OREF/ORS Resident Research Symposia

OREF/ORS SOUTHEAST REGION II
RESIDENT RESEARCH SYMPOSIUM

Wednesday, September 26, 2018

Duke University Hospital
Albert Eye Research Institute
(adjacent to the Duke Eye Center)
Roz and Milton Lachman Family Auditorium
1st Floor, Lecture Hall 1001
2351 Erwin Road, Durham, NC  27705

Hosted by:

Benjamin A. Alman, MD
Distinguished James R. Urbaniak Professor and Chair
Department of Orthopaedic Surgery
Duke University Medical Center
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About OREF:
The Orthopaedic Research and Education Foundation (OREF) was founded in 1955 to ensure an expanding base of knowledge and effective, evidence-based treatment protocols for orthopaedic surgeons to continually improve patient care. Since its founding, OREF has funded more than $100 million in research and educational grants and awards that benefit all of orthopaedics. For more information about OREF grants and awards, please visit www.oref.org. Follow OREF on its Facebook page (OREFtoday) and on Twitter (@OREFtoday).

About ORS:
The Orthopaedic Research Society (ORS) is the pre-eminent organization for the advancement of musculoskeletal research. It seeks to transform the future through global multidisciplinary collaborations—focusing on the complex challenges of orthopaedic treatment. The ORS advances the global orthopaedic research agenda through excellence in research, education, collaboration, communication and advocacy. The ORS Annual Meeting, MyORS.org, and the *Journal of Orthopaedic Research* provide vital forums for the musculoskeletal community to discuss the current state of orthopaedic research. For more information or to join the ORS, please go to www.ors.org. Follow ORS on its Facebook page (Orthopaedic Research Society) and on Twitter (@ORSSociety).
OREF/ORS SOUTHEAST REGION RESIDENT RESEARCH SYMPOSIUM
SUMMARY AGENDA
Wednesday, September 26, 2018

<table>
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| 12:00 p.m. – 1:00 p.m. | Registration and Lunch  
Duke University Hospital  
Albert Eye Research Institute  
(adjacent to the Duke Eye Center)  
Roz and Milton Lachman Family Auditorium  
1st Floor, Lecture Hall 1001  
2351 Erwin Road  
Durham, NC |
| 1:00 p.m. – 1:05 p.m. | Welcome and Introduction  
Benjamin A. Alman, MD  
Chair, Department of Orthopaedic Surgery  
Duke University Medical Center |
| 1:05 p.m. – 1:08 p.m. | Michael Parks, MD  
Hospital for Special Surgery  
President, OREF Board of Trustees |
| 1:08 p.m. – 1:59 p.m. | Session I – Resident Research Presentations and Discussion |
| 1:59 p.m. – 2:09 p.m. | 10 Minute Break |
| 2:09 p.m. – 2:55 p.m. | Session II – Resident Research Presentations and Discussion |
| 2:55 p.m. – 3:05 p.m. | 10 Minute Break |
| 3:05 p.m. – 3:56 p.m. | Session III – Resident Research Presentations and Discussion |
| 3:56 p.m. – 4:00 p.m. | Introduction of Keynote Speaker |
| 4:00 p.m. – 5:00 p.m. | Keynote Address  
*Skeletal Stem Cell Aging: Is it Reversible?*  
Philipp Leucht, MD  
Assistant Professor of Orthopedics and Cell Biology  
New York University Langone Health  
New York |
| 5:00 p.m. – 6:00 p.m. | Reception  
Awards Presentation and Closing Remarks  
Duke University Hospital  
Albert Eye Research Institute |
Philipp Leucht, MD, grew up in Bochum, Germany, where he also attended medical school at the Ruhr-University Bochum. During his orthopaedic trauma residency at the Johann-Wolfgang-Goethe University in Frankfurt am Main, Germany, he was offered a postdoctoral fellowship at Stanford University. During this time, his basic science research focused on bone development, bone regeneration and stem cell biology. Once exposed to the U.S. academic system, he decided to that his academic future would be in the United States. He then applied and graduated from residency and fellowship at Stanford University and started his independent clinician-scientist career at the prestigious Hospital for Joint Diseases at New York University School of Medicine, where he now leads an NIH-funded research lab focusing on bone regeneration and stem cell biology.
Judges

Samuel B. Adams, Jr., MD
Duke University Medical Center
Durham, North Carolina

Edmund R. Campion, MD
University of North Carolina
Chapel Hill, North Carolina

Cynthia Emory, MD
Wake Forest University Baptist Medical Center
Winston-Salem, North Carolina

Philipp Leucht, MD
NYU Langone Health,
New York, New York

Joshua C. Patt, MD
Carolina's Healthcare System
Charlotte, North Carolina
OREF/ORS Southeast Region Resident Research Symposium

