45th Annual Mallory-Coleman Resident Research Day

Friday, June 2, 2017

Fawcett Center
OSU Campus
MALLORY-COLEMAN DAY

Mallory-Coleman resident research day was established by Drs. Thomas Mallory and Carl Coleman in 1972 in memory of Katherine Virginia Mallory and Sally Jo Coleman.

This research day was established to encourage the development of ideas related to research in orthopaedic surgery and related basic sciences.

Each year, a distinguished visiting professor from an outside institution is invited to moderate and analyze the resident presentations and provide constructive criticism and commentary.

Past Visiting Professors:

2016  Julie Switzer, MD
2015  Javad Parvizi, MD
2014  Leesa Galatz, MD
2013  Howard An, MD
2012  Regis O’Keefe, MD
2011  Henrik Malchau, MD
2010  Freddie Fu, MD
2009  James Heckman, MD
2008  Cato Laurencin, MD
2007  William Garrett, MD
2006  Peter Stern, MD
2005  James Goulet, MD
2004  Steven Arnoczky, DVM
2003  Joseph Buckwalter, MD
2002  Victor Goldberg, MD
2001  James Urbaniak, MD
2000  Douglas Jackson, MD
1999  Douglas Dennis, MD
1998  Thomas Einhorn, MD
1997  Larry S. Matthews, MD
1996  Gary Friedlander, MD
1995  James Herndon, MD
1994  Clement B. Sledge, MD

2017 MALLORY-COLEMAN VISITING PROFESSOR AND MODERATOR:

TAMARA ROZENTAL, MD

Dr. Tamara Rozental is an Assistant Professor of Orthopaedic Surgery at Harvard Medical School and Beth Israel Deaconess Medical Center. Dr. Rozental specializes in disorders of the hand, wrist, and elbow. In her practice, she evaluates and treats all upper extremity injuries and chronic conditions.

Dr. Rozental’s research focus includes fragility fractures of the upper extremity and bone health improvement programs. She has extensive research experience and has earned multiple accolades from the American Society for Surgery of the Hand and American Academy of Orthopaedic Surgeons. She serves as an Associate Editor for the Journal of Hand Surgery.

She is a graduate of Bryn Mawr College and was valedictorian at Cornell University Medical School. She performed her orthopaedic surgery residency at the University of Pennsylvania. Following residency, Dr. Rozental completed a hand and upper extremity fellowship at the Brigham and Women’s Hospital in Boston. Dr. Rozental has won numerous awards from the American Society for Surgery of the Hand. She was also recently selected as a leadership fellow for the Academy of Orthopaedic Surgeons. Her research focuses on fragility fractures of the upper extremity and received funding from several prestigious national foundations.

Dr. Rozental’s professional appointments include:
- Fellow of the American Academy of Orthopedic Surgeons
- Member of the American Society for Surgery of the Hand
- Director of the Hand Surgery Residency Rotation at the Beth Israel Deaconess Medical Center
- Leadership Fellow of the American Academy of Orthopaedic Surgeons
- Young Leader of the American Society for Surgery of the Hand
- Fellowship Director for BIDMC/Harvard Hand Surgery Fellowship

She has presented at numerous national and international meetings. Dr. Rozental’s scientific articles have been published in journals such as the Journal of Bone and Joint Surgery, the Journal of Hand Surgery and Clinical Orthopaedics and Related Research. She has received research funding from the American Society of Surgery of the Hand and the Orthopaedic Research and Education Foundation.
6:45 am  Welcome and Introduction

7:00 am  Steven Niedermeier, MD
“A Survey of Fellowship-trained Upper Extremity Surgeons on the Treatment of Lateral Epicondylitis”

7:13 am  Scott Shemory, MD
“Allograft versus Autograft for Medial Patellofemoral Ligament Reconstruction”

7:26 am  Amy Ravindra, MD
“A Prospective Evaluation of Predictors of Pain After Arthroscopic Rotator Cuff Repair: Psychosocial Factors Have a Stronger Association Than Structural Factors”

7:39 am  Rishi Gogineni, MD
“Acute Kidney Disease after Total Hip and Knee Arthroplasty: Incidence and Associated Factors”

7:52 am  Jacob Triplett, DO
“Periprosthetic Tibia Fractures: Outcomes and Review”

8:05 am  Jared L. Harwood, MD
“Operating Room Traffic: Affecting the Pulse of the OR”

8:18 am  Thomas Zink, DO
“Anterior Capsular Reconstruction (ACR) of the Shoulder for Chronic Instability Using a Dermal Allograft”

8:33 am  Nicole Meschbach, MD
“Factors Influencing Time to Union of Diaphyseal Humerus Fractures after Plate Fixation”

8:46 am  Steven Cotman, DO
“Role of Radiologists’ Comments on Plain Radiographs in the Initiation of Advanced Imaging”

8:59 am  Josh Everhart, MD, MPH
“When is Hemiarthroplasty Preferable to Intramedullary Prophylactic Fixation of Metastatic Disease of the Proximal Femur?”

9:12 am  Break

9:27 am  Amy Ravindra, MD
“A Cadaveric Analysis of Proximal Humerus Locking Plate Fit: Contour Mismatch May Lead to Malreduction”

9:40 am  Jeffrey Otte, MD
“Treatment of Madelung’s Disease with Vicker’s Ligament Release: A Case Series”

9:53 am  Andrew Crisologo, DPM
“Adult Onset Hypophosphatasia Presenting As Metatarsal Fractures And Stress Fractures”

10:06 am  Marissa Jamieson, MD
“Narcotic Use and Wastage after Hand and Upper Extremity Surgery”

10:19 am  Yoseph Rosenbaum, MD
“Adhesive Capsulitis Following Influenza Vaccination: Case Series and Review of the Literature”
<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>10:32 am</td>
<td>John Alexander, MD</td>
<td>“Targeted Muscle Reinnervation: An Operation to Prevent Neuroma and Phantom Limb Pain in Oncologic Amputees”</td>
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<tr>
<td>10:45 am</td>
<td>Anthony LoGiudice, MD</td>
<td>“Screw Post Study”</td>
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<td>10:58 am</td>
<td>Sean Sutphen, DO</td>
<td>“Radiographic and Clinical Results After Robot Assisted Lateral Unicompartmental Arthroplasty”</td>
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<tr>
<td>11:11 am</td>
<td>Nicholas Early, MD</td>
<td>“Effect of One Season of Play on Articular Cartilage Health in Collegiate Football Linemen”</td>
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<tr>
<td>11:24 am</td>
<td>Sohrab Virk, MD, MBA</td>
<td>“The Utility of Pre-operative Neuromonitoring for Adolescent Idiopathic Scoliosis”</td>
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<td>11:50 am</td>
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<td>Lunch</td>
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<tr>
<td>12:40 pm</td>
<td>Tamara Rozental, MD, Visiting Professor and Moderator</td>
<td>“Fragility Fracture Fighters”</td>
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<tr>
<td>1:40 pm</td>
<td>Jacob Triplett, DO</td>
<td>“Loss of Functional Internal Rotation Following Various Combinations of Bilateral Shoulder Arthroplasty”</td>
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<tr>
<td>1:53 pm</td>
<td>John Erickson, MD</td>
<td>“A Conservative Algorithm for Treating Pediatric Both Bone Forearm Fractures: A Lower Rate of Surgical Fixation and no Increased Risk With Delayed Surgical Treatment”</td>
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<tr>
<td>2:06 pm</td>
<td>Josh Everhart, MD, MPH</td>
<td>“Medical Comorbidities and Perioperative Allogeneic Red Blood Cell Transfusion are Risk Factors for Surgical Site Infection After Shoulder Arthroplasty”</td>
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<tr>
<td>2:19 pm</td>
<td>Ian Barron, DPM</td>
<td>“A Retrospective Analysis of the Intermetatarsal Angle and Hallux Abductus Angle Following First Metatarsophalangeal Joint Arthrodesis”</td>
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<tr>
<td>2:32 pm</td>
<td>Chris Sugalski, MD</td>
<td>“Figure of Eight Bracing for Displaced Midshaft Pediatric Clavicle Fractures”</td>
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<tr>
<td>2:45 pm</td>
<td>Richard Samade, MD</td>
<td>“Outcomes of Operative Versus Non-Operative Treatment of Chronic Seymour Fractures”</td>
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<tr>
<td>2:58 pm</td>
<td>Andrew Shacklett, MD</td>
<td>“Systematic Review: Biceps Tenodesis in Treatment of SLAP Tears in the Overhead Athlete”</td>
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<tr>
<td>3:11 pm</td>
<td>Krystin Hidden, MD</td>
<td>“Reverse Total Shoulder Arthroplasty for Massive, Irreparable Rotator Cuff Tears in the Absence of Glenohumeral Arthritis: A Systematic Review”</td>
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<td>3:30 pm</td>
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<td>End of Day</td>
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INTRODUCTION:
Lateral epicondylitis (LE) or “tennis elbow” refers to subacute or chronic pain at the lateral epicondyle of the humerus due to tendinosis of the extensor tendons and is a common musculoskeletal disorder of the upper extremity. The disability that results from the pain of this condition has direct impact on the functional capacity to work. For example in Washington State, epicondylitis had annual workers’ compensation claims incidence rate of 4.7 per 10,000 full time employees, resulting in an average annual direct cost of more than $12 million.

Various management strategies for LE have been proposed over time, but there is not a generalized consensus on the best treatment modality or algorithm. Surgical intervention is generally reserved for patients who have failed conservative means. There are numerous surgical methods used by orthopaedic surgeons. Unfortunately studies have had differing conclusions on the effectiveness of surgery for epicondylitis. Despite the prevalence of lateral epicondylitis, there is a lack of consensus on best treatment practices for this condition. The purpose of this study was to investigate current management for lateral epicondylitis by fellowship-trained upper extremity surgeons.

METHODS:
A survey consisting of 17 multiple-choice and fill-in-the blank questions was emailed to 3,354 upper extremity surgeons in the United States. Participants were identified from the American Society for Surgery of the Hand (ASSH) and American Shoulder and Elbow Surgeons (ASES) databases. The results were analyzed using pivot tables and multivariate analysis.

DATA AND RESULTS:
612 upper extremity surgeons completed the survey. The 5 most frequently prescribed non-operative treatments for lateral epicondylitis included home exercise program/stretching (81%), NSAIDs (75%), steroid injection (71%), counterforce bracing (68%), formal physical therapy (65%), and wrist brace (48%). Duration of non-operative treatment varies from 3 months (12%), 6 months (47%), and 12 months (39%). 59% of surgeons perform 3 or fewer surgeries per year, 29% perform 4 to 10, and 12% of surgeons will perform more than 10 per year. Before surgery, 42% of surgeons obtain an x-ray, and 33% obtain an MRI. Of the 95% of surgeons who offer surgery as a treatment, 56% perform open debridement with side-to-side repair, 21% perform open debridement with reattachment of the extensor mass to the lateral epicondyle, 16% who openly debride without side-to-side repair, 12% who arthroscopically debride, and only 4% who percutaneously release the extensor origin. Immobilization after surgery was quite variable ranging from long arm splint for 2 weeks (22%), short arm splint for 2 weeks (17%), and the majority who do not immobilize post-operatively at all (34%).

