North Carolina Orthopaedic Association

2015 Annual Meeting

Abstracts: Sports Medicine/ Pediatrics/Tumor

October 9-11, 2015 • Kiawah Island Golf Resort

Kiawah Island, South Carolina

This continuing medical education activity is jointly provided by the NCOA
and the Southern Regional Area Health Education Center

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Benjamin M. Wooster, MD (Resident)**
Duke University Medical Center, Durham, NC

Topic: **Evaluating the Effect of an Off-the-Shelf Hip Orthosis on Balance in Post-operative Hip Arthroscopy: A Pilot Study**
Saturday, October 10

Hip orthoses are commonly utilized in post-operative hip arthroscopy rehabilitation protocols. Although orthoses primarily function to restrict motion and protect compromised tissue, their role in balance restoration has not been previously studied. Early balance restoration in the post-operative period could expedite return to a pre-operative level of activity as well as decrease rehabilitation costs.

Purpose

A pilot study to evaluate the effect of an off-the-shelf hip orthosis on balance in patients who have undergone hip arthroscopy.

Methods

Twenty-four individuals who had undergone hip arthroscopy for pathology related to femoroacetabular impingement four weeks prior and prescribed an off-the-shelf hip orthosis (Sof-Tec Coxa®, Bauerfeind AG, Zeulenroda, Germany) for rehabilitation were recruited to participate. Participants completed a barefoot static single leg postural sway test on a force plate for 60 seconds. Initial testing side and bracing status were randomized. Unbraced trials were alternated between legs and were separated by at least one minute of rest. Braced trials were limited to one leg and were separated by at least two minutes of rest. Participants performed single leg postural sway tests until three valid trials were recorded for each condition or until a maximum number of six unsuccessful attempts were reached per condition. Participants who completed a total of three tests per condition were included in further analysis. Center of pressure (COP) deviations from each participant's two best trials were then analyzed using custom MATLAB® software (MathWorks, Natick, MA USA) after removing the initial and final three seconds of each trail to ensure data reflected steady postural state. The area of an ellipse that enveloped 95% of the COP data points (COPEA) were calculated and used to measure balance. Student's t-test was used to evaluate differences between groups with alpha level set to 0.05.

Results

A total of 17 participants (16 females, 1 male) completed testing and were included in further analysis. Ten participants balance measured by COPEA was significantly improved in the brace by an average of 82.25 +/- 67.94 ($p<0.05$). Seven participants' balance as measured by COPEA was significantly decreased in the brace by an average of 110.29 $\pm$ 151.04mm2 ($p<0.05$). No differences were observed between group demographics (age, $p=0.17$, body mass index, $p=0.18$), pre-operative pain duration ($p=0.22$), pre-operative hip range of motion (internal rotation, $p=0.49$, abduction, $p=0.46$, terminal flexion, $p=0.49$), pre-operative radiographic indices (acetabular index $p=0.12$, center edge angle, $p=0.08$), or intra-operative chondromalacia severity index ($p=0.19$).

Conclusions

Although hip orthoses are commonly utilized to limit range of motion and protect compromised tissue in the post-operative hip arthroscopy patient, the results of this study suggest that an off-the-shelf hip orthoses can also improve balance in certain patients. Further testing is needed to better elucidate which patients would benefit from improved balance with the use of a hip orthosis in the post-operative rehabilitation period. Funding: This study was partially supported through a research grant from Bauerfeind, AG.

Educational Objective: Discuss the role that an off-the-shelf hip orthosis plays in balance in the post-operative hip arthroscopy patient.

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Carter Clement, MD, MBA (Resident)**
University of North Carolina, Chapel Hill, NC

Topic: **Risk Factors for Infection following Knee Arthroscopy: Analysis of a Large United States Cohort**
Saturday, October 10

Background

Knee arthroscopy is one of the most common surgeries performed in orthopaedics and is generally regarded as safe. However, due to the relatively low rate of postoperative infection, previous studies have not been able to examine adequately large cohorts of patients to accurately characterize this complication. As a result, little is known about post-arthroscopic infections including the true frequency and associated risk factors. The purpose of this study was to use a large pooled data source to identify and quantify risk factors for infection following knee arthroscopy.