DETAILED AGENDA

Wednesday, September 26, 2018

<table>
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<tr>
<th>Time</th>
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| 1:00 p.m. – 1:05 p.m. | **Welcome and Introduction**  
Benjamin A. Alman, MD  
Chair, Department of Orthopaedic Surgery  
Duke University Medical Center |
| 1:05 p.m. – 1:08 p.m. | **About OREF and Grant Opportunities for Residents**  
Michael Parks, MD  
President, OREF Board of Trustees |
| 1:08 p.m. – 1:13 p.m. | **Efficacy of the Standardized Letter of Recommendation in the Evaluation of the Orthopaedic Resident Applicant**  
Matthew Pacana, MD, Palmetto Health/USC Medical Group |
| 1:14 p.m. – 1:19 p.m. | **Comorbidities and Complications as Drivers of Cost in Total Ankle Arthroplasty: Implications for Bundled Payment Models**  
Daniel Cunningham, MD, Duke University Medical Center |
| 1:20 p.m. – 1:25 p.m. | **Inflammatory Cytokines Correlate with Histology in Pathologic Posterior Tibial Tendons**  
David Tainter, MD, Duke University Medical Center |
| 1:26 p.m. – 1:31 p.m. | **Periprosthetic Ankle Fractures: Developing an Algorithm for Management**  
Alexander L. Lazarides, MD, Duke University Medical Center |
| 1:32 p.m. – 1:37 p.m. | **Early Outcomes of 3D Printed Total Talus Arthroplasty**  
Daniel Scott, MD, Duke University Medical Center |
| 1:38 p.m. – 1:43 p.m. | **A Step in the Right Direction: Body Location Determines Activity Tracking Device Accuracy in Arthroplasty Patients**  
Rahul Goel, MD, Emory University Orthopaedics |
| 1:44 p.m. – 1:49 p.m. | **New 5-Factor Modified Frailty Index Predicts Morbidity and Mortality in Primary Total Hip and Knee Arthroplasty**  
Sophia A. Traven, MD, Medical University of South Carolina |
| 1:49 p.m. – 1:59 p.m. | **Session 1 - Question and Answer** |

*Break*
OREF/ORS Southeast Region Resident Research Symposium

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Session II – Resident Research Presentations & Discussion

2:09 p.m. – 2:14 p.m.  Impact of Femoroacetabular Impingement Bony Abnormalities and Patient-Specific Factors on Chondrolabral Injury
Thomas Ergen, MD, Palmetto Health/USC Medical Group

2:15 p.m. – 2:20 p.m.  Cadaveric Study of a Novel Anatomic Reinforced Arthroscopic Medial Meniscal Root Reconstruction with Gracilis Autograft
Logan W. Huff, MD, Palmetto Health/USC Medical Group

2:21 p.m. – 2:26 p.m.  Nonoperative Management of a Severe Proximal Rectus Femoris Musculotendinous Injury in a Recreational Athlete
Chihyung Kevin Park, MD, Ochsner Medical Foundation

2:27 p.m. – 2:32 p.m.  Nonoperative Management of Posterior Shoulder Instability: An Assessment of Survival and Predictors for Conversion to Surgery at 1 to 10 Years After Diagnosis
Nick Johnson, MD, Carolinas Medical Center

2:33 p.m. – 2:38 p.m.  Reverse Shoulder Arthroplasty with and without Concomitant Latissimus Dorsi and Teres Minor Transfer for Shoulder Pseudoparalysis with Teres Minor Dysfunction: A Prospective Randomized Investigation
Bradley L. Young, MD, Carolinas Medical Center

2:39 p.m. – 2:44 p.m.  Suture Button Augmentation with Pronator Teres Reconstruction: A Biomechanical Analysis of Reconstruction Techniques for Longitudinal Forearm Instability
Scott Dart, MD, Carolinas Medical Center

2:45 p.m. – 2:55 p.m.  Session II - Question and Answer

Break

Session III – Resident Research Presentations & Discussion

3:05 p.m. – 3:10 p.m.  Vitamin D Trends in the Pediatric Orthopaedic Population: A Survey
Kevin Williams, MD, Palmetto Health/USC Medical Group

3:11 p.m. – 3:16 p.m.  Usage Patterns of Intraoperative Neuromonitoring During Degenerative, Non-Deformity, Cervical Spine Surgery: A Survey of the CSRS
Jeffrey Allen Konopka, MD, Emory University Orthopaedics

3:17 p.m. – 3:22 p.m.  Selective Thoracic Fusion in Adolescent Idiopathic Scoliosis: Comparison of the Lower Instrumented Vertebrae
Dale N. Segal, MD, Emory University Orthopaedics

3:23 p.m. – 3:28 p.m.  Hip Fractures Due to GSW are Bad Actors
Cody Hightower, MD, Palmetto Health/USC Medical Group
OREF/ORS Southeast Region Resident Research Symposium

DETAILED AGENDA

Wednesday, September 26, 2018

Session III – Resident Research Presentations & Discussion

Continued

3:29 p.m. – 3:34 p.m.  Initial Evaluation by a Nonoperative Provider Does Not Delay the Surgical Care of Operative Ankle Fractures in a Walk-In Orthopaedic Clinic
   Joseph Cline, MD, University of Tennessee Health Science Center – Campbell Clinic