DISCUSSION:
This study provides insight into current trends in treatment of lateral epicondylitis amongst fellowship-trained upper extremity surgeons. There is a lack of consensus in the literature in management of lateral epicondylitis and therefore clear guidelines for treatment do not exist. Future research may include prospective randomized control studies to help clarify best practice for this common diagnosis.
A SURVEY OF FELLOWSHIP-TRAINED UPPER EXTREMITY SURGEONS ON THE TREATMENT OF LATERAL EPICONDYLITIS, CONT'D.

Presenter: Steven Niedermeier, MD

REFERENCES:

ACKNOWLEDGEMENTS:
No funding was used for this project.

DISCLOSURES:
No financial disclosures.
INTRODUCTION:
Patellofemoral instability with recurrent patellar dislocation is a debilitating condition that frequently affects a young, active patient population. Isolated medial patellofemoral ligament (MPFL) reconstruction has emerged as an effective treatment of recurrent patellar dislocations that occur in the absence of significant patellofemoral malalignment or osseous abnormalities. Both allografts and autografts have been successfully used for MPFL reconstruction.

We hypothesize that MPFL reconstruction with allograft or autograft tissue yields similar low rates of recurrent dislocation and subjective patellar instability.

METHODS:
A record search identified 117 patients (80 allograft, 37 autograft) who underwent isolated MPFL reconstruction without concurrent bony procedures performed between 2008 and 2014 by four sports medicine fellowship trained surgeons at our center. Patient demographics (sex, age at time of surgery, and body mass index) and surgical data were identified by chart review.

Following collection of baseline data, patients with minimum of 1 year follow up were contacted by mail and telephone survey. 53 patients (45%) at a mean of 4 years following MPFL reconstruction elected to participate, and patient interviews were undertaken to identify the primary outcome of recurrent patellar dislocations and recurrent subjective patellofemoral instability. Patient reported outcomes data was then obtained in 33 patients, and included Knee injury and Osteoarthritis Outcome Score (KOOS) Pain, KOOS Symptoms, KOOS ADL, KOOS Sport/Rec, KOOS QOL, Marx scores, and Norwich Patellar Instability scores.

Means and standard deviations were calculated for continuous variables. A student’s t-test was utilized to compare recurrent dislocation, subjective instability, and patient reported outcomes between the MPFL allograft and autograft reconstruction groups. Differences with a p value <0.05 were considered to be significant.

DATA AND RESULTS:
37 patients had undergone allograft reconstruction and 16 patients had undergone autograft reconstruction. There were no significant differences in patient sex, age at reconstruction, body mass index, or lateral procedures performed between groups. Recurrent dislocation occurred in 1 patient in the allograft group (2.7%) and in 0 patients in the autograft group (0%) (p = 0.51). Recurrent subjective instability occurred in 10 patients in the allograft group (27.0%) and in 5 patients in the autograft group (31.3%) (p = 0.75).

Patient reported outcome forms were completed by 33 patients at a mean of 34 months following MPFL reconstruction (26 allograft, 7 autograft). KOOS Pain, KOOS Symptom, KOOS ADL, and KOOS QOL scores were significantly higher for the allograft group when compared to the autograft group (p < 0.05). There was no significant difference in KOOS Sport/Rec between the groups. Mean Marx score was not significantly different between groups, while the mean Norwich Patellar Instability score was significantly lower for the allograft group relative to the autograft group (Table 1).

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DISCUSSION:
Surgical management with MPFL reconstruction has been shown to be effective at improving patellar stability in the setting of recurrent instability. The overall rate of patellar redislocation after MPFL reconstruction in this study is low (overall 1.9%) and is similar to previously published rates. The most important finding of this study is that there was no significant difference in redislocation or subjective patellar instability after isolated MPFL reconstruction between allograft and autograft tissue groups.

This study also demonstrated significantly higher scores for multiple patient reported outcomes, including KOOS Pain, KOOS Symptom, KOOS ADL and KOOS QOL scores. This could be due to the autograft harvest, which carries with it comorbidity at the harvest site. Each autograft in this study was either semitendinosus or gracilis tendon, and the harvest of these tendons can result in pain at the harvest site, hamstring weakness, and diminished sensation in the distribution of the infrapatellar branches of the saphenous nerve.

This study demonstrated the effectiveness of isolated MPFL reconstruction with either allograft or autograft tissue for recurrent patellar dislocation in appropriately selected patients.

REFERENCES:

ACKNOWLEDGEMENTS:
This study was funded by an unrestricted grant from the Musculoskeletal Transplant Foundation (MTF).

DISCLOSURES:
Author DCF receives research support and is a paid consultant for MTF.
A PROSPECTIVE EVALUATION OF PREDICTORS OF PAIN AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR: PSYCHOSOCIAL FACTORS HAVE A STRONGER ASSOCIATION THAN STRUCTURAL FACTORS

Authors: Amy L. Ravindra, MD, Grant L. Jones, MD, Jonathan D. Barlow, MD, Julie Y. Bishop, MD
Presenter: Amy Ravindra, MD

INTRODUCTION:
Recent studies have shown that non-structural factors, such as mental health and coping skills, may be more influential than structural factors in predicting pain in patients presenting with shoulder pathology. The relationship between psychosocial factors and post-surgical outcomes following ARCR has not been well-defined.
The goal of this study is to prospectively evaluate which pre-operative factors correlate with post-operative pain following arthroscopic rotator cuff repair (ARCR).
We hypothesized that non-structural factors, including metrics of psychological well-being and pre-operative narcotic use, will correlate with higher pain levels post-operatively, while structural factors such as tear size will not be predictive.

METHODS:
99 patients who were scheduled to undergo ARCR by the senior authors were prospectively enrolled. They were separated by tear size into small (<1 cm), medium (1-3 cm) and large (3-5 cm), with patients evenly distributed in each group. The inclusion criteria were symptomatic, MRI-documented full-thickness or high-grade partial thickness RCT. Massive tears, irreparable tears, and revisions were excluded. Demographic data, tear-specific factors, and measures of pre-operative pain and function were collected. This included: gender, age, occupation, smoking status, tear mechanism (traumatic versus atraumatic), MRI findings (tear size, location, degree of atrophy and retraction), visual analog scale (VAS) pain scores, narcotic usage, range of motion (ROM) by goniometry, and functional and psychological assessments through the ASES, SST, WORC, and SF-36 questionnaires. VAS pain scores (documented in a daily pain journal for 2 weeks) and range of motion was collected during post-operative visits at 2 weeks, 6 weeks, 3 months, 6 months and 1 year. Number of days on narcotics post-operatively was recorded. The ASES, SST, WORC, and SF-36 questionnaires were repeated at the 1 year post-operative visit. Post-operative pain using the VAS scores was the primary outcome assessed.
Pearson or Spearman correlation coefficients between the pre-operative factors and VAS pain scores at each time point were calculated.

DATA AND RESULTS:
The mean age of our patient cohort was 56.4 years, and consisted of 54% males. There were 68% traumatic tears and 11% smokers. 13% of patients reported using narcotics pre-operatively. All repairs were arthroscopic double-row transosseous equivalent. ROM, VAS, and ASES scores all improved significantly from the pre-operative to the 1 year post-operative assessments: 136° versus 164° in forward elevation (p<0.001); 55° versus 64° in external rotation (p=0.005); L3 versus T12 in internal rotation (p<0.001); 4.2 versus 0.7 for VAS (p<0.001); and 42.3 versus 91.9 for ASES (p=0.001). The mean number of days on narcotics was 23.7. 70% of patients took narcotics for less than 1 week, 14% for 1 - 6 weeks, and 16% for 6 weeks - 1 year. The following pre-operative variables correlated with increased post-operative pain (VAS scores) at 1 year: pre-operative narcotic use, higher pre-operative VAS scores, and lower scores on the WORC index, WORC emotion section and SF-36 mental component summary. Pre-operative narcotic use and higher pre-operative VAS scores correlated with increased pain at 6 months post-operative. Neither tear characteristics nor demographic factors were predictive of pain at any point post-operatively.

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DISCUSSION:
In evaluating surgical outcomes after ARCR, our data shows that the factors most predictive of persistent post-operative pain are psychosocial characteristics, including poor performance on validated measures of emotional well-being. As expected, demographic and tear-specific structural factors did not correlate with post-operative pain scores. These findings are consistent with recent literature that has shown a relationship between mental health and the degree of pain associated with shoulder pathology. This information may be useful in the current healthcare climate, where re-imbursement and quality of care assessments are increasingly linked to patient reported outcome measures. Further investigation of this select patient population is warranted to optimize post-surgical outcomes.

REFERENCES:
1. Wylie JD, Suter T, Potter MQ, Granger EK, and Tashjian RZ. J Bone Joint Surg Am, 2016 Jan 16; 97

ACKNOWLEDGEMENTS:
Angela Pedroza
Arielle Smith

DISCLOSURES:
None
ACUTE KIDNEY DISEASE AFTER TOTAL HIP AND KNEE ARTHROPLASTY:
INCIDENCE AND ASSOCIATED FACTORS

Authors: Eric X. Jiang BS, Hrishikesh C. Gogineni MD, Joel L. Mayerson MD, Andrew H. Glassman MD MS, Robert A. Magnussen MD MPH, Thomas J. Scharschmidt MD

Presenter: Rishi Gogineni, MD

INTRODUCTION:
The incidence of acute kidney disease (AKD) after total joint arthroplasty (TJA) and factors associated with an increased risk of this complication have not been well characterized in the literature. We sought to calculate the incidence of postoperative AKD for patients undergoing total hip and knee arthroplasty and to identify risk factors associated with AKD.

METHODS:
1000 consecutive cases (860 unique patients, including revisions) of total knee arthroplasty (TKA) or total hip arthroplasty (THA) between January 2010 and May 2016 were identified. Seventy-nine cases were excluded due to preexisting kidney dysfunction. Of the 921 cases eligible for study inclusion, incomplete data regarding postoperative AKD were present in 23 cases, resulting in 898 cases (97.5%) included in the study. There were 492 females and 406 males with a mean age of 58.1 years (range 14-93). The Risk, Injury, Failure, Loss of kidney function, and End-stage kidney disease (RIFLE) criteria and serum creatinine values were used to determine whether patients suffered from AKD. Multiple logistic regression modeling was utilized to identify risk factors for development of postoperative AKD.

DATA AND RESULTS:
Overall incidence of postoperative AKD was 6.8% (n=61). Use of perioperative ARB or ACEi (p = 0.030), increasing body mass index (p = 0.014), and use of vancomycin perioperatively (p = 0.021) were significantly significant risk factors associated with increased odds of development of post-operative AKD.

DISCUSSION:
The incidence rate of AKD of 6.8%. Pre-operative use of ACEIs or ARBs, perioperative vancomycin use, and increased BMI were associated with increased odds of post-operative AKD.

