERIALS

Two musculoskeletal radiologists retrospectively reviewed 142 MRI exams with Salter-Harris injuries from 2007 to present for the presence of periosteal entrapment. Evaluation included Salter-Harris grade, location, presence of periosteal entrapment, and degree of entrapment measured in distance extending within the physis. Available follow-up imaging findings and clinical evaluations were recorded.

RESULTS

Of 144 Salter-Harris injuries on MRI, 59 cases were type I injuries, 48 cases were type 2 injuries, 20 cases were type 3 injuries, 14 cases were type 3 injuries, and 3 cases were type 5 injuries. The most common location for type I injuries was the distal fibula. The most common location for type 2 injuries was the distal radius. Type 3 and 4 Salter-Harris injuries showed no particular location preference. Of the 144 cases, 96 cases were in boys and 48 in girls. Average age of boys was 13 years, 9 months. The average age for girls was 12 years, 4 months.

CONCLUSION

Periosteal entrapment is observed in 7% of Salter-Harris injuries by MRI; entrapment is an under-reported phenomenon in current literature. In our series periosteal entrapment occurred most commonly at the distal tibia and fibula. Continued follow-up will reveal whether premature physeal arrest/growth disturbance is associated with periosteal entrapment.

CLINICAL RELEVANCE/APPLICATION

To make aware the frequency and potential implications of perisosteal entrapment in Salter Harris fractures.

RC213-04 Plastic Bowing Fractures of the Pediatric Forearm: Evaluation of a Novel Computer Aided Method for Detection

Monday, Nov. 30 9:10AM - 9:20AM Location: N230

Participants
Uygar Teomete, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose
Yuwei Zhou, Coral Gables, FL (*Abstract Co-Author*) Nothing to Disclose
Ozgur Dandin, MD, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Weizhao Zhao, Coral Gables, FL (*Abstract Co-Author*) Nothing to Disclose
Taner Dandinoglu, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Onur Osman, PhD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

(1) To develop a computer aided diagnosis (CAD) system for detection of plastic bowing fractures of the pediatric forearm and (2) to compare its feasibility with respect to the radiologists' interpretation.

METHOD AND MATERIALS

Following IRB approval, we retrospectively analyzed the forearm radiographs of the patients presenting to the pediatric emergency room following trauma. We included a total of 55 pediatric patients from all age groups. We used morphological operations to extract the forearm diapyseal features. In geometry, the radius of curvature, R, is a measure of the radius of the circular arc which best approximates the curve at that point. Along with the border of the bone, at every point, the more "bending" of the curve, the smaller of the radius of curvature; the "flatter" of the curve, the bigger of the radius of curvature. Average of R increases with increased bowing level. Curvature of the radial and ulnar diaphyses were caculated for the normal patients with normal interpretation and for the patients with plastic bowing fracture. Leave one out cross validation scheme was used for avoiding bias in our evaluations. Results were compared with the radiologist's interpretation. t-test was used to determine statistical significance level.

RESULTS

Curvature values were obtained from our CAD method in the training step. With a sensitivity of 80% in detecting plastic bowing fractures, we recorded 92% specificity. When compared to radiologists' conventional readings, we did not find significant differences between the proposed method and the radiologists' reading using t-test ($p>0.05$).

CONCLUSION

The proposed automated computer aided detection method can be used as a second opinion to aid the radiologist's decision making by highlighting the suspicious regions for plastic bowing fracture. To best of our knowledge, this is the first attempt towards automatizing quantitative evaluation of pediatric buckle fractures from radiographs.

CLINICAL RELEVANCE/APPLICATION

Our CAD method is fast, effective an reliable. It can be used as a standalone application or as a plugin to the PACS viewer in a radiology workstation. Its use as a second opinion may obviate the need to obtain additional radiographs of the contralateral forearm for comparison, preventing unnecessary radiation exposure to the child.

RC213-05 Growth Recovery Lines are More Common in Infants at High- vs. Low-risk for Abuse

Monday, Nov. 30 9:20AM - 9:30AM Location: N230

Participants
Matthew A. Zapala, MD,PhD, Boston, MA (*Presenter*) Nothing to Disclose
Andy Tsai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Growth recovery lines (GRLs), AKA growth arrest, Harris, and Parks lines are transverse radiodense metaphyseal bands believed to be due to a temporary arrest of enchondral ossification-caused by local or systemic insults such as intermittent illness and malnutrition. The purpose of this study was to determine if GRLs are more common in infants at high- vs. low-risk for abuse.