3:35 p.m. – 3:40 p.m.  Hypoalbuminemia Predicts Mortality and Complications in the Non-Geriatric Patient with Lower Extremity Trauma
   Jacob Wilson, MD, Emory University Orthopaedics

3:41 p.m. – 3:46 p.m.  Time to Surgery >24h Increases the Risk for Surgical Site Infection in the Elderly with a Displaced Femoral Neck Fracture
   Rafael Serrano, MD, University of South Florida

3:46 p.m. – 3:56 p.m.  Session III - Question and Answer

3:56 p.m. – 4:00 p.m.  Introduction of Keynote Speaker

4:00 p.m. – 5:00 p.m.  Keynote Address
   Skeletal Stem Cell Aging: Is It Reversible?
   Philipp Leucht, MD
   Assistant Professor of Orthopedics and Cell Biology
   New York University Langone Health
   New York

5:00 p.m. – 6:00 p.m.  Reception
   Awards Presentation and Closing Remarks
   Duke University Hospital
   Albert Eye Research Institute
   (Adjacent to the Duke Eye Center)
   Roz and Milton Lachman Family Auditorium
   1st Floor, Lecture Hall 1001
   2351 Erwin Road
Efficacy of the Standardized Letter of Recommendation in the Evaluation of the Orthopaedic Resident Applicant

Matthew Pacana, MD  
Palmetto Health/USC Medical Group

Purpose: To determine if the AOA standardized letter of recommendation (SLOR) creates an objective system for evaluating orthopedic applicants.

Significance: In the orthopedic application process, the letters of recommendation demonstrate that applicants receive few poor evaluations adding to the confusion of the resident selection. The American Orthopedic Association released the SLOR form with the goal to reduce the bias towards overly complimentary evaluations. We hypothesize the SLOR does not create an objective tool to evaluate similarly talented applicants and adds significant time and confusion.

Methodology: All applicant letters from the 2017 application cycle were included. Criteria including rank, AOA status, STEP scores, and all SLOR questions were evaluated. Qualitative statistics have been used with plans for more statistical analysis at completion of data collection.

Results: 550 of 691 letters evaluated used the SLOR. Preliminary results show that 40.8% of recommenders knew the applicants for one month or less but would still rank the applicants as highly ranked or guaranteed match 89.4% of the time.

Conclusions: Our evaluation shows no significant reduction in bias between the SLOR and personal letters. We hope this study will help to provide a more objective approach to applicant evaluation and contribute to growing application literature.
Comorbidities and Complications as Drivers of Cost in Total Ankle Arthroplasty: Implications for Bundled Payment Models

Daniel Cunningham, MD
Duke University Medical Center

Background: The Comprehensive Care for Joint Replacement model (CJR) provides bundled payments for in-hospital and 90-day post-discharge care of patients undergoing total ankle arthroplasty (TAA). Defining patient factors associated with increased costs during TAA could help identify modifiable preoperative patient factors as well as determine targets for cost reduction.

Methods: This study is part of an IRB-approved single-center observational study of patients undergoing TAA from 1/1/2012 to 12/15/2016. Patients were included if they met CJR criteria for inclusion into the bundled payment model. All Medicare payments beginning at the index procedure through 90 days postoperatively were identified. Patient, operative, and post-operative characteristics were associated with costs in adjusted, multivariable analyses.

Results: Cerebrovascular disease was significantly associated with increased costs ($5,595.25 mean, $1,710.22 - $9,480.28 95% CI) in adjusted analyses (p=0.005). Increased length of stay, discharge to skilled nursing facility (SNF), admissions, ED visits, and wound complications were significant post-operative drivers of payment.

Conclusion: Cerebrovascular disease predicted increased post-operative costs. The relationship between patient profile and increased financial burden highlights the potential utility of patient profile-drive payment stratification. SNF placement, readmission, ED visitation, and wound complications are post-operative targets for reducing costs for patients undergoing TAA.
Inflammatory Cytokines Correlate with Histology in Pathologic Posterior Tibial Tendons

David Tainter, MD
Duke University Medical Center

Introduction: The pathophysiology of the pain in posterior tibial tendon dysfunction (PTTD) is not well understood, nor is the involvement of the posterior tibial tendon (PTT) insertion. We hypothesize that inflammatory cytokines, matrix metalloproteases (MMPs), and pain neurotransmitter profiles are elevated in the diseased PTT as well as the PTT insertion.

Methods: PTT and flexor digitorum longus (FDL) samples were collected from 21 patients undergoing FDL tendon transfer surgery. The samples incubated in media for 48 hours. Inflammatory cytokines and MMPs concentrations were determined by ELISA. Glutamate was detected using a colorimetric assay. Analysis done with Friedman’s test and Wilcoxon-signed-rank post-hoc tests with Bonferroni corrected α = 0.0167. Tendon samples were frozen sectioned for histology and graded. Spearman’s rho was used to determine non-parametric correlation.

Results: Diseased PTT and PTT insertion groups were significantly elevated compared to healthy FDL for inflammatory cytokines IL-1β, IL-6, IL-8, IL-10, and TNF-α and MMPs MMP-1, MMP-2, and MMP-3 (p<0.005). Differences in glutamate concentrations were also significant, but only the diseased PTT group was significantly elevated compared to the healthy FDL tendons (p<0.01). Histologic grading correlated with inflammatory cytokine levels.