Methods

An administrative healthcare database (Pearldiver, Fort Wayne, IN, USA) with complete records from a large private insurer and a random 5% Medicare sample was used to identify all patients undergoing knee arthroscopy by Current Procedural Terminology (CPT) codes over an 8 year period (2005-2012). Each arthroscopy CPT code was designated by the senior author as "high-risk" or "low-risk" based on the invasiveness of the procedure (e.g. procedures with an open component were considered "high risk"). Patients who developed infections within 90 days of surgery were identified using International Classification of Disease 9th Revision (ICD-9) and CPT infection codes. Patients were compared based on clinical and demographic factors including age, gender, BMI, tobacco use, the presence of diabetes, and overall comorbidity burden as measured by Charlson Comorbidity Index.

Results

433,423 patients underwent 501,691 arthroscopic knee procedures from 2005-2012. A deep postoperative infection, defined by the need for operative incision and drainage (I&D), occurred at a rate of 0.20%. A superficial infection, not requiring operative I&D, occurred at a rate of 0.26%. "High risk" procedures were the largest risk factor for deep, superficial and total infections ($P<0.001$; relative risk of 2.3, 2.1, and 2.2, respectively). There was also a higher rate of deep, superficial, and total infections among tobacco users, diabetics, patients under 50 years of age, and males (in order of decreasing relative risk). The observed age difference is confounded by the invasiveness of the procedure; the average age of patients undergoing "high risk" procedures was 31.3 years, and that of patients undergoing "low risk" procedures was 47.8 years. Increased Charlson Comorbity Index was associated with superficial and total infections ($P<0.001$) and demonstrated a strong trend toward association with deep infections ($P=0.074$).

Conclusion

Risk of infection after knee arthroscopy is elevated for relatively invasive procedures such as those with an open component, tobacco users, diabetics, the morbidly obese, and patients with a relatively large comorbidity burden. Identification of these risk factors will assist surgeons with patient selection, allow more informed preoperative discussion between surgeons and their patients including specific estimates of relative risk that can be quoted for a patient's given situation, and will facilitate efforts to focus infection prevention on patients with higher inherent risk.

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Daryl Henshaw, MD**
Wake Forest School of Medicine, Winston-Salem, NC

Topic: **Randomized Prospective Study of Anesthetic Techniques in Unicondylar Knee Arthroplasty**
Saturday, October 10

Background

The aim of this study was to compare the analgesia provided by a psoas compartment block (PCB) and a adductor canal block (ACB) and to investigate the degree of motor weakness caused by these two nerve blocks under the hypothesis that the ACB would provide equivalent analgesia while causing less quadriceps motor weakness.

Methods

150 patients undergoing medial UKA were randomized in a double-blind manner to receive either a PCB or an ACB. All patients received multimodal analgesics, unless contraindicated, sham blockade at the alternate site and a posterior capsule injection during surgery. Pain (NRS) at rest and with movement, opioid consumption and opioid related side effects were recorded for 24 hours. The primary end point was NRS pain scores with rest and movement at 6 hours.

Results

147 patients were analyzed. Pain scores were equivalent at 6 hours with rest (NRS 1.0 ± 2 vs 1.1 ± 2.2 $p < 0.0001$) and with movement (NRS 1.6 ± 2.6 vs 1.5 ± 2.8 $p<0.0001$). Additionally, pain scores at rest and with movement at 12, 18 and 24 hours were equivalent. No significant differences were found between groups for time to first analgesic or for cumulative opioid consumption at 6,12,18 or 24 hours. Quadriceps motor strength was significantly higher in the ACB group.

Conclusions

An ACB provides equivalent analgesia following medial UKA when compared to a PCB while causing significantly less motor weakness. No differences were found in the time to first analgesic or total opioids consumed over 24 hours. An ACB should be considered for postoperative analgesia following medial UKA.