DISCLOSURES:
No financial disclosures to report for any of the authors.

REFERENCES:
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INTRODUCTION:
Periprosthetic fractures around total knee arthroplasty (TKA) are well documented in the literature. Of these, supracondylar femur fractures are the most common, with periprosthetic tibia fractures occurring much less frequently. These rare fracture pose reconstructive challenges to the treating surgeon as they are often complicated by such factors as poor bone stock, previous soft tissue injury, implant loosening and instability, and pre-existing implant and cement which may impede successful reduction and placement of fixation devices predisposing to malunion or nonunion. As utilization of arthroplasty continues to rise, periprosthetic fractures of the tibia will likely become more prevalent. Currently, there is a paucity of information concerning clinical and radiographic outcomes following open reduction and internal fixation (ORIF) of these complicated fractures. Periprosthetic fracture management is largely based on recommendations (Mayo Classification) made twenty years ago. With newer design technology, the adjuvant use of locking plates in the presence of implant stable periprosthetic tibial fractures (Felix IIA and IIIA) is unknown.

METHODS:
A retrospective review of a prospectively collected database revealed nineteen patients who sustained a periprosthetic fracture of the tibia around a TKA from 2008 to 2014. Four of these patients were lost to follow up before one year, and one patient died in the hospital as a result of the constellation of their injuries; these five were excluded from final analysis, leaving a total of fourteen patients for analysis. Each of the nineteen patients underwent fixation utilizing plate and screw instrumentation according to the injury pattern as well as soft tissue consideration. All fixation constructs included a single plate as well as locking and non-locking screws in a hybrid construct concept; there was no use of cables, allograft, or other fixation adjunct products in this series. All patients were allowed immediate range of motion of all joints of the lower extremity postoperatively, with weight bearing proceeding according to surgeon preference but not beginning earlier than four weeks postoperatively in this series.

Statistical analysis was performed, with means, ranges and confidence intervals calculated for continuous variables and compared using Student’s t-tests. Frequencies were calculated for continuous variables and compared using Fisher’s exact test for increased accuracy in small proportion analysis. A significance level of P<0.05 was set as significant, with a trend defined as a P value being between 0.05 and 0.1.

DATA AND RESULTS:
The average age of the patients was 71.3 years. There were 35.8% male patients, the average ASA was 3.2, and 35.7% were open injuries. All fractures were either Type IIA or IIIA by the Felix Classification System and B1 or C according to the UCS. A stem was present in 50% of the tibial components.

Table 1 presents the surgical and outcome data for the 14 patients within the series. The average surgical time was 111.6 minutes. Average follow-up was 25.1 months. All fractures were plated using locking screw and plate technology with a hybrid combination of locking and non-locking screws. Of the patients that were followed for the entire course of treatment, 11 (78.6%) obtained...
fracture union with the first surgery.

Three patients required additional surgery to achieve fracture union, two that successfully achieved union for a total union rate of 92.9%. There was only one (7.1%) deep infection noted, but three (21.4%) of the patients had wound complications that required supplemental tissue coverage. The average post-operative knee range of motion (ROM) was 1.4 to 108.6 degrees. Pre-operative ROM was unable to be obtained due to the nature of the injuries.

<table>
<thead>
<tr>
<th>Operative Time (minutes)</th>
<th>111.6 ± 30.6 (71-197)</th>
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<tbody>
<tr>
<td>Implants Used</td>
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<tr>
<td>3.5mm Anterolateral Locking Proximal Tibia Plate</td>
<td>4 (28.6%)</td>
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<tr>
<td>4.5mm Anterolateral Locking Proximal Tibia Plate</td>
<td>3 (21.4%)</td>
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<tr>
<td>Medial Locking Distal Tibia Plate</td>
<td>5 (35.7%)</td>
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<tr>
<td>Metaphyseal 3.5/4.5mm Plate</td>
<td>2 (14.3%)</td>
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<tr>
<td>Length of Follow Up (months)</td>
<td>25.1 ± 18.4 (4.7-56.0)</td>
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<tr>
<td>Fracture Union</td>
<td>11 (78.6%)</td>
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<tr>
<td>Time to Union (months)</td>
<td>8.4 ± 3.4 (4-13)</td>
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<tr>
<td>Complications</td>
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<tr>
<td>Wound Issues Requiring Coverage</td>
<td>3 (21.4%)</td>
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<tr>
<td>Nonunion</td>
<td>2 (14.3%)</td>
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<tr>
<td>Malunion</td>
<td>1 (7.1%)</td>
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<tr>
<td>Deep Infection</td>
<td>1 (7.1%)</td>
</tr>
<tr>
<td>DVT/PE</td>
<td>0</td>
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<tr>
<td>Postoperative Knee Range of Motion (degrees flexion-extension)</td>
<td>1.4 – 108.6</td>
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</tbody>
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DISCUSSION:
Treatment of periprosthetic (TKA) tibial fractures carries a relatively high risk of complications and nonunion after primary stabilization, and patients should be counseled accordingly.

REFERENCES:

DISCLOSURES:
BCT is a consultant for, receives royalties from, and is on the speakers' bureau of ZimmerBiomet, is on the editorial staff of Orthobullets.com, and is on the speakers' bureau for Depuy Synthes
INTRODUCTION:
Surgical site infections (SSIs) are frequent, costly, and dangerous. Excessive door openings are thought to contribute. SSIs at OSU have steadily increased since 2014. A pilot study at OSU, noted room traffic rates in orthopaedic cases to be nearly double than rates reported in the literature at other institutions.

The purpose of this study is to determine the effectiveness of strategic interventions to reduce OR traffic in orthopaedic surgery cases. Our hypothesis was that intervention strategies significantly reduce OR traffic in implant cases. There were 2 observation phases, pre-intervention and post-intervention. This year’s presentation serves as an update on the post-intervention phase of our study.

METHODS:
The focus of the intervention study was to increase awareness about room traffic and provide guidance in techniques that could reduce room traffic in the OR. After the initial observation (pre-intervention) phase, a multidisciplinary team developed intervention strategies that were approved by the hospital system patient and quality safety department. In the second phase prospective, observational data collection was performed over the same 3-month time period (a year later) and compared to pre-intervention operating room traffic. A total of 35 cases were observed in the pre-intervention group, while 42 cases were observed in the post-intervention group. Standardized data collection forms were used. Intra-class correlation coefficients were used to assess inter-rater reliability and assure agreement in room-traffic ratings prior to proceeding with the study.

Statistical and data analyses were performed using Microsoft Excel and STATA 14.0 (StataCorp, College Station, TX). Unpaired, two sample Student’s t-tests were used to compare pre- and post-intervention groups. An alpha of 0.05 (α= 0.05) was considered to be statistically significant. Assuming 80% power and an alpha of 0.05, a power analysis indicated we needed at least 35 cases per group to detect a 10% difference in room traffic rate.

DATA AND RESULTS:
Mean number of door openings per case and mean rate of door openings decreased significantly with our intervention. Door openings per minute decreased by 22% (p = 0.0011). No significant reduction in room traffic was noted among trauma cases (p = 0.8453). However, a 36.9% reduction in the room traffic rate per minute was noted among arthroplasty cases (p < 0.0001). Each surgical team member group (nursing, scrub technologist, surgical, vendor, and radiology) excluding anesthesia had significant reductions in OR traffic following the intervention.
OPERATING ROOM TRAFFIC: AFFECTING THE PULSE OF THE OR, CONTD.

Presenter: Jared L. Harwood, MD

DISCUSSION:
Our success depended on the teamwork and buy-in of all staff. Designated OR “Champions” consisting of nurses and vendors who took ownership of the initiative provided significant influence on overall room traffic.

Strategic behavioral interventions that focus on education and awareness can create impactful behavior changes in the OR environment to decrease door openings. The most impactful change for this study was likely a focus on pre-case planning. Many door openings were attributed to a need for supplies or information; surgical teams worked to anticipate these needs to minimize door openings. This study has shown that education and increased awareness can significantly OR traffic for orthopaedic cases. Reduction in OR traffic may help to eliminate distractions in the OR and reduce air contamination, which in turn may reduce SSIs and sentinel events leading to better patient outcomes.

REFERENCES:

ACKNOWLEDGEMENTS:
The authors would like to thank Dr. Maurice Manring for his assistance in the preparation and submission of related manuscripts as well as support from the Patient and Quality Safety Department as and OR staff that worked hard to help improve OR traffic.

DISCLOSURES:
No financial conflicts exist with any other authors.
INTRODUCTION:
The shoulder is the most commonly dislocated major joint in the body and is often associated with acute soft tissue and bony injuries with the potential for the development of chronic instability without appropriate treatment. The treatment of chronic anterior shoulder instability poses a reconstructive challenge to orthopedic surgeons. Multiple stabilization procedures have been developed. However, the outcomes of these treatment modalities are variable in the chronic setting and may pose significant morbidity. The ideal stabilization procedure not only prevents anterior dislocation of the humeral head relative to the glenoid but also maximizes shoulder function while minimizing the morbidity to the patient. With growing interest in soft tissue reconstruction using a dermal allograft and the early results supporting its efficacy in the treatment of massive irreparable rotator cuff pathology, its role in anterior shoulder instability is of interest. Here we present a case of its application and discuss the surgical technique employed.

METHODS:
A 42-year-old male with a history of a traumatic anterior shoulder dislocation developed chronic anterior shoulder instability after he failed multiple surgical stabilization procedures. He initially underwent an arthroscopic soft tissue stabilization procedure, which was later followed by an open stabilization procedure with bony augmentation by transfer of the coracoid to the glenoid. Both procedures failed to provide stability and he suffered from recurrent dislocations along with signs of anterior shoulder instability with a positive apprehension-relocation test as well as weakness in forward elevation and abduction with guarding due to pain. He underwent anterior capsular reconstruction with a dermal allograft in order to provide anterior stability and to reconstruct the damaged and incompetent anterior soft tissues. A standard deltopectoral approach was used and the lesser tuberosity and anterior aspect of the glenoid were exposed. A bur was used to decorticate the anterior glenoid rim and lesser tuberosity. Suture anchors were placed into the anterior margin of the glenoid, and the sutures were then passed through the medial aspect of the graft. The sutures were then passed through another anchor, which was placed medially thus, securing the graft onto the glenoid. The shoulder was then carefully examined for the most stable position of internal and external rotation, taking care to avoid over tensioning in internal rotation, which would place significant strain on the graft and risk failure. Two suture anchors were then placed into the lesser tuberosity along the articular margin. With the arm in the predetermined position of stability, the sutures were passed through the lateral aspect of the graft. A double row fixation technique was utilized to secure the graft to the lesser tuberosity. The shoulder was found to remain stable intraoperatively and the wound was then closed. Post-operatively the patient was maintained in a sling and swathe, kept non-weight bearing, and was slowly progressed to passive range of motion exercises with restrictions in external rotation to not exceed neutral.