Conclusion: Diseased PTT and the PTT insertion demonstrated significantly elevated levels of inflammatory cytokines and MMPs compared to healthy FDL controls, suggesting a role for inflammation in the disease process. The amount of inflammation correlated with increased tendon degradation. The PTT, but not the insertion, contained significantly larger amounts of glutamate.
Periprosthetic Ankle Fractures: Developing an Algorithm for Management

Alexander L. Lazarides, MD
Duke University Medical Center

Purpose: To determine risk factors for and clinical outcomes from patients with postoperative periprosthetic fractures about a total ankle replacement (TAR) to develop an evidence-based algorithm for the management of these patients.

Significance: Periprosthetic fracture is an uncommon but challenging complication of patients undergoing TAR. Evidence on the management of and outcomes from periprosthetic fractures about a TAR are limited.

Methods: This was a retrospective analysis of patients undergoing a TAR from 2007 through 2017 with a subsequent periprosthetic fracture >4 weeks from index surgery. Stability was defined radiographically and intraoperatively where appropriate. Univariate and multivariate analyses were used to identify differences in outcomes.

Results: 32 patients with a mean age of 65.3 years were identified with a remote TAR periprosthetic fracture with an average follow up of 26 months (range 3-104 months). Fractures were primarily located about the medial malleolus (62.5%). The majority of fractures (75%) were deemed to have stable implants. Fractures of the talus were always unstable and always required revision TAR surgery (100%, p= 0.0002). There was no difference in patient reported outcomes between stable and unstable fractures with regards to AOFAS, SF-36 or VAS scores at an average of 36 months. In a multivariate analysis, fracture location (talus), less time to fracture and implant type (Infinity) were found to be predictive of unstable implants (p<0.001). Implant stability was independently associated with the need for revision surgery (p<0.049). Nonoperative treatment was independently associated with treatment failure (p<0.001).

Conclusion: This retrospective review demonstrates that the majority of stable fractures about a TAR required operative fixation. Despite attempts at nonoperative management, management with immobilization is fraught with a high rate of subsequent surgical intervention. Fractures about the talus should be treated with revision TAR surgery or arthrodesis.
Early Outcomes of 3D Printed Total Talus Arthroplasty

Daniel Scott, MD
Duke University Medical Center

Significance: Patients with talar avascular necrosis have limited treatment options to manage their symptoms. Historically, surgical options have been limited and can leave patients with little ankle motion and have high failure rates. The use of custom 3D printed total talar replacements (TTR) has arisen as a treatment option for these patients, possibly allowing for better preservation of hind-foot motion.

Hypothesis: Patients undergoing TTR will demonstrate a statistically significant improvement in FAOS scores at one year after surgery.

Methodology: We retrospectively reviewed 15 patients who underwent a TTR over 2 years. Patient outcomes were reviewed including age, sex, comorbidities, etiology of talar pathology, number and type of prior surgeries, as well as FAOS and VAS scores, and range of motion. Data analysis performed with student T-test and multivariate regression.

Results: FAOS scores showed statistically significant improvements post-operatively as compared to pre-operative scores. There was a statistically significant decrease in VAS pain scores from 7.0 pre-operatively to 3.6. Average follow-up was 12.8 months.

Conclusion: Our hypothesis was confirmed that these patients show statistically significant improvements in AOFS scores at 1 year. TTR represents an exciting treatment options for patients with talar avascular necrosis, though longer-term follow-up is needed.
A Step in the Right Direction: Body Location Determines Activity Tracking Device Accuracy in Arthroplasty Patients

Rahul Goel, MD
Emory University Orthopaedics

Significance: Studies have utilized subjective patient reported outcomes to measure patient function after TJA. Objective data assessing postoperative function is lacking, and there is interest in SP and AMDs to measure activity levels.

Hypothesis: Smartphones (SP) and activity monitoring devices (AMD) can effectively monitor step counts after total joint arthroplasty (TJA).

Methodology: This three-armed, prospective, observational study of healthy, asymptomatic individuals (n=10), TJA inpatients (n=24), and two-weeks status-post TJA (n=25), compared counted steps with AMD and SP worn on specified locations (wrist, hip, ankle, neck). Acceptable error was defined as <30%.

Results: All inpatients required use of an ambulatory assist device, and AMDs and SPs had unacceptable error. Two-week postoperative patients required less assist and had significant improvements in stride-length and cadence. AMD and SP on the contralateral ankle and hip, respectively, had error rates less than 30% (range 10.83%-15.98%). Regression analysis found increases in postoperative day and cadence led to decrease in device error.

Conclusion: Immediately postoperatively, AMDs and SPs have limited utility for step-counting. As gait normalizes and level of assist decreases, AMDs and SPs on the contralateral ankle and hip, respectively, demonstrated low error rates. These devices offer a novel method for objective outcomes, as well as remote monitoring of patient progress.
New 5-Factor Modified Frailty Index Predicts Morbidity And Mortality in Primary Total Hip and Knee Arthroplasty

Sophia A. Traven, MD
Medical University of South Carolina

Purpose: The goal of this study is to examine the predictive value of the mFI-5 for complications, readmission, and mortality in patients undergoing primary total hip and knee arthroplasty.