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Kathleen Reay, MD (Resident)**
Duke University Medical Center, Durham, NC

Topic: **Accuracy of MRI Findings in Predicting Intra-articular Hip Pathology in Hip Arthroscopy**
Saturday, October 10

Purpose

This retrospective case series compares MRI findings to intra-operative labral and chondral pathology in the presence of hip dysplasia.

Methods

Seventeen patients (19 hips) with hip dysplasia underwent a combined hip arthroscopy and periacetabular osteotomy by a single surgeon from January 1, 2013 to December 31, 2013. A fellowship-trained musculoskeletal radiologist blindly reviewed the 19 preoperative MRIs for labral, chondral, and ligamentum teres pathology. MRI findings were directly compared to the operative report.

Results

Fourteen females and three males, average age 29.49 years (range, 17-42 years) comprised the cohort. MRI findings correctly correlated to labral pathology in 18/19 (94.7%) hips. In one hip (5.3%) MRI demonstrated a labral tear whereas an intact labrum was demonstrated intra-operatively. MRI and intra-operative findings differed with respect to acetabular or femoral head chondral pathology in 8/19 (42.1%) hips. MRI demonstrated acetabular cartilage delamination in 4/19 (21.1%) hips with intact intra-operative acetabular cartilage. When intra-operative femoral cartilage was intact, MRI demonstrated femoral head partial thickness cartilaginous lesions in 3/19 (15.8%) hips. When there was intra-operative delamination along the acetabulum, MRI demonstrated no chondral defect in the acetabulum in 1/19 (5.3%) hip. In one (5.3%) hip MRI demonstrated questionable acetabular chondral loss where intra-operative grade III/IV acetabular changes were present. MRI and intra-operative findings differed in regard to the ligamentum teres in 10/19 (52.6%) hips. A frayed, degenerative, or partial tear in the ligamentum teres on MRI was demonstrated in 5/19 (26.3%) hips when there was no intra-operatively tear. MRI showed a complete ligamentum teres rupture in one (5.3%) hip when a small tear was seen intra-operatively. MRI demonstrated degenerative, partially torn, or hypertrophied ligamentum teres in 4/19 (21.1%) hips with normal ligamentum teres intra-operatively.

Conclusion

This study supports that MRI may accurately diagnosis labral pathology (94%). However, MRI correlation was less accurate in chondral or ligamentum teres pathology.

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Sarah N. Pierrie, MD (Resident)**
Carolinas Medical Center, Charlotte, NC

Topic: **Prevalence and Complications of Musculoskeletal Infections in Adolescents: A Result of Delay in Diagnosis?**
Saturday, October 10

Purpose

Musculoskeletal infections in children commonly occur in the first decade of life and there is little data about their prevalence and characteristics in adolescents. Our clinical experience suggests that adolescents diagnosed with musculoskeletal infections have a delayed time to diagnosis, which may result in higher complication rates. The purpose of this study was to evaluate the prevalence, characteristics, and complications of musculoskeletal infections in adolescents at a tertiary care children's hospital.

Methods

A retrospective study of patients with musculoskeletal infections ages 10-17 years at our institution from 2008 to 2013 was performed. Demographic data, historical information, laboratory values, imaging studies, surgical records, and clinical outcomes were extracted from the medical record.