DATA AND RESULTS:
At 6 months postoperatively, the patient’s shoulder remained stable with no recurrent instances of anterior subluxation or dislocation. Subjectively the patient no longer felt unstable and clinically had negative apprehension testing. Furthermore, the patient had regained near full range of motion with forward elevation to 160 degrees, abduction to 160 degrees, and external rotation to 30 degrees.
**DISCUSSION:**
Use of a dermal allograft for ACR has not been previously reported in the literature. Here, we discuss early postoperative findings of its application in a patient with chronic anterior shoulder instability who has failed previous surgeries. Early results show promise of its application as an alternative treatment modality in this cohort. The technique described in this report serves as a platform of its application. Longer term follow up is needed to validate its use.

**DISCLOSURES:**
Dr. Long is a paid consultant for Arthrex
Purpose:
While humeral diaphyseal fractures managed operatively often heal without complication, little is known about time to union rates and underlying factors which may play a role in influencing these outcomes. Much data exists concerning plate versus intramedullary fixation, less is known about union results based upon patient characteristics, fracture characteristics, and surgical technique. The purpose of our study was to evaluate time to union in diaphyseal humerus fractures after plate fixation, and identify any factor which may contribute to increased time to union, nonunion, or other complication.

Methods:
A retrospective review at our institution was performed on all patients >18 years undergoing operative fixation of diaphyseal humerus fractures (AO/OTA Classification – 12-A1 to 12-C3; CPT code 24515) from 2006 to 2016. Exclusion criteria included incomplete records/radiographs, pathologic fracture, revision surgery, and/or concurrent surgery – i.e undergoing simultaneous arthroplasty). Data was collected on basic demographics, fracture characteristics, and surgical approach and technique. Serial radiographs were then examined to assess for union.

Results:
Complete data was available for 135 patients with mean age of 40.67 and BMI of 29.77. Mean time to union was 18.99 weeks with overall complication rate of 8.9% (8 nonunions (5.95%), 1 malunion, 1 hardware failure, and 2 infections). There was no correlation between age or BMI and time to union. There was a trend towards open fractures requiring longer time to union than closed (24.35 weeks vs 18.16; p=0.072). There was no difference in time to union in regards to gender, smoking, proximal/middle/distal third humeral shaft fracture location, anterior vs posterior surgical approach, or bridge vs rigid plating technique. In regards to nonunion, open fracture did have a higher rate of occurrence than closed (22.4% vs 3.4%; p=0.011). There was also a trend towards males having a higher nonunion rate (10.1% vs 1.5%; p=0.063).

Conclusion:
Overall, time to union of 19 weeks following plate osteosynthesis of humeral diaphyseal fractures was similar to prior reported literature results, but is notably longer than when compared to other fractures undergoing fixation. Our data is the first to suggest that only open fracture results in both increased time to union and nonunion following plate fixation. Age, BMI, gender, smoking, fracture classification, surgical approach, and surgical technique did not have an impact. In addition, there was a trend toward a higher nonunion rate in males. This data can be used to better counsel patients towards realistic post-operative expectations and expected length of healing time and recovering. Future study could potentially examine whether the addition of grafting or biologic substitutes can improve outcomes for healing operative humeral diaphyseal fractures.
INTRODUCTION:
Beginning January 2017, Medicare requires the application of appropriate use criteria for ordering advanced imaging. Although some previous research has examined factors which influence the ordering of advanced imaging, little has focused on orthopedic clinical decision making and none has addressed communications between radiologists and referring physicians. This study investigated the hypothesis that some advanced musculoskeletal imaging is obtained primarily because of comments in the interpreting radiologists’ reports of plain x-rays, i.e., that such comments influence clinicians to order imaging studies that they might not otherwise order. The primary focus of this study was to answer the following question: Do comments in the interpreting radiologists’ reports on plain radiographs of the hip, knee and ankle result in an increased proportion of subsequent advanced imaging studies (computerized axial imaging and magnetic resonance imaging)? Secondly, we attempted to determine the additional facility charges based on our findings. A finding of increased likelihood of advanced imaging after radiologist commentary would support future investigation of any effect on patient outcomes.

METHODS:
Sequential radiologist-created reports from the MCHS Picture Archiving and Communication System (PACS) of the hip, knee, and ankle were reviewed. The search involved looking at all x-ray reports from the specified joints and recording all reports that included a recommendation for subsequent advanced imaging. A power analysis determined that 340 charts per group (with recommendation, without recommendation) would be needed to determine a 15% difference between the two groups with a type 1 error of 5% and type 2 error of 20%.

This analysis involved 340 patients with a joint X-ray reports where the interpreting radiologist commented about advanced imaging: 101 (29.7%) hip, 184 (54.1%) knee, and 55 (16.2%) ankle joints, and another 340 patients where the radiologist made no comments regarding advanced imaging (same distribution of hip, knee, and ankle joints)

The data were analyzed using logistic regression to determine if there was a difference in the number of advanced imaging studies subsequently obtained between the groups and, if so, was the difference statistically significant. We further sought to analyze the financial impact of any differences. A general "total expense due to additional imaging among patients with negative hip, knee or ankle X-rays" could be estimated if the following information was known: among all Mount Carmel patients who have a negative hip, knee or ankle X-ray: 1) what proportion represents hips, knees and ankles; and 2) what proportion within each group receive a recommendation from the radiologist to undergo advanced imaging.

DATA AND RESULTS:
The disparity in the rates of advanced imaging according to whether the radiologist recommended it was largest for patients with hip X-rays with an odds ratio of 16.4 (p<0.0001; 95% confidence interval: 4.8 – 86.7). Knee x-rays showed an odds ratio of 5.5 (p<0.0001; 95% confidence interval: 2.3 – 15.2) and ankles of 8.1 (p=0.0041, 95% confidence interval: 1.7 – 77.5). Our financial analysis showed on a per x-ray basis a 151% increase for hip x-rays, 87% increase for knee x-rays,
and a 114% increase in ankle x-rays when the interpreting radiologist mentions advanced imaging in his/her report. When using the prevalence of a low occurrence diagnosis such as an occult hip fracture, we found the recommendation of the radiologist to have a high negative predictive value of 98.4%, but a very poor positive predictive value of 13.5%.

**DISCUSSION:**
Our study shows that a recommendation to obtain advanced imaging in a radiologist’s report results in an increased incidence of subsequently obtaining CT or MRI in the absence of other identifiable predisposing factors. This was statistically significant for hips, knees, and ankles, but was most pronounced in radiologist’s reports of the hip, which shows a 16.4 fold higher incidence of advanced imaging obtained after plain films and has a significant financial impact on the healthcare system. When the radiologist’s report is viewed as an independent test, our data found a very high negative predictive value of 98.4%, but a very low positive predictive value of 13.5%. If a physician is relying exclusively on the read of the radiologist to further guide treatment, ordering an additional imaging study to scan for pathology has low diagnostic yield, but is effective in determining the absence of a specific entity such as an occult hip fracture.

**REFERENCES:**

**DISCLOSURES:**
NONE
WHEN IS HEMIARTHROPLASTY PREFERABLE TO INTRAMEDULLARY PROPHYLACTIC FIXATION OF METASTATIC DISEASE OF THE PROXIMAL FEMUR?

Authors: James Lin, BS, Juan Santiago-Torres, MD, Joshua Everhart, MD, MPH, Nichole Zayan, BS, Joel Mayerson, MD, Thomas Scharschmidt, MD

Presenter: Joshua Everhart, MD, MPH

INTRODUCTION:
Metastatic lesions to the hip can result in impending or complete pathologic fractures, causing significant morbidity and mortality for cancer patients. This could be managed operatively by procedures such as intramedullary (IM) nail fixation and hemiarthroplasty. The relevant existing literature is limited to a handful of studies that either provide no direct statistical comparison between the two procedures, or report no long-term postoperative outcomes. The purposes of this study are to determine if there are differences among patients treated with prophylactic fixation of metastatic hip lesions with IM nail versus hip hemiarthroplasty with regard to: 1) length of survival after surgery 2) treatment failure (defined as progression to pathologic fracture, failure of fixation, or return to the operating room), 3) pain relief, or 4) ability to ambulate without gait aids after surgery.

METHODS:
A retrospective review was performed on 89 patients who had undergone hemiarthroplasty (n = 23) or IM nail fixation (n = 66) for prophylactic treatment of an impending pathologic fracture due to malignant lesions of the hip between 2010 and 2014 at a single quaternary care hospital. Cox proportional hazards and logistic regression modeling were performed to determine risk of death, fixation failure, pain relief, and return to ambulation without gait aids after adjusting for cancer diagnosis and medical comorbidities.

DATA AND RESULTS:
Median survival time after surgery was 14.4 months (interquartile range 4.4 – 39 months) with no difference in survival between hemiarthroplasty and IM nail (HR 1.49 CI 0.77, 2.51; p = 0.28). Hemiarthroplasty was associated with a lower risk of pathologic fracture, fixation failure, or reoperation (HR 0.03, CI 0.002, 0.59; p = 0.02). Risk factors for treatment failure were local radiation (HR 16.2, CI 1.00, 263; p = 0.05) and increased BMI (HR 1.39 per 1 point increase, CI 1.11, 1.76; p = 0.005). There was a trend toward improved rates of pain relief with hemiarthroplasty (OR 13.6, CI 0.63, 295; p = 0.10). Hemiarthroplasty did not increase odds of unassisted ambulation after surgery compared to IM nail fixation (OR 1.75, CI 0.46, 6.73; p = 0.41). The strongest predictor of postoperative ambulation was preoperative ambulation without gait aids (HR 27.2, CI 6.67, 111; p < 0.001), while higher BMI decreased likelihood of postoperative ambulation (HR 0.84 per 1 point increase, CI 0.76, 0.95; p = 0.005).
**When is Hemiarthroplasty Preferable to Intramedullary Prophylactic Fixation of Metastatic Disease of the Proximal Femur?, Contd.**

Presenter: Joshua Everhart, MD, MPH

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**Figure 1.** Kaplan-Meier survival plot of patients treated with hemiarthroplasty or IM nail. There was no difference in survival between groups (p=0.33)

<table>
<thead>
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<th>Hazard Ratio (95% CI)</th>
<th>P-value</th>
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<td>Treatment (hemi)</td>
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<tr>
<td>Treatment (IM nail)</td>
<td>1.0 (referent)</td>
</tr>
<tr>
<td>Local radiation (pre or post-surgery)</td>
<td>16.2 (1.00, 263)</td>
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<tr>
<td>BMI (per point)</td>
<td>1.39 (1.11, 1.76)</td>
</tr>
<tr>
<td>Myeloma lesion</td>
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</tbody>
</table>

**Table 1.** Cox proportional hazards for treatment failure (progression to fracture, failure of fixation, or need for reoperation after prophylactic fixation)

**Discussion:**
There is no difference in survival and no difference in likelihood of being ambulatory without gait aids after prophylactic femoral fixation with IM nails versus hemiarthroplasty in patients with metastatic disease of the proximal femur. However, hemiarthroplasty may offer benefits of lower treatment failure and better odds of pain relief in those who present with inability to bear weight due to pain. Therefore, we recommend considering hemiarthroplasty in patients with life expectancy longer than 1 year suffering from impending fractures of the femoral head or neck.