Significance: While the 11-factor modified frailty index (mFI) has been shown to predict morbidity and mortality in patients across many surgical specialties, the newer 5-factor index has yet to be evaluated in the orthopaedic population.

Methodology: A retrospective analysis of the NSQIP database was conducted and patients were identified by CPT code. The 5-factor score, which includes presence of comorbid diabetes, hypertension, congestive heart failure, chronic obstructive pulmonary disease, and functional status, was calculated for each patient. Multivariate logistic regression models were used to assess the relationship between the mFI-5 and postoperative complications.

Results: 140,158 patients undergoing THA and 226,398 for TKA were identified. The mFI-5 was a strong predictor for any complication, including life-threatening medical complications, surgical site infections, readmission, and 30-day mortality among both populations (p < 0.001).

Conclusion: The mFI-5 is an independent predictor of postoperative morbidity and mortality following primary THA and TKA. This tool can be used to risk-stratify and counsel patients prior to surgery in order to optimize their outcomes.
Impact of Femoroacetabular Impingement Bony Abnormalities and Patient-Specific Factors on Chondrolabral Injury

Thomas Ergen, MD
Palmetto Health/USC Medical Group

**Purpose:** To evaluate the relationship between radiographic parameters and patient specific variables on the severity of hip chondrolabral damage.

**Significance:** Femoroacetabular impingement (FAI) is a common cause of hip pain that results from abnormal conflict between the acetabulum and femoral head/neck, and often is associated with chondrolabral injury.

**Methodology:** A retrospective analysis of radiographic findings, patient specific variables, and intraoperative chondrolabral injury was performed on 205 patients who underwent hip arthroscopy. Lateral center edge angle (LCEA), alpha angle, cross over sign, BMI, and age were obtained preoperatively. Labral tear size and chondral injury, using Outerbridge classification, were measured and recorded intra-operatively. Cross tabulations and t-tests were used to evaluate for significant differences.

**Results:** There was a significant difference with acetabular and femoral chondromalacia with BMI >25. Additionally, age >35 and alpha angle >55 lead to more significant acetabular chondromalacia. Finally, both LCEA >35 and alpha angle >55 showed larger labral tears.

**Conclusion:** Our findings suggest increased BMI, age, LCEA, and alpha angle can have a significant impact on the severity of chondrolabral injury. This data will one day be able to give physicians and patients realistic expectations of their outcomes preoperatively based on radiographic and patient specific data.
Numerous techniques to repair medial meniscus posterior root tears (MMPRT) have been published. Current methods have failed to restore the normal anatomy and function of the meniscus root and resulted in the rapid progression of arthritis. Reconstruction of MMPRT by the addition of auto-graft tissue may improve the healing rates and prevent long-term sequelae of MMPRTs.

A novel arthroscopic technique consisting of reconstruction of the meniscal root with gracilis autograft and reinforcement with collagen coated suture tape was tested in cadavers. After arthroscopic reconstruction, the disarticulated knee was photographed and studied for anatomic placement of graft and for biomechanical strength of the constructs using cyclical loading.

Biomechanical testing on cadavers showed average load to failure of 208 N, which is similar to published repair techniques. The procedure was found to be reproducible in the cadaver lab creating an anatomic re-attachment of the MMPRT.

The healing rates of repairs and/or reconstructions of MMPRTs are suboptimal and current techniques need improvement. Direct repair of the torn meniscus back to the tibia without biologic tissue results in a non-anatomic and a biologically weak construct long-term. The novel reconstruction technique creates an anatomic construct with suitable load to failure characteristics at time zero with potential for improving strength with healing over time. Additional cadaveric and clinical studies are warranted to elucidate the efficacy of this procedure and to optimize the technique. Clinical case studies following post-operative MRI for biological healing are currently in progress and showing promising results.
Nonoperative Management of a Severe Proximal Rectus Femoris Musculotendinous Injury in a Recreational Athlete

Chihyung Kevin Park, MD
Ochsner Medical Foundation

Purpose: This report describes proximal Rectus Femoris muscle injury mechanism, treatment, rehabilitation and healed follow-up imaging of a nonprofessional but competitive adult male.

Significance: This injury is a relatively rare occurrence in both the general and elite athletic populations. Because RF avulsions are rare, there is no definitive protocol about how to treat this injury. Acute and long-term imaging and functional outcomes are not described with current literature.

Methodology: Detailed description of mechanism of injury, rehabilitation process and timeline, and MRI provides structural information of pathology.

Result: With RF injury return to play time table for elite athletes and recreational athletes are similar with nonsurgical management. With 12 weeks of physical therapy rehabilitation, patient was satisfied with near baseline function at full, competitive sports activities.