METHOD AND MATERIALS

The reports of initial high detail ACR compliant skeletal surveys done at a large pediatric hospital between 1999 and 2013 were reviewed, along with the relevant clinical records. Infants were considered at low-risk for abuse if they had a skull fracture without significant intracranial injury (ICI) on CT, a history of a fall and the determination of Child Protection Team (CPT)/social work assessment. High risk infants had significant ICI, retinal hemorrhages, skeletal injuries (other than skull fractures) and the determination of risk by CPT/social work assessment. There were 53 low-risk infants (age range, 0.4-12 months; mean, 4.7 months) and 21 high-risk infants (range, 0.8-9.1; mean, 4.2). Using a 4 point Likert scale, a pediatric radiology attending and fellow independently evaluated the frontal radiographs of the lower extremities from the skeletal surveys for the presence of at least one GRL involving the distal femurs/tibias. The data were pooled and differences between the two groups were calculated.

RESULTS

Intra- and inter-reader agreement was very good (Cohen's kappa inter-reader = 0.77 and intra-reader = 0.82 and 0.84). The relative prevalence of GRLs in the low-risk groups was 38% (SD 8%, reader 1 = 17/53, reader 2 = 23/53) vs. 71% (SD 7%, reader 1 = 16/21, reader 2 = 14/21) in the high-risk group ($p < 0.001$, odds ratio 4.1, 95% CI 1.8 to 9.8).

CONCLUSION

GRLs are encountered at a significantly higher rate in infants at high- vs. low-risk for abuse. This difference may reflect the response of enchondral ossification to intermittent stresses associated with abusive events. However, since healing classic metaphyseal lesions may appear as radiodense transverse metaphyseal bands, some of the apparent GRLs in the high-risk group may reflect the residua of inflicted metaphyseal injury.

CLINICAL RELEVANCE/APPLICATION

GRLs may carry special significance when encountered in infants with suspected abuse. The possibility that some apparent GRLs may in-fact reflect healing occult metaphyseal injuries deserves further study.

RC213-06 Definition of a Scoring System for Assessment of Skeletal Age Using MRI of Hand and Wrist in Healthy Males and Females Children: Gender Differences

Monday, Nov. 30 9:30AM - 9:40AM Location: N230

Participants
Milvia Martino, MS, Rome, Italy (*Presenter*) Nothing to Disclose
Rosa Maria Ammendola, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Ernesto Tomei, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Sofia Battisti, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Richard C. Semelka, MD, Chapel Hill, NC (*Abstract Co-Author*) Research support, Siemens AG.; Consultant, Guerbet SA.
Iacopo Carbone, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic Resonance Imaging (MRI) of hand and wrist is a radiation free tool used to create a gender specific scoring system method for the skeletal age (SA) estimation in the healthy pediatric population.

METHOD AND MATERIALS

96 healthy young male (chronological age (CA)1y6mo to 19y) and 108 females (CA range 4y to 19y) were enrolled. 9 bones of the wrist and hand have been analyzed at different stages of the skeletal maturation detecting different pattern of growth among tubular and carpal bones based on several anatomic features of the cartilaginous and osseous component .Two operators first in consensus and after 6 months blinded from CA established a MRI scoring system. Correlation between CA and MRI bone age estimation was determined with Pearson coefficient (R2). Spearman's correlation coefficient (r) was used to analyze each carpal and tubular bones stages development.

RESULTS

A significant linear correlation (R2) between MRI bone age estimation and CA was demonstrated in males (R2 = 0.976, A operators in consensus, R2 = 0.978 B first operator in the double-blind, R2 = 0.977 C second operator in double-blind) and females (R2 = 0,9694, operators in consensus, R2= 0.9751 B first operator double-blind, R2= 0.9710 C second operator in double-blind).Radius and Ulna showed a stronger correlation with the skeletal age in both males and (Radius r= 0.96; Ulna r = 0,963, p = <0.0001) females (Radius r = 0.975, Ulna r = 0.963720 p <.05000) . A good linear correlation was observed (males R2=0,96; females R^2 = 0.9472) between the sum of scoring system assigned for each subject and the CA in years. The growth curve resulting from the correlation

between CA and SA shows in males 2 peaks than 3 observed in females and related to the growth spurt in the pubertal age following by phases of deceleration.