**Selected References:**

**Acknowledgements/Disclosures:**
No relevant disclosures/acknowledgements
A CADAVERIC ANALYSIS OF PROXIMAL HUMERUS LOCKING PLATE FIT: CONTOUR MISMATCH MAY LEAD TO MALREDUCTION

Authors: Amy L Ravindra MD, Austin Roebke BS, Kanu Goyal MD
Presenter: Amy Ravindra, MD

INTRODUCTION:
Mismatch between a proximal humerus locking plate and the contour of the bone may have consequences for attaining and maintaining proximal humerus fracture reduction. The purpose of this study was to quantify the proximal humerus locking plate-bone mismatch utilizing a large sample of human cadaveric humeri. Our secondary goal is to determine if any morphologic or demographic factors are associated with contour mismatch.

METHODS:
97 cadaveric human humeri, evenly distributed by gender, race, age, and laterality were selected from the Hamann-Todd human osteological collection at the Cleveland Museum of Natural History. Humerus length, head diameter, and neck-shaft angle were measured. 3-hole and 5-hole 3.5 mm proximal humerus locking compression plates (Synthes, West Chester, PA) were affixed to the specimen with clay strips. If the plate was under-contoured and made contact with bone proximally and distally but not in the middle, the plate fit was described as “spanning”. A digital caliper was used to measure the maximum gap distance from the plate to the bone (figure 1). In the instance of a spanning fit, this was at the level of the proximal-most shaft screw hole. ANOVA and student’s t-tests were conducted to evaluate for differences in plate-bone distance between the two plate lengths, gender, race, age, and laterality. Correlation between plate-bone distance and humerus length, head diameter, and neck-shaft angle were determined using a simple linear regression.

DATA AND RESULTS:
The plate fit onto all 97 specimens (for both the 3-hole and 5-hole plates) were spanning. The mean plate-bone distance for the 3-hole plate was 1.5 ± 0.6 mm (range 0.3 to 2.9mm), and for the 5-hole plate was 2.5 ± 0.9 mm (range 0.7 to 5.0 mm) (p=0.01). Female and right-sided humeri were shown to have significantly larger plate-bone gap distance when compared to their counterparts (p=0.01). Age and race had no effect on plate-bone gap distance.

Mean humeral length, humeral head diameter, and neck-shaft angle were 318.6 ± 21.9 and 42.1 ± 3.6 mm, and 132.8 ± 4.1 degrees, respectively. No correlation was found between plate-bone gap distance and humeral length (R²=0.03), head diameter (R²=0.05), or neck-shaft angle (R²=0.08).

Continued on Next Page
DISCUSSION:
This cadaveric study demonstrates that a contour mismatch exists between proximal humerus locking plates and the bone, which is associated with a longer plate, female gender, and right side. The proximal humerus locking plate was under-contoured and spanned all 97 specimens. Intra-operatively, applying an undercontoured plate flush to bone may lead to medial displacement of the humeral head at the calcar increasing the risk of loss of fracture fixation (figure 1). In fractures with any metaphyseal comminution, the malreduction will be more pronounced. Non-anatomic reduction, particularly at the medial calcar, is associated with inferior clinical outcomes in the literature. Therefore, caution should be exercised when using the proximal humerus locking plate as a reduction aide. To avoid malreduction, alternative reduction techniques (figure 3) should be considered.

REFERENCES:

ACKNOWLEDGEMENTS:
Hamann-Todd human osteological collection at the Cleveland Museum of Natural History

DISCLOSURES:
None
INTRODUCTION:
Madelung’s deformity is an uncommon congenital condition of the wrist characterized by partial to complete physeal arrest of the volar ulnar distal radius that results in a characteristic deformity that can lead to pain and limited range of motion. The etiology is unclear however it has become increasingly accepted that an abnormally thick fibrous radiolunate ligament (Vicker’s ligament) acts as a tether across the volar ulnar radial physis. The purpose of this study was to evaluate the surgical outcomes in a series of Madelung wrists treated with a Vicker’s ligament resection. We hypothesize that early treatment of Madelung’s disease with Vicker’s ligament release minimizes progression of deformity and may prevent the need for future surgeries.

METHODS:
A retrospective review was performed at a single large pediatric institution from 2013 to 2016 for patients with a diagnosis of Madelung’s disease treated with Vicker’s ligament release. The inclusion criteria included skeletally immature patients with Madelung’s disease who underwent Vicker’s ligament release by one of two fellowship-trained hand surgeons. Exclusion criteria included patients who were skeletally mature, underwent osteotomy procedures, or had incomplete follow-up. Patient demographics were collected, concomitant surgeries were recorded, and outcomes including range of motion (ROM) and pain were documented. Standard anterior-posterior and lateral radiographs were studied pre- and post-operatively to monitor radiographic deformity and progression.

DATA AND RESULTS:
Retrospective review identified six female patients with bilateral Madelung’s deformity who underwent bilateral Vicker’s ligament resection (12 total wrists). The average age of presentation was 7.5 years, with an average follow-up of 16.3 months. Reasons for presentation included sports injuries (2), ulnar-sided wrist pain (2), and mild deformity (2). Radial physiolysis was performed in 10 wrists, radial epiphysiodesis was performed in two wrists, and ulnar epiphysiodesis was performed in two wrists. There were no intraoperative complications. Pain resolved within the first one month after surgery for all patients, and all patients returned to their pre-surgery activities. There was no loss of ROM, and four wrists with pre-operative supination deficits improved by an average of 17 degrees. Radiographic measurements were used to objectively monitor the deformity following surgery. No radiographic improvement was seen in 20% of the wrists, while an improvement was demonstrated in 80% of the wrists. No patients displayed progression of the deformity.
TREATMENT OF MADELING’S DISEASE WITH VICKER’S LIGAMENT RELEASE: A CASE SERIES, CONTD.

Presenter: Jeffrey Otte, MD

Figure 1. 9 year old female presented pre-operatively (left) with mild deformity and pain. She demonstrated significant improvement in phyeal angle at 9 months post-operatively (right) in the absence of pain.

DISCUSSION:
Similar to results seen in Vickers original series, our experience with resection of the Vicker’s ligament and radial physiolysis has seen promising results. In our series, all of our patients were skeletally immature at the time of surgical intervention and all presented with bilateral deformity. All patients were female and only one had a family history of Madelung’s disease. After Vicker’s ligament resection and physiolysis, we saw an improvement in pain within the first month in all patients and all patients returned to their pre-surgery activities. Range of motion improved or was maintained in all wrists. We saw an improvement in deformity in a vast majority of patients without progression of deformity in any wrists. Overall, our results are similar to those of previous data.

In this small case series of skeletally immature patients with known Madelung’s deformity, Vicker’s ligament excision may improve pain, improve range of motion, and halt the progression of radiographic deformity. This technique may lead to future research in preventing future surgeries for patients with Madelung’s deformity at an early stage.

REFERENCES:

DISCLOSURES:
The authors have no disclosures.
Adult hypophosphatasia (HPP) is a mild form of a rare, inherited metabolic disease caused by a heterozygous mutation in the alkaline phosphatase (ALP) gene. This mutation causes a decrease in the level and activity of the ALP enzyme and is estimated to be approximately 47 times more common than the homozygous presentation. Decreased ALP production subsequently causes a decrease in the hydrolysis of inorganic pyrophosphate (PPi) into Pi, which is needed for hydroxyapatite formation and this PPi accumulation inhibits bone formation. Adult HPP prevalence is estimated to be 1/6370. Adult HPP can present with complaints of fractures, chronic muscle and bone pain, multiple or difficult to heal metatarsal stress fractures. The current research body does not have objective data for prevalence of adult HPP in patients presenting with metatarsal stress fractures. The purpose of this study was to determine first the possible prevalence of adult HPP presenting with metatarsal fractures or metatarsal stress fractures and if adequate possible adult HPP patients were encountered to support a prospective evaluation of the same with proper diagnostic workup. It is noted in other studies that adults with a persistently low ALP level had up to a 50% prevalence of having an ALP mutation.

This preliminary study was designed as a retrospective review of de-identified data obtained from the OSUMC information warehouse honest broker process for patients (18 years and older) who presented to the OSUMC podiatry department using ICD-9 and ICD-10CM codes for metatarsal stress fracture and metatarsal fracture as well as a recorded ALP level. Patients over a five year period were requested. This data was reviewed to determine how many people with a diagnosis of metatarsal stress fracture also had a low ALP level to estimate how many may have adult HPP.

The data set was evaluated with Microsoft Excel which revealed 7 of the 861 patients had an abnormally low ALP level. This amounts to 0.81% of the included patients meeting the initial, limited criteria for evaluation of adult HPP. Given the reported general population estimated prevalence of 1/6370, our population was found to be 50.8 times higher when focusing on these diagnoses.

While many patients may have identifiable causes for metatarsal fracture or stress fracture, these injuries are nonetheless abnormal in otherwise healthy patients. Our limited data reveals a 50.8-fold increase of possible adult HPP patients based on ALP level alone (0.81% compared to 0.02%) compared to estimated general population prevalence. While our dataset is not enough to diagnose adult HPP on ALP levels alone, this pilot is helpful to estimate of how many patients could have a heterozygous ALP mutation and supports our further study and workup of these suspected adult HPP patients as we have undertaken.
REFERENCES:

ACKNOWLEDGEMENTS:
We appreciate the help of Steven Cotten, PhD in clinical lab medicine and Dawn Allain, MS, CGC in the clinical genetics department.

DISCLOSURES:
None
Narcotic Use and Wastage After Hand and Upper Extremity Surgery

Authors: Marissa Jamieson MD, Joshua Everhart MD, Kanu Goyal MD
Presenter: Marissa Jamieson, MD

INTRODUCTION:
Narcotic abuse and dependence has become an epidemic in the United States. Many people who abuse narcotics had their first exposure to these drugs with prescription medication. Narcotics are commonly prescribed after outpatient hand and upper extremity surgery, but oftentimes the patients’ need for opioids may be significantly less than what is prescribed. The goal of this study is to gain insight into how many narcotic pills are going unused after outpatient hand and upper extremity surgery and offer evidence to support a change in prescribing patterns for certain post-operative patients. We hypothesize that a significant amount of narcotic medication is going unused.

METHODS:
All patients undergoing surgery at a single outpatient hand and upper extremity center over a 5 month period were prospectively recruited to the study. One of five different surgeons performed all procedures. On their first post-operative visit, all patients were given a questionnaire that asked about number of pills used, need to obtain more medications, side effects, and pain control. Demographic data and details about surgery were obtained through chart review. Multivariate regression models were used to determine the association between the baseline data and the outcomes of interest, specifically: 1) self-rated pain control <7/10 (10 = no pain), 2) number of narcotic pills used, 3) number of narcotic pills unused, 4) unplanned ER visit, clinic call for pain refill, or visit to another provider.