Conclusion: There has been an increased number of organized recreational sports league, and kickball is gaining more popularity among adults, which may result in a greater occurrence of this type of injury in general population. Our case demonstrates that elite athletes and non-professional athlete’s return to play time table is approximately similar in non-operative management with set time frame. Also, MRI can provide a resolution far beyond the capacity of ultrasound.
Nonoperative Management of Posterior Shoulder Instability: An Assessment of Survival and Predictors for Conversion to Surgery at 1 to 10 Years After Diagnosis

Nick Johnson, MD
Carolinas Medical Center

Significance: Posterior shoulder instability (PSI) is a relatively rare condition accounting for approximately 3% of patients with glenohumeral instability. While non-operative management of PSI is the primary treatment for many patients, its role in the treatment of symptomatic PSI is less clear, and little is known about the rate and risk factors for eventually requiring surgical intervention.

Hypothesis: A large percentage of patients initially treated non-operatively for PSI will eventually undergo surgery.

Methods: A search was conducted through the Rochester Epidemiology Project (REP) to identify all cases of posterior shoulder instability between 1996 and 2015. Complete medical records were reviewed for 2091 potential cases. The study included 143 patients with a clinical diagnosis of PSI, supporting imaging, and minimum 5-year follow-up in the REP database.

Results: 64 of 143 patients with PSI were managed non-operatively for at least one year after diagnosis. Long-term follow-up demonstrates that 46% of these patients converted to surgery between 1 and 10 years after initial diagnosis. Non-throwing athletes (including contact/weightlifting athletes) showed a trend towards an increased risk for surgery (p=0.07).

Conclusion: A high percentage of patients who initially choose to pursue non-operative management for PSI will ultimately choose to undergo surgery on a delayed basis.
Reverse Shoulder Arthroplasty with and without Concomitant Latissimus Dorsi and Teres Major Transfer for Shoulder Pseudoparalysis with Teres Minor Dysfunction: A Prospective, Randomized Investigation

Bradley L. Young, MD
Carolinas Medical Center

Purpose: To analyze patient reported outcomes between reverse shoulder arthroplasty (RSA) with and without concomitant latissimus dorsi (LD) and teres major (TM) transfer for shoulder pseudoparalysis with teres minor dysfunction.

Significance: RSA does not restore external rotation, which is impaired with teres minor dysfunction. Such dysfunction has been associated with diminished functional outcomes and patient satisfaction. LD and TM tendon transfers have been performed concurrently with RSA to restore both active elevation and external rotation.

Methodology: Twenty-eight patients with concurrent shoulder pseudoparalysis and teres minor dysfunction were randomized into two groups: RSA with transfer or RSA without transfer. Outcome measures included the Activities of Daily Living and External Rotation (ADLER) Score, Disabilities of the Arm, Shoulder and Hand (DASH) Score, American Shoulder and Elbow Surgeons (ASES) Score, and Simple Shoulder Questionnaire (SST).

Results: Gender, BMI, age, and complication rates were similar between groups. There was no significant difference in the ADLER, DASH, ASES, or SST between the groups pre-operatively or at one-year follow-up.

Conclusion: There does not appear to be a difference in functional outcome or satisfaction between patients with concomitant shoulder pseudoparalysis and teres minor dysfunction who underwent RSA with or without LD and TM transfer.
Suture Button Augmentation with Pronator Teres Reconstruction: A Biomechanical Analysis of Reconstruction Techniques for Longitudinal Forearm Instability

Scott Dart, MD
Carolinas Medical Center

**Purpose:** The purpose of this study was to assess the optimal reconstructive method to best restore native forearm stability. We hypothesize that suture button augmentation would help with immediate stability of the forearm.

**Significance:** Reconstructive techniques which include a suture button construct to augment biological forearm interosseous membrane (IOM) reconstruction have been described. There are no known studies assessing biomechanical stability of suture button augmentation of a biologic reconstruction.

**Methods:** With eight fresh-frozen, intact upper limb cadaveric specimens, the displacement of the radius relative to the ulna was tested with successive deconstruction then reconstructive techniques. The specimens were cyclically loaded using a uniaxial materials test apparatus. The radioulnar displacement was the primary endpoint measured by the crosshead displacement. A repeated measure one-way ANOVA and Tukey test was used for statistical analysis.

**Results:** There was a statistically significant decrease (p<0.05) in the radioulnar displacement with pronator teres IOM reconstruction augmented with 1 and 2 mini tightrope devices compared to the destabilized condition. Pronator teres reconstruction with radial head replacement also restored radioulnar longitudinal stability.

**Conclusion:** Pronator teres transfer with suture button augmentation or pronator transfer with radial head replacement both effectively restore radioulnar stability similar to that of an intact specimen.
Vitamin D Trends in the Pediatric Orthopaedic Population: A Survey

Kevin Williams, MD
Palmetto Health/USC Medical Group

Purpose: Evaluate the knowledge of vitamin D trends among Pediatric Society of North America (POSNA) members and increase awareness of vitamin D amongst all providers.

Significance: Multiple studies have demonstrated the potential health benefits of vitamin D supplementation including improved bone health, reduced fracture risk, protection from autoimmune disease, and decreased cancer risk. Despite recent evidence of increased vitamin D supplementation in the US, vitamin D deficiency is still prevalent.

