

MAOA BREAK-OUT SESSION #8
PEDIATRICS
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84. Reliability of Radiological Classifications Used in Legg-Calve-Perthes Disease

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Radiological assessment of Perthes disease is a valuable tool in the assessment, management, and prognostication of Perthes disease. However, radiological assessment is not an easy task and all classification systems used in Perthes have some degree of inter- and intra-rater variability. In the past, there were some isolated studies to find the reliability of classifications used in Perthes. In this study, we comprehensively studied three most commonly used radiological classifications (Salter-Thompson, lateral pillar, and Catterall). We had 44 sets of Perthes radiographs (AP and lateral) taken in fragmentation stage, and two experienced observers assessed and classified the radiographs on two separate occasions. In this study, we found out that the average inter-rater reliability of Salter-Thompson, lateral pillar, and Catterall were 0.163 (0.08-0.236), 0.722 (0.581-0.824), and 0.433 (0.280-0.546), respectively. The intra-rater reliability was 0.313 and .699 for Salter-Thompson, 0.707 and 0.658 for the lateral pillar, and 0.38 and 0.577 for Catterall. Further, we figured out the possible reason for low reliability associated with Catterall classification. Hence, we think that the quantitative method of lateral pillar has better intra-rater and inter-rater reliability as compared to other classification systems, and the reliability of Catterall classification can be significantly improved if some radiological parameters like metaphyseal reaction and identification of junction of involved to uninvolved regions are optimized.

85. Surgical Results for Patellofemoral Pain in the Pediatric Population

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The aim of this study was to evaluate the outcome of pediatric patellofemoral pain and instability due to subluxation, dislocation, or lateral tracking that was treated with a soft-tissue realignment performed by a single surgeon. All pediatric patients undergoing the index procedure for symptomatic subluxation or dislocation of the patella were included. The index procedure consisted of a patellar realignment by arthrotomy of the knee, vastus lateralis release, and vastus medialis advancement with application of cylinder cast all performed by a single surgeon over an approximately 20-year period. The patient population had an age range from 8-18 years. The patients were sent a blinded questionnaire by mail. In total, 44 patients responded with a total of 55 operative knees. The average follow-up was six years and one month. Before surgery, patients reported a total of 44 knees with giving way, 47 with pain, 22 with locking, and 47 with dislocating chronically. After surgery, patients reported a total of 18 knees giving way, 37 with pain, 7 with locking, and 11 with continued dislocations. The patients were separated into groups for outcome purposes of less than 2-year follow-up, 2-5 year follow-up and greater than 5 years of follow-up. A total of 41 knees were reported to have improvement after surgery with 11 from the less than 2-year follow-up group and 15 from each of the other two groups. A total of four knees were reported to have remained the same overall. A total of 10 knees were reported to be worse since surgery with 1 from the less than 2-year follow-up group, 1 from the 2-5 year follow-up group, and 8 from the greater than 5-year follow-up group. There was statistical significance between those with improved knees with less than 5-year follow-up (26/30) versus those with over 5-year follow-up (15/25) with a P value = 0.02365. Of the 44 patients, 22 of 23 patients with less than 5 years of follow-up would have the surgery again and recommend it to a friend. However, in the greater than 5-year follow-up group, 13 of 21 patients would not have the surgery again. The P-value (0.0) was significant comparing those groups. Unfortunately, this remains a common and difficult problem in this age group.

86. ♦ Portable Skeletal Traction for Pediatric Femoral Shaft Fractures: Comparison Between Phase I and Phase II

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Between 1995-97 (phase I), 40 pediatric isolated femoral shaft fractures were treated successfully with portable skeletal traction. Traction incorporated into a 1-1/2 spica cast was applied at the distal tibia with the leg in extension, hip flexed. During phase II (2002-03), the same technique was used in 50 cases; however, the long leg cast was eliminated and limited above the knee. Among the 90 cases with sufficient follow-up, 20 in phase I and 30 in phase II were analyzed. There was no significant difference between the two group's outcome. Hospitalization averaged five days in phase I versus six days in phase II. All fractures united in acceptable alignment and function. Fracture overlap averaged 0.994 cm versus 1.040 cm for phase II, $p=0.707$. Varus angulation averaged 5.23° versus 5.40° for phase II, $p=0.470$. Anterior angulation averaged 4.353° versus 1.920° for phase II, $p=0.000$. Complications in both series were minimal. Portable skeletal traction with bilateral half spica is just as effective as 1-1/2 spica cast for pediatric femoral shaft fracture treatment 3-11 years old.