CONCLUSION

The score system for MRI bone age estimation can be potentially used as a clinical tool to evaluate skeletal development. Males and females have patterns of maturation corresponding to a different clinical speed of growth. The MRI score system shows specific anatomical details characterizing the pubertal age when between the sexes there is a gap of about 2 years.

CLINICAL RELEVANCE/APPLICATION

Bone age estimation is performed in pediatric patients with growth failure and advanced or delayed puberty maturation mainly covering the clinical areas of endocrine, skeletal and metabolic diseases.

RC213-07 Pediatric Elbow MR

Monday, Nov. 30 9:40AM - 10:00AM Location: N230

Participants
John D. MacKenzie, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Review developmental anatomy of the pediatric elbow as depicted by MRI. 2) Review technical imaging considerations when imaging the pediatric elbow with MRI. 3) Review unqiue lesions that occur at the pediatric elbow as depicted by MRI.

ABSTRACT

MRI presents an unique view into the detection and characterization of pediatric elbow pathology. Developmental changes at the pediatric elbow have a characteristic and predictable anatomy and it is important for the radiologist to understand the normal developmental appearance and separate this from pathology. Technical imaging considerations for high resolution MRI will be reviewed. Common pathologies unique to the pediatric elbow will be discussed and placed into context with their appearance on MRI.

RC213-08 Imaging of Slipped Capital Femoral Epiphysis: From Early Diagnosis to Late Sequelae

Monday, Nov. 30 10:20AM - 10:40AM Location: N230

Participants
Delma Y. Jarrett, MD, Boston, MA, (delma.jarrett@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize imaging findings of SCFE using radiographs, MR, CT, and US. 2) Understand surgical management and normal post-operative appearance of SCFE. 3) Recognize imaging findings of immediate and delayed post-operative complications of SCFE.

RC213-09 Absence of Rickets in Infants with Fatal Abusive Head Trauma and Classic Metaphyseal Lesions

Monday, Nov. 30 10:40AM - 10:50AM Location: N230

Participants
Jeannette M. Perez-Rossello, MD, Boston, MA (*Presenter*) Nothing to Disclose
Anna McDonald, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andrew E. Rosenberg, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Andy Tsai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if rickets is present in infant homicides with classic metaphyseal lesions (CMLs) and other skeletal injuries.

METHOD AND MATERIALS

This study was exempt from the institutional human subjects board review because the infants were all deceased. An archival review (1984-2012) was performed of the radiologic and histopathologic findings of 46 consecutive infant fatalities referred from the state Medical Examiner's Office for the evaluation of possible child abuse. Thirty infants with distal femoral histologic material were identified. Additional inclusion criteria were: 1) The medical examiner determined that the infant had sustained a head injury and that the manner of death was a homicide; 2) At least one CML was evident on skeletal survey; 3) CMLs were confirmed at autopsy; and 4) Non-CML fractures were also present. Nine infants (mean age 3.9 months, range: 1-9 months) were identified. Two pediatric radiologists independently reviewed the skeletal surveys for rachitic changes at the wrists and knees. A bone and soft tissue pathologist reviewed the distal femoral histologic sections for rickets.

RESULTS

There were no radiographic or pathologic features of rickets in the cohort.

CONCLUSION

Our findings provide no support for the view that the CML is due to rickets. Rather, they strengthen a robust literature that states that the CML is a traumatic injury commonly encountered in physically abused infants.

CLINICAL RELEVANCE/APPLICATION

This work confirms the traditional view that the classic metaphyseal lesion is a fracture encountered in abused infants rather than a manifestation of rickets. The classic metaphyseal lesion is a characteristic fracture in child abuse and should be reported as such.

RC213-10 Can Coronal STIR be Used as Screening for Acute Non-traumatic Hip Pain in Children?