Patient Questionnaire

How many narcotic pills have you used thus far?
How many narcotic pills do you have remaining in your bottle?
Did you have to call our office to obtain more narcotic pain medicine?
Did you have to go an urgent care or emergency department for pain control?
Did any other physician prescribe pain medication, narcotic or non-narcotic?
Did you take any non-narcotic pain pills after your surgery?
How satisfied were you with your postoperative pain control (0 being not controlled at all and 10 being completely controlled)?
Did you have any side effects from the narcotic medicine (nausea, itching, etc.)?
Where are your remaining narcotic pills? Is that where you plan on keeping them?
Did you use narcotic pain medication prior to your surgery?

DATA AND RESULTS:
Completed questionnaires were collected on 305 patients on a median of 13 days post-operatively. The average age of patients was 48.7 years and the most common procedure performed was carpal tunnel release.

Continued on Next Page
Patients were prescribed an average of 33 narcotic pills after their surgical procedure but reported using a median of only 14 pills. A total of 4,276 pills went unused, accounting for 44% of all prescribed narcotics. 203 patients reported having unused pills and 77% of these patients kept the pills and did not discard them. 65 patients (21%) obtained additional narcotics outside of the original prescription.

Higher narcotic use after surgery was associated with lower age, baseline narcotic use, a procedure involving bone, tendon, or ligament work (as opposed to soft tissue alone), use of a regional block, unemployment, and longer surgical time. Patients who sought out extra narcotics had a statistically significant association with Medicaid status, unemployment, baseline narcotic use, and OR time greater than 55 minutes. Independent risk factors for poor patient rated pain control (<7/10) included unemployment, a history of psychiatric or mood disorder, and OR time greater than 55 minutes; whereas bone-related procedures and retirement were associated with better pain control.

**DISCUSSION:**
A large number of narcotic pills are going unused after outpatient hand and upper extremity surgery and the majority of these unused narcotics are not being returned to the pharmacy or to the provider. With the growing opioid epidemic, it is important for physicians to be cognizant of their potential contribution to this problem. While narcotics are very effective for acute pain, the risk of abuse/dependence increases after just a few days of use. With the data from this study, we have created and implemented a new standardized perioperative pain regimen that involves improved patient education, patient-specific and individualized pain plans, and a multi-modal approach. The next phase of our study will involve using a predictive model to prescribe narcotics with a goal of decreasing use and wastage and improving pain control.

**REFERENCES:**

**DISCLOSURES:** None.
INTRODUCTION:
Adhesive capsulitis following vaccination is a condition involving loss of glenohumeral range of motion after the administration of an ipsilateral vaccine. Thought to stem from improper injection technique into the upper third of the deltoid, it has been classified by the US government as a Shoulder Injury Related to Vaccine Administration (SIRVA), but it has not been well described in orthopaedic literature. We performed a retrospective chart review to identify the basic characteristics of patients with this condition and present a case series of 11 such cases.

METHODS:
After obtaining IRB approval from the sponsoring institution, retrospective chart review was conducted using ICD codes to identify all patients in the last 10 years who were seen in the office of the two senior authors for adhesive capsulitis. Once these 835 patients were identified, we applied inclusion and exclusion criteria leaving 11 cases to be included for study. Inclusion criteria were: patients between the ages of 18-89 diagnosed with adhesive capsulitis, symptoms started within 1 month of receiving an intramuscular vaccine injection in the affected shoulder. Exclusion criteria were: patients below the age of 18 or greater than 89, those who were experiencing shoulder symptoms prior to receiving the vaccine, those who have had previous injury, surgery, or dysfunction in the shoulder diagnosed with adhesive capsulitis, and prisoners. Demographic and treatment data were collected and analyzed.

DATA AND RESULTS:
Of the 11 patients, 10 were female. Ten were right-hand dominant, and eight of the patients had their non-dominant shoulder affected. Eight of the patients were between the ages of 49 and 64, and the mean age was 51. Ten of the patients developed pain in the shoulder immediately following or within one day of administration of the vaccine. Duration of symptoms prior to presentation averaged 125 days, and ranged from 2 weeks to 12 months. Seven of the patients presented following influenza vaccination, and four of the patients presented in the month of November. Ten of the patients were given a referral to physical therapy, which was effective 60% of the time. Four patients received steroid injections, which had 75% efficacy, and two went on to have surgery, which improved symptoms in both cases. One of those was discovered to have septic arthritis which was thought to be secondary to the injection. Patients came to the office for an average of 3.9 visits each.

<table>
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Table 1: Patient data for 11 cases of adhesive capsulitis
ADHESIVE CAPSULITIS FOLLOWING INFLUENZA VACCINATION: CASE SERIES AND REVIEW OF THE LITERATURE, CONT'D.

Presenter: Yoseph Rosenbaum, MD

DISCUSSION:
Adhesive capsulitis can develop following vaccine injection. Patients often present in the late fall or winter months, perhaps following “flu blitzes” or other required vaccination events related to their employment. Patients often relate that the inciting injection was delivered “higher than normal” or “too high” in the deltoid muscle, reflecting improper technique. Patients can have symptoms that continue for months, necessitating multiple follow-up visits, physical therapy, injections, or even surgery. Public awareness of this condition is increasing, and there can be severe economic implications involved; the Office of Special Masters of the US Court of Federal Claims, which has been designated to handle such claims, has settled at least 112 of these injury claims since 2011, with plaintiffs receiving as much as $1 million in compensation per case. We aim to increase awareness of this condition among orthopaedic surgeons.

REFERENCES:

ACKNOWLEDGEMENTS:
No sources of external funding were used in this study.

DISCLOSURES:
We have no disclosures to report.
Introduction:
Despite evidence favoring limb salvage over amputation\(^1\), amputation remains a cornerstone in the management of extremity malignancy, accounting for 18,000 amputations annually\(^2\). Oncologic indications include neurovascular involvement, local recurrence, unplanned excision, palliation and projected poor residual limb function\(^3\). Extremity amputation is frequently debilitating physically and mentally\(^2\). Residual limb pain is an important contributor to an amputee’s motivation and ability to utilize a prosthesis. Approximately 25% of major limb amputees develop chronic localized pain due to symptomatic neuromas\(^4\). Forming at the end of severed or damaged nerves, neuromas consist of disorganized nerve fibers intertwined with scar tissue due to uncoordinated regeneration. They can cause difficult to treat focal pain that is aggravated with prosthetic use, thus reducing an amputee’s functional abilities and quality of life.

In addition, amputees often also experience phantom limb pain (PLP) and phantom limb sensation (PLS) within their residual limb(s). PLP describes painful sensations referred to the absent limb that are attributed to a nerve injury and subsequent chemical, physiologic and morphologic changes\(^5\). The precise etiology of PLP and PLS is unknown, but it is surmised that both spontaneous and abnormal peripheral nerve signals and central remodeling including cortical reorganization and gray matter changes play a role\(^6,7\).

Despite advancements in prosthetic design, neuromas and PLP often impede prosthetic tolerance. The prevalence of symptomatic neuroma and phantom limb pain (NPLP) in amputees postoperatively are 9-67% and 2-25%, respectively\(^8\). Similarly in the oncologic population, amputation is associated with high rates of phantom limb pain (37-87%) and poor prosthetic use (20-32%)\(^3,9,10\).

Current treatment regimens for NPLP provided inconsistent results. A novel strategy to address NPLP in amputees is targeted muscle reinnervation (TMR). Via nerve transfer of residual peripheral nerves to otherwise redundant target muscle motor nerves, TMR may prevent symptomatic neuromas, phantom limb pain and allow for enhanced bioprosthetic function via muscle reinnervation\(^11,12\). The central principle underlying the nerve transfers in TMR surgery is to reestablish some of the functions of the amputated nerve through the reinnervation of redundant residual muscle units with the severed peripheral nerve from the amputation surgery.

This study seeks to determine the success of TMR in preventing symptomatic neuroma formation and phantom limb pain (NPLP) as well as rates of prosthetic use in oncology patients undergoing amputation.

Methods:
Patients undergoing amputation with TMR as treatment for a malignant diagnosis at The Ohio State University Wexner Medical Center between April 2015 and March 2017 were included in the study. Medical records were reviewed and patient demographics, oncologic characteristics, adjuvant treatments, incidence of post-operative neuroma and phantom limb pain and time to prosthetic use were recorded.
TARGETED MUSCLE REINNERVATION: AN OPERATION TO PREVENT NEUROMA AND PHANTOM LIMB PAIN IN ONCOLOGY AMPUTEES, CONTD.

Presenter: John Alexander, MD

Results:
Sixteen patients with a primary oncologic diagnosis have undergone amputation with concomitant TMR. Six amputations were performed at the index resection with the remaining eleven patients having undergone secondary amputation due to residual tumor at positive margins or local recurrence. One year follow-up data is available for 4 patients, with only one subject reporting phantom limb pain and no neuromas reported. Ten (66%, 10/15) subjects completing at least 1-month follow-up report PLP. Rates at 1-3 month and 6-month follow-up of patients reporting PLP are 23% (3/13) and 27% (3/11), respectively. No patients developed symptomatic neuroma. Wound complications are reported in 40%, one requiring return to the operating room.

Conclusion:
In addition to enhancing prosthetic use, TMR can reduce pain; in fact, we have noted trends towards earlier disuse of narcotics in our primary TMR cohort. Our results suggest that targeted reinnervation is an effective method to prevent painful neuroma and phantom limb pain symptoms that affect amputees and has potential to positively impact the amputee population through improved prosthetic use, neuropathic pain control, decreased narcotic consumption and improved activities of daily living. Long-term follow-up data will be crucial in determining the durability of targeted muscle re-innervation in this patient population.

Acknowledgements:
None.

Disclosures:
None.

References:
Nikolajsen et al. Curr Rev Pain. 4: 166-170, 2000
Daigler, et al. World J Surg Oncol. 7: 15, 2009
**Screw Post Study**

Authors: Eric Welder, BS, Anthony LoGiudice MD, Kanu Goyal MD

Presenter: Anthony LoGiudice, MD

**INTRODUCTION:**

Tendon and ligament injuries in the upper extremity often accompany common and complex fractures or dislocations. Once identified, appropriately addressing these soft tissue injuries are often critical in the overall treatment and recovery. A multitude of fixation techniques have been developed with unique applications for each design. This innovation has resulted in costly implants, however.

A screw post is a well described construct that can be employed with ligament or tendon repairs to provide durable and high tension fixation. This study explores the utility of a screw post construct to achieve well tensioned repairs using two techniques of its application: (1) Screw post angulation and (2) Screw post length. This may provide a low cost alternative to ligament or tendon fixation to bone.

Our hypothesis was that greater screw post angulation in the line of pull of the construct would provide increased tension and advancement of the repaired tissues. Furthermore, we postulated that greater exposed initial screw lengths would directly allow for increased tension and advancement as well.