87. Acetabular Morphology in Bladder Exstrophy Complex

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BACKGROUND: Little information is available concerning the acetabular morphology in adults with a history of bladder exstrophy. The purpose of this study is to document the pelvic anatomy in mature exstrophy patients that have not had prior surgery. To our knowledge, this is the first study that details the coxometric measurements of the hip joint in adult patients that were not treated with a pelvic osteotomy.

MATERIALS AND METHODS: From 1976 to 2003, 31 patients (62 hips) were seen at our institution for urologic problems related to bladder exstrophy without adjunctive pelvic osteotomy surgery to improve the initial genitourinary outcome. There were 18 males and 13 females with a mean age of 30 years at last follow-up. Radiographs at final follow-up were analyzed for lateral center edge angle, acetabular index, head extrusion, hip center of rotation, acetabular version, retroversion index, sacral width, and interteardrop distance.

RESULTS: Most hips (60) had no arthritis. The mean lateral center edge angle, acetabular index, and head extrusion index were 32°, 5.7°, and 0.266% respectively. Fifty-eight percent had a retroverted acetabulum, and 42% were neutral or anteverted. The interteardrop distance averaged 154 millimeters.

CONCLUSION: This is the largest series of adult patients with bladder exstrophy reported. Most patients will not develop early arthritis and the majority (58%) have a retroverted orientation of the acetabulum.

88. A Comparison of Digital versus Conventional Radiography Regarding Measurement of Acetabular Index: Intraobserver and Interobserver Variation

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BACKGROUND: Recent years have seen numerous health care facilities transition from conventional radiographs (CR) to digital radiographs (DR). A concern that has surfaced in our practice involves the use of DR to determine the acetabular index (AI). A comparison between computer assisted measurements using DR and manual measurements using CR was performed.

METHODS: Anterior/posterior radiographs of 25 patients aged 1-36 months were obtained. AI was measured bilaterally on 25 pairs of radiographs with three repetitions by five attending orthopedists and five orthopedic residents resulting in AI measurements on 50 hips with 30 repeated measures. A period of at least two weeks passed between repeating measurements on the same film. Additionally, the average time needed to complete the measurement for CR versus DR was noted.

RESULTS: Preliminary results with regards to intraobserver and interobserver reliability and variability were determined using Excel. The mean intraobserver error for each examiner ranged from 2.16° to 2.28° with +/- 1.87 and +/- 2.46 SD, respectively. The accuracy (+/- 2SD) was +/- 3.74 and +/- 4.92 accordingly. Overall, CR intraobserver mean error was 2.15° (+/- 1.83). Overall DR intraobserver mean error was 2.28° (+/- 2.51). The mean interobserver error was 2.35° (+/- 1.55). The mean interobserver CR error was 2.43° (+/- 1.32) and the mean interobserver DR error was 2.27° (+/- 1.65). Mean time to complete each reading was 20 seconds for DR and 57 seconds for CR ($p < 0.001$), a highly significant difference.

CONCLUSIONS: Our preliminary results show no difference between intraobserver and interobserver variability or reliability. The significant decrease in time to read DR is likely due to the automatic angle display once lines are drawn. Our study helps to confirm the accuracy of measurements using DR. Therefore, while our study specifically examined the AI, we believe this information would transfer to other orthopedic radiographic measurements.