Results

Thirty patients (21 males, 9 females) with an average age of 12.7 years were diagnosed with and treated for musculoskeletal infections including osteomyelitis (n=15), septic arthritis of the hip (14) and knee (3), deep soft tissue infections (8), and sacroiliitis (3). Mean time from onset of symptoms to diagnosis was 9.3 days (range, one to 30 days). Twenty-five of 30 patients (83%) were assessed by at least one outpatient provider (including eleven who had seen two or more providers) and eight were evaluated by an orthopaedic surgeon prior to diagnosis. At the time of admission, only two patients had a measured temperature greater than 38.0°C and more than half were weightbearing on the affected extremity. Mean admission WBC count was 11,600 cells/mm3 (range, 5.1 to 33.1), ESR 50.6 mm/hr (range, one to 140), and CRP 15.5 mg/L (range, 1.3 to 38.7). Eight patients (27%) had multifocal infection confirmed on MRI. A total of 46 surgeries were performed on 24 patients (range, one to nine procedures per patient). Twelve patients had medical complications (including DVT, PE, and secondary pneumonia) or musculoskeletal sequelae of infection (including avascular necrosis, limb length discrepancy, and arthralgia requiring arthroplasty or arthrodesis) at final follow-up. Compared to the remainder of the sample, the group who experienced complications had a significantly elevated admission CRP (22.67 versus 10.74 mg/L, p=0.003) and longer length of hospital stay (15.08 versus 5.06 days, p=0.002). There was also a trend toward longer duration of symptoms prior to diagnosis (11.45 days compared to 7.94 days, p=0.26).

Conclusion

Adolescents with musculoskeletal infections frequently experience a profound delay in diagnosis. This may be secondary to evaluation by multiple providers prior to definitive diagnosis or to symptoms distinct from their younger counterparts (e.g. lack of fever, ability to weightbear). This delay in diagnosis contributes to significant medical and orthopaedic complications in this cohort. Multifocal infection was diagnosed in 27% of these patients, suggesting that axial imaging may be an important diagnostic tool in this population.

Educational Objectives:

1. To illustrate that the long-term morbidity of infection in older children is not insignificant and may be related to delay in diagnosis.
2. To demonstrate that axial imaging can play an important role in diagnosing multifocal infection in this population.
3. To emphasize that the early detection and urgent management of musculoskeletal infections is essential.

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Paulvalery Roulette, MD (Resident)**
Carolinas Healthcare System, Charlotte, NC

Topic: **The Utility of Screening MRI for Pediatric Patients with Suspected Musculoskeletal Infection**
Saturday, October 10

Purpose

Soft tissue, bone and joint infections present a diagnostic challenge in children. In an effort to accurately diagnose and manage patients presenting with musculoskeletal infections at our institution, a screening MRI protocol was developed. The purpose of this study is to describe our imaging protocol and report on a cohort of patients who underwent a screening MRI for suspected musculoskeletal infection prior to any procedural intervention. We also sought to determine which clinical or laboratory values would be predictive of patients presenting with septic arthritis versus multifocal musculoskeletal infection.

Methods

A retrospective chart review was performed on all patients less than 19 years old who were evaluated for suspected musculoskeletal infection and underwent a screening MRI during 2008-2014. A group of patients presenting with septic arthritis of the hip, septic arthritis of any joint and multifocal musculoskeletal infection were analyzed utilizing independent variables including age, gender, weight bearing status upon presentation, WBC, CRP (mg/dL), hemoglobin, ESR, temperature upon admission, and number of positive Kocher criteria.

Results

88 patients were included in the study. 53 (60.2%) patients were diagnosed with musculoskeletal infection, 19 (21.5%) with septic arthritis alone, and 13 (14.7%) with multifocal musculoskeletal infection. The average age of patients with septic arthritis was 3.3 years of age and 7 years of age (p=0.09) in those with multifocal infection. There were significantly different CRP (13.1 vs 4.5 mg/dL) and WBC (12.1 vs 13.8) values between those with multifocal infections and those with septic arthritis alone. There was no significant difference in age, gender, weight bearing status, hemoglobin, ESR, temperature, or number of positive Kocher criteria among the septic arthritis alone versus multifocal musculoskeletal infection groups.

Conclusion

A screening MRI is useful in the diagnosis and management of patients presenting with musculoskeletal infection. The odds of having a multifocal musculoskeletal infection on MRI versus an isolated septic arthritis was 9.7 times higher with a CRP >11, however no other clinical factors were useful in determining the presence of an associated bone or soft tissue infection on MRI.

Educational Objective: The use of MRI is recommended in the evaluation and management of children with musculoskeletal infections as clinical factors alone may not be helpful in determining the presence of multifocal infection. The early recognition of a multifocal infection allows one to make the appropriate diagnosis and provide proper surgical care at the initial operation.