Methodology: Our survey was distributed to 1316 POSNA members and the response data was depersonalized and analyzed via chi square and Fisher’s exact testing.

Results: 395 responses were recorded. 69% of participants rated their vitamin D knowledge as fair to good and represented a wide, experienced demographic. Most estimate that over 25% of their practice is vitamin D deficient with about a 50% compliance rate of supplementation.

Conclusion: Survey participants demonstrated a wide variety of responses indicating their understanding of vitamin D testing and supplementation. Although providers estimate a high deficiency rate, many do not routinely check vitamin D and there is no standard indication of who or when to test. More studies are needed to provide a standardized protocol for vitamin D testing/supplementation in the pediatric orthopaedic literature.
Purpose: The purpose of the study is to determine the current usage patterns and selection reason for use of neuromonitoring in degenerative cervical spine surgery for cervical radiculopathy and myelopathy.

Significance: Intra-operative neuromonitoring (ION) is frequently used in spine surgery but its indication for use has not been verified. We hypothesize that ION does not have criteria that is universally accepted.

Methodology: A survey was administered to 441 current spine surgeons who are members of the Cervical Spine Research Society to assess practice patterns of ION use in cervical radiculopathy or myelopathy. Survey monkey was used to collect the data and results analyzed by excel and SPSS.

Results: 115 spine surgeons responded to the survey (26%). In cervical spine surgery for radiculopathy, 38% of respondents use ION routinely compared to 64% in myelopathy cases (p<0.001). Overall, the primary reason ION was used in myelopathy and radiculopathy was thought to prevent positioning/hypotension related neurologic complications outside of the surgical field at a valuable rate (35.4%).

Conclusions: Our data indicates great variation in ION utilization and decisions for using ION. ION is used most routinely in patients undergoing surgery for myelopathy. Understanding the current practice patterns of neuromonitoring amongst CSRS members may help guide future use criteria.
Selective Thoracic Fusion in Adolescent Idiopathic Scoliosis: Comparison of the Lower Instrumented Vertebrae

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**Purpose:** To compare clinical outcomes and radiographic parameters between patients treated with a selective thoracic fusion that had a lower instrumented vertebra at T11, T12, and L1.

**Significance:** Selective thoracic fusions (STF) are well-established for treating patients with adolescent idiopathic scoliosis (AIS). However, fusions that end at the thoracolumbar junction have been proposed to cause adjacent segment complications.

**Methodology:** The Harms Study Group database was queried for patients with AIS that had Lenke type 1 & 2 curves treated with a STF that had an LIV at T11, T12 or L1. Coronal curve magnitude, sagittal stable vertebrae (SSV) and distal junctional kyphosis (DJK) were measured. Clinical and functional outcomes were assessed using the SRS-22 questionnaire and truncal flexibility testing.

**Results:** The lower instrumented level was below the SSV in 22.7%, 40% and 66.2% of patients in the LIV-T11, T12 and L1 groups, respectively (p<0.001). Development of DJK occurred in 0%, 2.5% and 0.8% in the LIV-T11, T12 and L1 groups, respectively (p=0.5). The 5-year postoperative total SRS 22 scores were 4.21, 4.50 and 4.38 (p=0.029).

**Conclusion:** There was no significant difference in SRS22 scores, development of distal junctional kyphosis or loss of lumbar mobility between patients treated with a selective thoracic fusion who had an LIV at T11, T12 or L1.
fractures due to gunshot injuries (GSW) may have worse outcomes compared to others. We believe complications may include fixation failure, heterotopic ossification (HO), avascular necrosis (AVN), post-traumatic arthritis (PTA) and/or chondrolysis. Our review shows no comprehensive study on GSW hip fractures treated surgically.

Patients who sustained a low velocity GSW to the hip resulting in a fracture to the femoral head (OTA 31-C), neck (OTA 31-B), or intertrochanteric/peritrochantric region (OTA 31-A) at two Level-1 Trauma Centers were eligible for inclusion. Additional criteria included age, surgical stabilization of the fracture and adequate follow-up. Patient demographics, injury and surgical details, additional injuries and complications were recorded.

There were 31 patients (28 males) with a mean age of 28 (18-59). There were 25 31-A, 5 31-B and 1 31-C type fractures. 29 sustained additional GSW injuries. 21 patients were treated with IMN and 10 had ORIF. Average hospital stay was 10 days (2-62). One patient had nonunion and treated with revision ORIF. One had hardware failure and subsequent revision ORIF. One patient had removal of screw that penetrated the hip joint. Two patients had orthopedic surgical site infections. Abdominal GSW correlated with non-orthopedic infections (p<0.03). There were 6 cases of HO and no cases of AVN, PTA, or chondrolysis.