89. Management of the Degenerative Hip in Dwarfs

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INTRODUCTION: Hip dysplasia in the many manifestations of dwarfism present difficult challenges to the arthroplasty surgeon. A modified modular hip (S-ROM, DePuy, Warsaw, IN) has been used with success in dealing with these difficult cases.

METHODS: A prospective clinical and radiographic review of 13 dwarfs managed with a modular hip stem has been performed. All stems were transected at the tip to avoid impingement anteriorly. A standard postoperative hip protocol was followed. Seven patients were achondroplastic, two had spondyloepiphyseal dysplasia, and the remaining were undetermined.

RESULTS: All patients achieved stable fixation of the implant as determined clinically and radiographically. All patients required excessive anteversion of the femoral stem to gain stability. One patient had recurrent dislocations and required revision to a severely anteverted position on the femoral side. Three patients complained of subjective sciatic nerve symptoms postoperatively but with no objective motor loss. Four patients complained of progressive lumbar spine symptoms postoperatively. Despite transecting the stem, one patient had a perforation of the femoral diaphysis with no sequelae.

DISCUSSION AND CONCLUSION: Dysplastic hip secondary to dwarfism present many operative difficulties. The small stature demands small stem diameters and also non-traditional short lengths to manage excessive femoral bowing. Modularity is critical to manage the severe torsion of the femur and the abnormal degree of version required to obtain stability. Because of the associated joint anomalies, one should expect additional lower extremity problems: all of which need to be managed to maintain mobility in this patient population.

90. A New Orthosis for Clubfoot Treatment

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INTRODUCTION: Parental noncompliance with orthotic bracing following the Ponseti method of clubfoot correction can lead to recurrence of deformity. Skin breakdown around the heel is a common factor in noncompliance with traditional clubfoot orthoses. A novel orthotic system with an articulating abduction bar was devised to allow independent leg movement. We hypothesize that skin breakdown will be less common and compliance will be greater with this new orthosis as compared to more traditional orthoses.

METHODS: A retrospective review identified 34 patients (60 clubfeet) that had been treated with the new articulating brace following the Ponseti method. The following data were collected: pre-treatment classification, number of casts required for correction, incidence of skin breakdown, parental report of noncompliance with orthotic use, and recurrence of deformity.

RESULTS: Of the 34 patients, 27 had idiopathic clubfeet, 5 had myelodysplasia, and 2 were syndromic. The pre-treatment classification was Dimeglio grade II in 6, grade III in 40, and grade IV in 14. The average number of casts needed for correction was 4.6 (range, 3-10). Noncompliance with the new orthosis was reported in none of the 34 patients and skin breakdown occurred in only 2 patients (5.9%) at an average follow-up of 4.7 months. No patient has had recurrence of deformity to date.

DISCUSSION: At short-term follow-up, compliance with a new orthotic system was excellent and skin breakdown around the heel was not common. Longer follow-up will be necessary to assess the incidence of recurrent deformity with this orthotic system.

91. WNT7A Mutation Analysis in Congenital Clubfoot

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Idiopathic clubfoot is a prominent birth defect affecting 1-7 per 1,000 births dependent on ethnic background. The etiology of this defect has yet to be solved. Studies have indicated a single gene contributor as a valid theory. A previous linkage analysis study demonstrated an area of interest on chromosome 3 (38.3) where wingless-type MMTV integration site family member 7A (WNT7A) is located. WNT7A is an interesting candidate gene because of its temporal regulation on cell fate during limb development. It is plausible that a mutation in this gene could affect the protein's ability to confer dorsal patterning, thus disturbing normal axis development of the limb and contributing to the birth defect. This study was aimed to evaluate WNT7A gene in a patient population with idiopathic talipes equinovarus (ITEV). Twenty patients with ITEV were identified for the purpose of this study. Fifty non-related individuals without birth defects were used as controls. Genomic DNA was extracted and the four exon regions of the WNT7A gene were PCR amplified. The PCR products were purified and subsequently processed through bi-directional sequence analysis using BLAT software. As a result, 16 of 20 clubfoot patients showed a transversion G>T (N), C>A (N) in the position 13896353 of chromosome 3. Of the 50 control subjects, 9 demonstrated this same nucleotide variation. Therefore, we conclude that there is a polymorphism at position 13896353 of exon 1 of the WNT7A gene on chromosome 3. We found no evidence sustaining the association of WNT7A polymorphism and the ITEV phenotype, or mutations on the coding region of this gene. Further studies would include sequencing of additional genes in the area on chromosome 3 associated with ITEV through linkage analysis and evaluation of gene regulation of candidate genes.