Monday, Nov. 30 10:50AM - 11:00AM Location: N230

Participants
Monica M. Forbes-Amrhein, MD, PhD, Zionsville, IN (*Presenter*) Nothing to Disclose
Matthew R. Wanner, MD, Zionsville, IN (*Abstract Co-Author*) Nothing to Disclose
Trenton D. Roth, MD, Indianapolis, IN (*Abstract Co-Author*) Institutional research support, Siemens AG; Institutional research support, Koninklijke Philips NV
Megan B. Marine, MD, Carmel, IN (*Abstract Co-Author*) Nothing to Disclose
Boaz Karmazyn, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if coronal STIR can be used as a screening test for acute non-traumatic hip pain in children

METHOD AND MATERIALS

A 4 year (2008-2012) retrospective analysis was performed of pediatric (age< 18 years) pelvic MRI studies. Only patients with the following indications were accepted; acute hip pain, limping, or refusal to bear weight. Exclusion criteria included known trauma, known pelvic pathology, and follow-up studies. Each study was anonymized. The coronal STIR series and later the full MRI studies, including all series, were reviewed in a randomized order independently by a pediatric radiologist (rad1) and a musculoskeletal radiologist (rad2). The full MRI study was considered the gold standard. Analysis of the interobserver variability on the negative and positive studies of the STIR only series was reported using Kappa statistics, and overall percentage agreement.

RESULTS

A total of 127 studies were included. 103 (83%) studies were positive by both radiologists. The most common pathologies that were identified by rad1 and rad2 were: hip effusion (63% and 57%), osteomyelitis (58% and 59%) and myositis (37% and 38%). 46% and 54% patients had more than one pathology.Using the full MR as the gold standard, the STIR-only series yields a sensitivity and specificity of 94% and 83% (rad1) and 94% and 67% (rad2). In 42% and 54% of the 97 true positive STIR-only studies, inconsistencies were found on the full MR scans, the most common of which were missed osteomyelitis (20% and 21% by rad1 and rad2) and myositis (7% and 13% by rad1 and rad2). The readers agreed on 111 (87.4%) coronal STIRs (95 abnormal; 16 normal), Kappa statistic is moderate, 0.59.

CONCLUSION

Coronal STIR of the pelvis has high sensitivity (94%) with good interobserver agreement in detecting pathology in children with acute hip pain. However, the study should be supervised by a radiologist and, when positive, a full MR study should be performed as it may change findings in 42% to 54% of cases.

CLINICAL RELEVANCE/APPLICATION

Coronal STIR MR can be used as a screening for evaluation of acute non traumatic hip pain in children. However, when positive, a full MR study should be performed as it can alter the findings in about half of the cases.

RC213-11 Utility of Post Intervention Hip Spica MRI, Retrospective Evaluation of Experience at a Large Children's Hospital

Monday, Nov. 30 11:00AM - 11:10AM Location: N230

Participants
Siddharth P. Jadhav, MD, Houston, TX (*Presenter*) Nothing to Disclose
Farahnaz Golriz, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Vinitha Shenava, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
J. H. Kan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The objective of this study is to evaluate utility of post intervention hip spica MRI and to determine if there are pre-intervention predictors of failed reduction and need for reintervention. We also evaluate rates of reintervention after closed and open reduction.

METHOD AND MATERIALS

All patients who had hip spica MRI at our institution from 2008 to 2014 were retrospectively identified. This included 42 hips in 29 patients. Data was retrospectively reviewed including age at intervention, acetabular angle, degree of lateral and superoinferior displacement of the femoral head, intervention performed, MRI findings and need for reintervention. Wilcoxon scores were calculated and Wilcoxon two sample tests were performed to find correlation between age, acetabular angle, degree of lateral displacement and degree of superoinferior displacement and the need for re-intervention

RESULTS

Mean age at time of intervention was 20.1 months (range 4.7 to 63.8). Mean acetabular angle was 37.5 degrees (range 20-52). Mean lateral displacement was 11.2 mm (range 3-20mm) and mean superoinferior displacement was 5.7 mm (range 0-19mm). There was no correlation between age (P value=0.12), acetabular angle (P value=0.46), degree of lateral displacement (P value=0.82) and degree of superoinferior displacement (P value=0.54) and the need for re-intervention. Out of 19 hips that underwent closed reduction, 8 (42%) needed reintervention. Out of 23 hips that underwent open reduction, 1 (4%) needed reintervention but this could have been determined on the fluoroscopic images alone. Variables leading to a 42% rate of re-intervention in children who undergo closed reduction may be operator dependent or be related to extra-articular causes such as femoral version and biomechanical muscle imbalance.