This review represents the largest study on surgically-treated GSW to the hip. More than half the patients sustained additional GSW. Abdominal GSW continues to be a source of infection. HO was the main complication.
Initial Evaluation by a Nonoperative Provider Does Not Delay the Surgical Care of Operative Ankle Fractures in a Walk-in Orthopaedic Clinic

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Purpose: This study assesses whether evaluation by a nonoperative provider delays the care of patients with operative ankle fractures compared to those seen by an orthopaedic surgeon in an orthopaedic walk-in clinic.

Significance: Orthopaedic walk-in clinics are commonly staffed by physicians and nonoperative providers. Whether the care of simple fractures differs between these providers is unknown.

Methodology: A cohort of patients who were seen in a walk-in setting and who subsequently underwent surgical treatment for an isolated ankle fracture were identified. The cohort was divided based on whether the initial clinic visit was conducted by an operative or nonoperative provider (physician assistant, nurse practitioner, non-operative MD). A second cohort treated by a fellowship-trained hand surgeon in their private practice was used as a control group.

Results: 138 were identified, with 61 seen by a surgeon, and 77 seen by a nonoperative provider. No significant differences were found comparing days to surgery or days to first visit with treating surgeon between the operative and nonoperative groups (p>.05). The control group underwent surgery significantly sooner than either walk-in group.

Conclusion: Evaluation by a nonoperative provider is not associated with an increased duration to definitive treatment compared to an operative provider.
Hypoalbuminemia Predicts Mortality and Complications in the Non-Geriatric Patient with Lower Extremity Trauma

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Purpose: Hypoalbuminemia is a risk factor for mortality and complications after other orthopedic surgeries. We hypothesized that hypoalbuminemia may predispose patients with lower extremity trauma to complications and mortality.

Significance: Malnutrition serves as a potentially modifiable risk factor and if recognized at admission could be intervened upon.

Methods: The NSQIP database was reviewed and patients <65 years-old who underwent surgery for a lower extremity fracture (including pelvis and acetabulum) were included. Preoperative demographic information, serum albumin levels, and post-operative outcomes were collected. Poisson analysis with robust error variance was then performed.

Results: 5,673 patients (mean age 51 years old) were identified and 29.6% were found to have hypoalbuminemia. Patients with albumin <3.5 g/dl had higher rates of postoperative complications (9.3% v. 2.6%; aRR 1.63), rates of sepsis (1.5% v. 0.5%, aRR 2.35), re-intubation (2.3% v. 0.4%; aRR 3.84), reoperation (5.5% v. 2.6%, aRR 1.74), and readmission (11.4% v. 4.1%; aRR 2.53). Importantly, patients with hypoalbuminemia had increased rates of mortality (3.2% v. 0.4%; aRR 4.86, 95% CI 2.66-8.87).

Conclusions: Hypoalbuminemia is a powerful predictor of postoperative course and mortality in non-geriatric, lower extremity orthopedic trauma patients. Further study into the utility of supplementation is warranted as this may represent a modifiable risk factor.
**Purpose:** To assess the influence of time to surgery on the development of surgical site infection (SSI) in the elderly with a displaced femoral neck fracture treated with an arthroplasty.

**Method:** All patients >60 years old undergoing a partial or a total hip replacement for a displaced intracapsular femur fracture (OTA31B) between 2008-2017 were retrospectively reviewed from a multicenter database. Data analysis included: demographics, fracture pattern, preoperative risk factors for infection (smoking, diabetes, BMI>35, immunosuppression, anemia, anticoagulation medication, dementia, ASA>3, alcohol abuse, malignancy, renal failure, vascular diseases, MRSA carrier, and active UTI), time from admission to surgical procedure, length of surgery, level of physician involvement (resident/fellow/attending), and development of SSI. Patients were excluded if <60 years old, follow up <3 months, pathologic/peri-prosthetic fractures, and revision arthroplasty. Patients were placed into 5 groups, based on the range of time between arrival to the hospital and surgery: 0-12hrs, 12-24hrs, 24-36hrs, 36-48hrs, and 48+ hours. Univariate chi-square test of independence and a binary logistic regression test were conducted to determine significant differences in infection rates between the groups.

**Results:** A total of 697 patients were included in the study. Mean age was 79 years old (Range: 60-101). 68% were females. Forty (5.7%) patients developed a SSI. Of those, 23 developed a deep SSI requiring an exchange arthroplasty along with IV antibiotics, and 17 patients developed a superficial SSI managed with a course of oral or IV antibiotics. Univariate chi-square comparison between groups showed the next SSI rates (P<0.001): [0-12h]: 1.5%, [12-24h]: 3.6%, [24-36h]: 12.2%, [36-48h]:16.1%,[+48h]: 7.1%. The regression analysis adjusted for preoperative risk factors yielded 24 hours as the cut off at which the infection rate significantly increased. The Odds Ratio for development of SSI in groups 24-36h and 36-48h was respectively 9 (p=0.004) and 12 (p=0.001) times greater compared to the reference group 0-12h.

**Conclusion:** Our findings indicate that the time to surgery for displaced femoral neck fractures in the elderly should be minimized to decrease the risk of SSI, ideally within 24 hours of arrival. Preoperative assessment and optimization should be performed with the goal of preventing unnecessary delays that can lead to increased risks of perioperative morbidity and mortality.
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