**METHODS:**

A strain-based force gauge was fixed to a horizontal wood frame. A 2-0 Fiberwire suture (Arthrex) was tied to the hooked end of the gauge, with the other end tied in a no-slip loop knot. This was set under tension around a cortical self-tapping screw with a washer (Synthes 3.5mm x 30mm). This screw was drilled and placed at 50mm away in line with the pull of the gauge. The angulation of the screw was varied from perpendicular, aiming away from the suture. Screw angles (Q) were 90, 75, 60, 45, and 30 degrees. The initial exposed length of the screw was 20mm.

Three trials were performed for each set angulation, taking measurements at exposed screw lengths of 20mm, 16mm, 12mm, 8mm and 4mm. We measured the initial and final tension as well as system length at each interval. Angles were measured with a free standing protractor, tension with a strain-based force gauge, and length with digital calipers.

All data were recorded into an Excel (Microsoft) worksheet. Average actual measurements of each exposed screw length, tension, and system length were compiled across the trials for each screw angulation and standard deviations were calculated.

**DATA AND RESULTS:**

Our data showed that increasing the exposed screw length at increased angles from perpendicular yielded greater changes in system tension as well as system length. We observed a linear relationship when comparing the amount of screw exposed to the change, or shortening, of the system. A similar linear relationship was observed when comparing system tension and length of screw exposed.
The percentage of change of length and tension seemed optimized at 45 degrees, where an additional 62% of change in the system could be yielded when starting with 20mm of screw exposed.

Of note, at 60 degrees, the 4mm screw length could not be attained as the washer and screw head interfered with advancing the screw further.

DISCUSSION:
This study demonstrates that varying the angle and exposed length affects the change in length and tension of a screw post construct. We observed 45 degrees to be the optimal angle in maximizing additional tension and shortening of system length. In vivo, this will effectively increase the tension of the repair because muscle-tendon units behave as viscoelastic materials, but the absolute and % change in tension experienced by the system will depend on the length and cross sectional geometry of the muscle tendon unit.

REFERENCES:
1. Thomopoulos et al., “Variation of Biomechanical, Structural, and Compositional Properties along the Tendon to Bone Insertion Site.”

ACKNOWLEDGEMENTS:
No external funding was used for this project.

DISCLOSURES:
No disclosures.
INTRODUCTION:
Isolated lateral unicompartmental osteoarthritis of the knee is an uncommon finding, with an incidence of 5-10% of osteoarthritic knees. Many surgeons are unfamiliar with the more demanding nuances of lateral unicompartmental arthroplasty (UKA) technique compared to medial UKA or total knee arthroplasty. Robotic-assisted arthroplasty has given surgeons a tool to help improve accuracy in component placement, which may be a useful adjunct to lateral UKA. The goal of this study is to evaluate the accuracy and early clinical outcomes of this procedure.

METHODS:
We retrospectively reviewed 20 robotic-arm assisted lateral UKA in 18 patients, performed by a single fellowship-trained arthroplasty surgeon from December 2011 through August 2013. Indications for lateral UKA were: isolated lateral knee pain, intact anterior cruciate ligament, correctable valgus deformity with verified maintenance of medial joint space on stress radiograph or through intraoperative visual inspection. Patellofemoral arthritis was not used as a selection criterion in this study. A full hospital and clinical chart review and radiographic evaluation was performed.

DATA AND RESULTS:
Average follow up was 32 months. Intraoperative results showed a surgical time of 120.8 minutes. Average inpatient stay was 44.9 hours, with 11 patients (55%) being discharged on postoperative day 1. Range of motion at 6 weeks averaged 131.7 degrees. There were no major complications at most recent follow up.

Radiographic data showed accurate placement of the tibial component at an average of 91.7 degrees to the anatomic axis of the tibia. Only 3 of the 20 tibial components (15%) fell outside our alignment objective of 90 +/- 3 degrees. Recreation of the individual anatomic axes of the tibia and femur were accurate as well. In all patients, tibiofemoral axis was improved but remained in slight valgus as to not overload the medial compartment.

DISCUSSION:
Our study shows that robotic-arm assisted lateral UKA is a reproducible and accurate procedure, with excellent short-term outcomes when performed in the appropriate patient. Operative times were longer than historical medial UKA and TKA procedures, but this did not lead to intraoperative complications or slowed postoperative rehabilitation. 17 patients (85%) fell within our goal for tibial coronal component placement. All patients had accurate coronal and sagittal recreation of their native alignment, without overcorrection.

In conclusion, robotic-arm assisted lateral UKA leads to accurate and reproducible placement of components and excellent short-term outcomes.
**REFERENCES:**


**DISCLOSURES:**

None
INTRODUCTION:
Articular cartilage lesions are common in elite level football players. Biomechanical and epidemiological studies have identified specific risks for articular cartilage injuries in football linemen. Magnetic resonance imaging (MRI) is a widely used and effective instrument for diagnosing articular cartilage lesions. To our knowledge, the effect of one season of play on the articular cartilage of football linemen has not been previously evaluated. The purpose of this study is to determine the prevalence and severity of articular cartilage lesions of the knee using a 3.0-T MRI scanner in asymptomatic collegiate football linemen before and after one season of play. We hypothesized that there would be an increase in number and severity of articular cartilage lesions after one season of play.

METHODS:
Asymptomatic right and left knees of 15 collegiate level football linemen were imaged with a 3.0-T MRI scanner before and after one season of play. 3 players did not complete the post season scan and one player’s left knee post season scan was poor quality and not included. Images were evaluated for articular cartilage lesions, meniscal pathology, bone marrow lesions, prepatellar bursitis, fat pad edema, patellar tendinopathy, quadriceps tendinopathy, ganglion cysts, synovial cysts, Baker’s cysts, effusion, and Osgood Schlatter Disease. Articular cartilage lesions were rated and compared using a modified Noyes scoring system. All statistical tests were performed with a standard statistical software package (STATA 13.1, College Station, TX). Pre-season and post-season Noyes scores were compared using exact 1-sided (post>pre) paired Wilcoxon signed rank test. McNemar’s chi-squared test was used to compare paired dichotomous data (for example, presence of a Baker’s cyst pre season versus post season).

DATA AND RESULTS:
25 of the 30 knees (83.3%) scanned preseason had at least one abnormality. 19 of the 23 knees (82.6%) scanned post season had at least one abnormality. Preseason and post season prevalence of patellar tendinopathy (43.3% and 34.8%) and Osgood Schlatter Disease (23.3% and 30.4%) were the most common abnormalities. Patellofemoral cartilage lesions were present in 30% and 34.8% of pre and post season scans respectively. Articular cartilage lesions from any compartment were present in 36.7% and 43.5% of pre and post season scans respectively. Mean patellofemoral cartilage scores for the 23 pre and post season scans increased significantly from 0.61 to 0.78 respectively (p=0.04). Mean composite cartilage scores for the 23 pre and post season scans increased significantly from 0.87 to 1.22 respectively (p=0.02).
**DISCUSSION:**
A high number of abnormal knee MRI findings were present in asymptomatic collegiate football linemen. A season of collegiate football play in linemen may significantly impact the health of articular cartilage in a similar fashion as with other sports such as collegiate basketball.

**REFERENCES:**

**ACKNOWLEDGEMENTS:**
This study received funding from NFL Charities.

**DISCLOSURES:**
The authors have no personal disclosures relevant to this study.
THE Utility of Pre-Operative Neuromonitoring for Adolescent Idiopathic Scoliosis

Authors: Sohrab Virk MD, MBA., Jan Klamar MD, Allan Beebe MD, Quincy Samora MD
Presenter: Sohrab Virk, MD, MBA

INTRODUCTION:
Intraoperative neuromonitoring is a well-established and widely used modality to assist in completing corrective surgery for adolescent idiopathic scoliosis (AIS) safely. The role of pre-operative measurement of somatosensory evoked potentials (SSEPs) and/or transcranial magnetic stimulation (TMS) to determine if there is transpinal pathology, however, is not clear. This study attempts to retrospectively review the records of patients that underwent corrective surgery for AIS to determine if pre-operative SSEP/TMS measurement provided any clinical benefit.

We hypothesized that there would be a portion of patients with abnormal pre-operative results that might benefit from further imaging to determine if intra-spinal pathology was present. Furthermore, knowledge that there were pre-operative defects in SSEP/TMS measurements might benefit clinicians during interpretation of intra-operative neuromonitoring results.

METHODS:
A review of medical charts between 2010 and 2012 was conducted for patients undergoing surgery for scoliosis. Those patients with diagnoses other than AIS were excluded. Patients with incomplete pre-operative or intra-operative data were also excluded. Relevant clinical information such as age, gender, number of levels fused and major cobb angle were recorded. Pre-operative neuromonitoring measurements and intra-operative neuromonitoring results were reviewed by an attending neurologist. Any instance where the intra-operative surgical plan or neuromonitoring result interpretation was influenced by preoperative results was recorded. Similarly, if further imaging was obtained based on pre-operative results then this was noted. Any acute neurologic complication such as paralysis was noted.

DATA AND RESULTS:
There were a total of 81 patients that met our inclusion criteria. The average age was 15.00 years (+/- 1.92 years). There were 64 females and 17 males within our cohort. The major cobb angle at pre-operative evaluation averaged 57.5 degrees (+/- 10.81 degrees). There were 10 patients with abnormal pre-operative SSEP/TMS results. There were no changes in protocol that were done during intra-operative neuromonitoring based upon pre-operative neuromonitoring findings. No additional imaging was required for patients with abnormal pre-operative neuromonitoring results. There was no statistically significant difference in pre-operative cobb angle between the group of patients with abnormal pre-operative neuromonitoring as compared to those with normal baseline testing.
THE UTILITY OF PRE-OPERATIVE NEUROMONITORING FOR ADOLESCENT IDIOPATHIC SCOLIOSIS, CONT'D.

Presenter: Sohrab Virk, MD, MBA

DISCUSSION:
Our study shows that pre-operative testing of TMS/SSEP does not impact the clinical course for AIS patients being treated operatively. Similarly, our findings do not demonstrate any correlation between pre-operative neuromonitoring abnormalities and cobb angle. Given our results, we would not recommend obtaining pre-operative SSEP or TMS measurements for patients with AIS.

REFERENCES:

ACKNOWLEDGEMENTS:
The authors appreciate the assistance of Teaya Rough in gathering and organizing data study
THE INCIDENCE OF ANCONEOUS EPITROCHELARIS IN ULNAR NERVE DECOMPRESSION: A RETROSPECTIVE CHART REVIEW

Authors: Shankar Narayanan, MD, Gregory Versteeg, BS, Kara Colvell, BS, Teresa DiMeco, CNP, and Hisham Awan, MD
Presenter: Shankar Narayanan, MD

Introduction:
The Ulnar nerve can be compressed at multiple sites including an anatomical variant, the Anconeus Epitrochlearis (AE). (Wadsworth 1977). Compression of the ulnar nerve due to the AE has been reported as early as 1979 and 1984 (Dahners 1984). It has previously been reported that cadaveric, ultrasound, and MRI studies have shown a prevalence of the AE in 4% to 34% of the general population (Massear 1988). However, the prevalence of an AE in patients with a clinical diagnosis of ulnar nerve neuropathy undergoing ulnar nerve decompression at the elbow has never been elucidated.