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Mitchell R. Klement, MD (Resident)**
Duke University Medical Center, Durham, NC

Topic: **Treatment of Pelvic Chondroblastoma with Denosumab: The Role of RANK Signaling in Benign-Aggressive Tumors**
Saturday, October 10

In bone remodeling and turnover, the RANK ligand (RANK-L) binds the RANK receptor to stimulate osteoclast maturation and bone resorption. Overactivity of the RANK signaling pathway is important in the pathophysiology of bone destruction by many tumors. Denosumab (Xgeva) is a monoclonal antibody against the RANK ligand and thereby interrupts RANK signaling through competitive inhibition. It has been widely used in the treatment of Giant Cell Tumor of Bone (GCT). Like GCT, Chondroblastoma is a benign-aggressive tumor with severe osteolysis mediated by RANK signaling. Given the clinical, histologic, and molecular similarities of GCT and Chondroblastoma, we suspected that Denosumab would be similarly useful to treat Chondroblastoma. In this article we review a case of a 15 year-old male with a pelvic Chondroblastoma with extensive involvement of the acetabulum that was treated with neoadjuvant Denosumab. The treatment resulted in an increase in bone stock, allowing for resection of the lesion with salvage of the acetabulum and preservation of lower extremity function. Histologic analysis, including immunohistochemistry staining for RANK and RANK-L, was performed on the tumor tissue both pre- and post-treatment with Denosumab. The findings discussed give further insight into the cellular and molecular characteristics of Chondroblastoma, the role of RANK signaling, and its differences from Giant Cell Tumor of Bone. While the appropriate indications, dosing, and duration of treatment are still being investigated, we feel the clinical response to treatment with Denosumab by this patient are encouraging regarding the potential for improvements in treatment and management of patients with osteolytic pathologic lesions such as Chondroblastoma.

Main educational objectives:

1. Describe a novel treatment of Chondroblastoma with Denosumab.
2. Discuss the role of the RANK/RANK-L signaling pathway in Chondroblastoma, and how it is affected by treatment with Denosumab.
3. Highlight proposed differences in the RANK/RANK-L signaling pathway between GCT and Chondroblastoma, and how this may affect treatment outcomes.

North Carolina Orthopaedic Association 2015 Annual Meeting

Lecture Abstract

Speaker: **Mitchell R. Klement, MD (Resident)**
Duke University Medical Center, Durham, NC

Topic: **Risk Factors for Disease Progression and Implant Failure following Surgical Treatment of Extremity Metastatic Bone Disease**
Saturday, October 10

Background

Surgical stabilization is a mainstay of treatment for symptomatic bone metastases when a pathologic fracture is impending or already has occurred. While Mirel's criteria can suggest when surgical prophylaxis is indicated, it does not account for important variables such as disease duration, organ or origin, cancer histology, or adjuvant treatments. The purpose of this study is to assess risk factors for failure of surgical stabilization and disease progression in the treatment of metastatic bone disease.

Methods

Retrospective chart review evaluated 89 metastatic bony lesions of an extremity treated surgically between 2004 and 2014. Lesion characteristics, operative details, and follow up data were collected, and a Mirel's score was assigned at diagnosis. Radiographs prior to and following surgical intervention were assessed for disease progression based on criteria described by Harada et al.

Results

Overall, 43.8% of lesions demonstrated radiographic disease progression between visits, with 22.49% showing radiographic progression at final follow-up. Revision rate was 17.9%, and need for revision was significantly associated with the organ of disease origin and extremity involved. Gender, use of cement, fracture present at the time of surgery, and Mirel's score showed trends but did not reach significance.

Conclusions

Certain patients are likely to progress despite multimodal therapy for their at-risk skeletal lesions. Lesions of the lower extremity and certain tumor types should be considered for resection and endoprosthetic reconstruction, rather than prophylactic fixation, given a high likelihood of disease progression.

Educational Objective: Outline risk factors associated with implant failure and disease progression following operative treatment of metastatic bone disease of the extremities.