92. Evaluation of Gene Expression in Slipped Capital Femoral Epiphysis Utilizing Laser Capture Microdissection and RT-PCR

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BACKGROUND: Slipped capital femoral epiphysis is a poorly understood condition that impacts adolescents. Its consequences can be severe, even in cases where there is early recognition and treatment is implemented. Prior studies have suggested that the etiology may be related to abnormal collagen comprising the growth plate cartilage, but no investigations have analyzed collagen on a molecular level in the affected tissue. This study evaluates expression of collagen-specific mRNA from growth plate chondrocytes of patients suffering slipped capital femoral epiphysis. The work utilizes laser capture microdissection (LCM) techniques followed by real time polymerase chain reaction (RT-PCR) to determine if a change or abnormality in collagen gene expression may be involved in the weakening of the epiphysis, a characteristic of the pathology.

MATERIALS AND METHODS: This study is IRB-approved. Study specimens were obtained from core biopsies of epiphyseal plates in surgical patients undergoing repair of slipped capital femoral epiphysis. The core biopsies are part of the routine surgical procedure and would normally be discarded. Following surgical removal of the tissues, samples were placed in *RNAlater* to maintain RNA integrity of component cells. Specimens were prepared for LCM, in which individual or several chondrocytes were selected for analysis from specific regions of fresh frozen, ethanol-fixed and stained tissue blocks. Single or small groups of cells were identified and their total RNA was extracted. The RNA was DNase-treated and subjected to RT-PCR. Primers developed specifically for the genes of interest (types II, IX, X, and XI collagen and others) are being utilized to evaluate expression levels.

DISCUSSION: This study is the first to measure collagen gene expression utilizing LCM followed by mRNA analysis with RT-PCR for physeal chondrocytes from slipped capital femoral epiphysis. With these techniques, correlation of spatial location and gene expression of the cells can be made to provide greater insight into this pathology and a more complete understanding of growth plate biology in general.

93. Morphologic Features of Both Hips in Patients Treated with Periacetabular Osteotomy for Unilateral or Bilateral Congenital Acetabular Dysplasia

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BACKGROUND: The purpose of this study is to determine the incidence and severity of acetabular retroversion in both hips in a population of patients with hip dysplasia as well as to introduce a classification of hip dysplasia based on morphologic characteristics.

MATERIALS AND METHODS: We evaluated the morphologic characteristics of both hips in 174 patients (348 hips). One hundred forty-three of the patients had a unilateral corrective acetabular osteotomy and 21 had bilateral osteotomies. Measurements of both hips prior to surgery included lateral center edge angle, acetabular index, anterior center edge angle, head extension index, congruence, hip center of rotation, acetabular version, and a newly described retroversion index.

RESULTS: Of the operated hips, 53% of the sockets were anteverted, 42% retroverted, and 5% neutral. The mean retroversion index was 33%. Of the 153 contralateral hips that did not have surgery, only 24% were radiographically normal. Thirty-five percent had classic dysplasia with neutral or anteverted sockets, 22% had pure retrotorsion abnormalities, and 35% were dysplastic with retrotorsion.

CONCLUSIONS: This is the first study that we are aware of which documents the morphologic status of the contralateral hip in a group of patients requiring acetabular osteotomy for symptomatic development dysplasia of the hip in adulthood. The majority of the contralateral hips are abnormal with a large percentage having retrotorsion abnormalities.

◆ The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an “off label” use).