CONCLUSION

Hip spica MRI is useful in determining need for reintervention after closed hip reduction. Value of MRI after open reduction is not clear since only 1 patient (4%) in our study needed reintervention after open reduction. This needs further evaluation. There is no correlation between age and pre-intervention imaging findings and the need for reintervention.

CLINICAL RELEVANCE/APPLICATION

Post intervention hip spica MRI is useful in determining need for reintervention after closed hip reduction but its role after open reduction is questionable.

RC213-12 Isolated Posteromedial Subtalar Coalitions: Incidence and Associated Morphologic Alterations of the Sustentaculum Tali

Monday, Nov. 30 11:10AM - 11:20AM Location: N230

Participants
Sarah D. Bixby, MD, Boston, MA (*Presenter*) Nothing to Disclose
Delma Y. Jarrett, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Patrick Johnston, MSc, Cambridge, MA (*Abstract Co-Author*) Employee, Ora, Inc
Susan Mahan, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the prevalence and morphologic alterations of subtalar coalitions which lie entirely posterior to the middle facet (MF), AKA "posteromedial subtalar (PMST) coalition."

METHOD AND MATERIALS

After obtaining IRB approval, radiology records from 2004-2012 were reviewed to identify CT studies of patients with confirmed subtalar coalition. 97 subjects (48 male, 49 female, mean age 13.73 years) with subtalar coalition were identified. Electronic medical records were reviewed and symptoms of foot or ankle pain were confirmed in all subjects. In 41 (42%) subjects the coalition was bilateral. CT images of 138 subtalar coalitions were reviewed to determine site of coalition. In those patients with isolated PMST coalitions, multiplanar reformatted images along the long axis of the sustentaculum tali (ST) were generated, from which the antero-posterior dimensions of the ST and MF were measured. A posterior sustentaculum (PS) measurement was then calculated defining the posterior extension of the ST beyond the middle facet (PS = ST-MF). Ratios of the MF to the PS measurements were calculated. 33 patients undergoing CT for triplane ankle fracture (21 male, 12 female, mean age 13.70 years) served as controls. Measurement were performed independently by two readers, and intra- and inter-reader reliability was estimated via a component of variance model.

RESULTS

97 of the 138 coalitions (70.2%) affected the MF and 2 (1.4%) involved the posterior facet. There were 39 (28.2%) isolated PMST coalitions identified in 33 patients (18 male, 15 female, mean age 14.07 years). The mean AP measurement of the MF and PS in the patients with PMST coalition were 12.70 mm and 15.90 mm, respectively, compared to 16.50 mm and 6.36 mm in the control population ($p<0.001$). The ratio of the MF to PS was 0.80 for PMST coalition patients versus 2.6 for controls ($p<0.001$).

CONCLUSION

In our cohort, 1/4 of all subtalar coalitions were of the PMST variety associated with an intact, but significantly shorter MF, and longer ST. This observation may aid in accurate diagnosis and provide insights into the morphogenesis of this relatively common disorder

CLINICAL RELEVANCE/APPLICATION

The presence of a "normal" middle facet at imaging may lead to missed isolated PMST coalitions; the morphology of the ST and MF provide helpful imaging clues to the diagnosis.

RC213-13 A Retrospective Study to Evaluate the Effect Recent Changes to NICE Guidelines Will Have on Imaging of the Paediatric Cervical Spine in Blunt Trauma in the UK

Monday, Nov. 30 11:20AM - 11:30AM Location: N230

Participants
Joseph Davies, MBBS, MRCS, London, United Kingdom (*Presenter*) Nothing to Disclose
Sammy Anwuzia, BSC,MSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jane Evanson, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Susan Cross, MBChB, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Paediatric cervical spine (c-spine) injury is a rare but devastating event. Imaging, particularly Computed Tomography (CT) is the investigation of choice to exclude injury. CT is however associated with increased thyroid radiation dose and risk of developing malignancy vs plain radiographs. Insufficient paediatric c-spine trauma data exists to produce robust imaging guidelines. There have been recent changes to NICE UK guidelines relating to evaluation of paediatric (<10 years) c-spine injury in trauma. We set out to investigate effects these changes have on the use of Computed Tomography (CT) in the investigation of c-spine injury

METHOD AND MATERIALS

5 year retrospective study of c-spine imaging in patients <10 years presenting to a level 1 trauma centre following blunt trauma. Data was collected relating to trauma mechanism, clinical presentation, radiologic evaluations and injury type. Patients with incomplete data were excluded. Criteria for c-spine CT in NICE head injury guideline 56 (CG 56) (GCS<8, inadequate plain radiographs, strong suspicion despite normal plain radiographs) and NICE head injury guideline 176 (CG176) (GCS <13, intubated, focal neurology, polytrauma, suspicion despite normal radiographs) were retrospectively applied to all cases with complete data to determine the proportion of patients requiring c-spine evaluation with CT.

RESULTS

278 patients underwent c-spine imaging and 217 had complete data. 80 patients met the criteria for a CT of the c-spine under CG 56, 4 of which had a significant c-spine injury. 1 patient with c-spine injury and a presenting GCS of 14 did not meet CG 56. 206 patients met the criteria for a CT under CG 176, 5 of which had a significant injury. Overall, there was one patient who presented

with significant c-spine injury who did not meet CG 56 guidelines, but falls under CG 176 criteria.

CONCLUSION

CG 176 is more inclusive and if followed will result in higher proportion of paediatric blunt trauma cases being eligible for a c-spine CT without an initial plain radiograph series. Increased paediatric thyroid radiation exposure will result.

CLINICAL RELEVANCE/APPLICATION

New guidelines are more sensitive for selecting c-spine injury, specificity is lower and results in potentially unnecessary thyroid irradiation. Further study is required to develop more robust paediatric trauma imaging guidelines.

RC213-14 Three-Point Dixon Technique for Fat Quantification and for Identifying Wasting Progression Rate of Pelvic and Thigh Muscles in Duchenne Muscular Dystrophy

Monday, Nov. 30 11:30AM - 11:40AM Location: N230

Participants
Jing Du, MD, Beijing, China (*Presenter*) Nothing to Disclose
Jiangxi Xiao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ying Zhu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Fei Y. Li, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Three-point Dixon technique was applied to quantify fat fraction (FF) and identify the annual rate of disease progression of leg muscles in Duchenne muscular dystrophy (DMD).

METHOD AND MATERIALS

This prospective study was approved by the Ethical Committee. Ninety boys with genetically and/or pathologically confirmed DMD were recruited. Imaging was performed with a 3-T unit by using a 32 channel phased-array coil. A quantitative water-fat separation method (IDEAL-Quant) was used. Imaging parameters were as follows: TR=6.3ms, TE=1ms, 6 echoes, bandwidth=111.11 kHz, FOV=32-40cm, slice thickness=7mm, matrix=160x160, flip angle= 3°, covering from the iliac crest to the knee, total imaging time=1min3sec. Images were processed on ADW4.6 workstation and FF of each muscle was calculated. The region of interest (ROI) was manually placed by tracing the outline of the individual muscle on the section level of the muscle belly. 18 muscles on each side were analyzed. Spearman correlation test was used to evaluate the correlation between age and FF. Linear correlation was used to show the relationship between age and FF.

RESULTS

90 DMD boys aged 2-13 (mean 5.8 years) were enrolled. The gluteus maximus was the most severely infiltrated (mean FF 28.82%±19.96%), followed by the adductor magnus (mean FF 23.13%±22.47%). The least affected muscle was the obturator externus (mean FF 3.67%±1.13%). Positive correlation was obtained between FF value and age for all the muscles with correlation coefficient varied from 0.28 to 0.76. Significant correlation was seen in the gluteus maximus muscle (r=0.68), adductor magnus (r=0.74), and the quadratus femoris (r=0.74~0.76). The muscle wasting progression can be calculated as (A + B*age). A stands for a constant and B stands for annual progression rate varied from 0.3% to 6.1% for different muscles.

CONCLUSION

IDEAL-Quant method can be used to quantitatively assess leg muscle fatty infiltration and identify muscle wasting progression in DMD patients.

CLINICAL RELEVANCE/APPLICATION

IDEAL-Quant method can be used to quantitatively assess leg muscle fat infiltration in DMD. This method should be used to monitor disease severity and follow-up.

RC213-15 Sports Injuries of the Pediatric Knee

Monday, Nov. 30 11:40AM - 12:00PM Location: N230

Participants
Jennifer Stimec, MD, Toronto, ON (*Presenter*) Nothing to Disclose