Hypothesis:
The incidence of the Anconeus Epitrochlearis in patients undergoing ulnar nerve decompression surgery will be between 5-10%. The presence of the Anconeus Epitrochlearis will not correlate with worsening EMG results.

Methods:
286 surgeries from a single surgeon who performed ulnar nerve decompression at the elbow (CPT 64718) between January 2014 and October 2016 were queried. A retrospective chart review was undertaken where demographic data, hand dominance, EMG results, and presence of an Anconeus Epitrochlearis was recorded. 58 patients were excluded from the study due to missing data or duplicate data query. Basic statistical analysis was undertaken.

Results:
Anconeus Epitrochlearis was found in 23/228 patients (10%). The average age of patients with AE was found to be similar to average age of patients without an AE undergoing ulnar nerve decompression at the elbow (51.21 and 51.12). EMG results did not demonstrate a difference amongst patients that had an AE versus those that did not who underwent decompression (41.56 m/s vs 42.23 m/s). The percentage of patients that had an AE on the same side as their hand dominance was found to be slightly increased but not statistically significant than patients undergoing ulnar nerve decompression without an AE on the same side as their hand dominance (60.87% to 55.39%). The percentage of patients that had an AE and Type 2 Diabetes (35.3%) was no different than the percentage of patients that did not have an AE but had Type 2 Diabetes and underwent ulnar nerve decompression (34.21%).

Discussion:
This is the first study that we know of that demonstrates incidence of an Anconeus Epitrochlearis in patients undergoing ulnar nerve decompression at the elbow which is 10%. There was no difference in the age of patients that have an AE versus those that do not undergoing decompression, which is different than prior literature published. EMG conduction velocity did
change based on presence of AE, and the presence of Type 2 Diabetes was not increased in patients with an AE.

REFERENCES:
INTERNAL ROTATION FOLLOWING TOTAL SHOULDER ARTHROPLASTY

Authors: Jacob J. Triplet, DO, Derek Berglund, MD, Jennifer Kurowicki, MD, Samuel Rosas MD, Brandon J Horn DO, Jonathan C. Levy, MD
Presenter: Jacob Triplet, DO

INTRODUCTION:
Limited internal rotation (IR) remains a concern for activities of daily living (ADLs) following bilateral shoulder arthroplasty (BSA). The purpose of this study is to evaluate the loss of the ability to perform functional IR tasks following BSA using various combinations of anatomic (TSA) and reverse (RSA) shoulder arthroplasty.

METHODS:
A retrospective review of an institutional shoulder surgery database was conducted for patients who underwent BSA with any combination of TSA or RSA with at least 2-year follow-up. Individual American Shoulder and Elbow Surgeons (ASES) score and Simple Shoulder Test (SST) questions specific to IR were used to assess patients’ ability to perform IR tasks with at least one of their shoulders.

DATA AND RESULTS:
Seventy-three patients met the criteria (47 TSA/TSA, 17 RSA/RSA, and 9 TSA/RSA). Average age at surgery was 72.1 years. Average follow-up was 51.4 months. Loss of the ability to wash the back was observed in 14 (30.4%) TSA/TSA, 3 (33.3%) TSA/RSA, and 9 (52.9%) RSA/RSA patients. Loss of the ability to tuck in shirt was observed in 5 (10.6%) TSA/TSA, 1 (11.1%) TSA/RSA, and 5 (29.4%) RSA/RSA patients. Loss of the ability to manage toileting was seen in none of the TSA/TSA or TSA/RSA groups, but 2 (11.8%) of RSA/RSA patients. Differences in ability to perform each task were not significant among the 3 groups (p>0.05).

DISCUSSION:
The majority of bilateral RSA patients are able to perform most IR tasks, and their ability to complete these tasks does not differ significantly from other combinations of BSA.

REFERENCES:

DISCLOSURES:
Jonathan Levy, MD is a paid consultant for DJO and Globus Medical. He receives royalties from DJO Orthopaedics and Innomed. No funding was obtained for this study.
INTRODUCTION:
Diaphyseal forearm fractures in pediatric patients are a common injury accounting for 6-16% of fractures in children. Pediatric both bone forearm fractures are occurring with increased frequency over the past several decades. Closed treatment with reduction and casting remains the gold standard in treatment of these injuries. Elastic stable intramedullary nailing (ESIN) has emerged as the surgical treatment of choice when fractures fail non-operative treatment and with it has seen increased utilization.

Compartment syndrome is a known complication of ESIN and has been associated with early treatment, open fractures, and multiple failed attempts at rod passage. It has been suggested that delayed treatment with ESIN would be associated with an increased need for open passage of rods, thus increasing invasiveness of procedure and potentially delaying time to healing. The purpose of this study was to analyze ten years of data on ESIN treatment of pediatric diaphyseal bone bone forearm fractures.

METHODS:
Retrospective chart review was performed on a consecutive series of pediatric patients at a single institution who underwent intramedullary fixation of diaphyseal forearm fractures. Patient demographics, operative details, radiographs, and complications were reviewed. Statistical analysis was performed.

DATA AND RESULTS:
2114 patients presented with pediatric diaphyseal both bone forearm fractures from January 1, 2006 to November 20, 2016. The vast majority were treated with closed reduction and casting in the emergency room by a senior orthopedic resident. Fractures with unacceptable alignment at follow up were wedged when amendable. Grade 1 open fractures were irrigated in the emergency room and admitted for 48 hours of IV antibiotics but were otherwise treated as closed. Fractures that failed closed treatment were indicated for operative stabilization.

CPT code search revealed 134 operatively treated forearm fractures (6.3%). 71 were treated with ESIN, the remaining patients received open reduction internal fixation (ORIF) with plate and screws or a hybrid construct. Six fractures were treated acutely (<48 hours). The remaining fractures were treated with ESIN at an average of 11.7 days from time of injury. Twenty-nine of fifty seven fractures that presented closed required open reduction to facilitate rod passage. Complications included 42 hardware removals (59%), 2 refractures after hardware removal, 1 cast saw burn, 1 extensor tendon rupture and zero compartment syndromes.

DISCUSSION:
Pediatric diaphyseal forearm fractures are increasingly common and continue to be treated more aggressively by surgeons around the world. Following a conservative protocol where only fractures that failed initial attempts at closed treatment allows for far less of these injuries to require surgery. Rates at which fractures were open reduced to facilitate rod passage were similar to other reported series despite the majority being done in delayed fashion.
A CONSERVATIVE ALGORITHM FOR TREATING PEDIATRIC BOTH BONE FOREARM FRACTURES: A LOWER RATE OF SURGICAL FIXATION AND NO INCREASED RISK WITH DELAYED SURGICAL TREATMENT, CONT'D.

Presenter: John Erickson, DO

Adherence to a conservative treatment algorithm for pediatric diaphyseal forearm fractures does not preclude successful delayed treatment in those ultimately requiring fixation with elastic stable intramedullary nailing and results in a lower percentage of fractures requiring operative intervention.

REFERENCES:

ACKNOWLEDGEMENTS:
None

DISCLOSURES:
No disclosures
INTRODUCTION:
Multiple perioperative factors have been implicated in infection risk following shoulder arthroplasty. The purpose of this study is to determine surgical site infection (SSI) risk due to medical comorbidities or blood transfusion following primary or revision shoulder arthroplasty.

METHODS:
Comprehensive data on medical comorbidities, surgical indication, perioperative transfusion and surgical site infection were obtained on 707 patients who underwent primary or revision hemiarthroplasty or total shoulder arthroplasty (TSA) in a single hospital system. Multivariate Poisson regression was used to determine the independent association between allogeneic red blood cell transfusion, medical comorbidities, and SSI after controlling for procedure.

DATA AND RESULTS:
The SSI rate was 1.9% for primary hemiarthroplasties and 1.3% for primary TSAs. Among patients without prior shoulder infection, revision arthroplasty or prior ORIF had higher SSI risk than primary arthroplasties (incidence risk ratio, IRR 11.4 95% CI 3.84, 34.0; p<0.001); among primary arthroplasties, SSI risk factors included male gender (IRR 60.0 CI 4.39, 819; p=0.002), rheumatoid arthritis (IRR 8.63 CI 1.84, 40.4; p=0.006) and long term corticosteroid use (IRR 37.4, CI 5.79, 242; p<0.001). Perioperative allogeneic red blood cell transfusion significantly increased SSI risk and was dose-dependent (IRR 1.68 per unit packed red blood cell, CI 1.21, 2.35; p=0.002).

Table 1. Surgical site infection patients

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<td>Total shoulder arthroplasty</td>
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<td>Hemiarthroplasty</td>
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<td>Primary arthroplasty</td>
<td>11 (50%)</td>
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<tr>
<td>Revision arthroplasty</td>
<td>11 (50%)</td>
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| Time to infection          | Median 141 days, Max 6.7 years |

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<tr>
<th>Intraoperative culture results</th>
<th>Frequency (Percentage)</th>
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<tr>
<td>Negative</td>
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<tr>
<td>Positive</td>
<td>14/22 (63.6%)</td>
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<tr>
<td>P. acnes</td>
<td>6 (42.9%)</td>
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<tr>
<td>Multiple organisms isolated</td>
<td>3 (21.4%)</td>
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<tr>
<td>MRSA</td>
<td>2 (14.3%)</td>
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<tr>
<td>MSSA</td>
<td>2 (14.3%)</td>
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<tr>
<td>Coagulase negative staphylococcus</td>
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<tr>
<td>Streptococcus sp.</td>
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<tr>
<td>Morganella morganii</td>
<td>1 (7.1%)</td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>1 (7.1%)</td>
</tr>
</tbody>
</table>

Continued on Next Page
Table 2. Independent risk factors for SSI after primary or revision shoulder arthroplasty.

<table>
<thead>
<tr>
<th>Revision surgery after prior ORIF or arthroplasty, no known prior infection (n=77)</th>
<th>Incidence Rate Ratio, 95% Confidence Interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male gender</td>
<td>11.3 (1.28, 100)</td>
<td>0.03</td>
</tr>
<tr>
<td>Age in years</td>
<td>1.05 (0.98, 1.13)</td>
<td>0.15</td>
</tr>
<tr>
<td>Long term corticosteroid use</td>
<td>139 (5.11, 3800)</td>
<td>0.003</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>N/A (no SSI's)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary arthroplasty, no prior ORIF or infection (n=568)</th>
<th>Incidence Rate Ratio, 95% Confidence Interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male gender</td>
<td>60.0 (4.39, 819)</td>
<td>0.002</td>
</tr>
<tr>
<td>Age in years</td>
<td>1.04 (0.98, 1.11)</td>
<td>0.20</td>
</tr>
<tr>
<td>Long term corticosteroid use</td>
<td>37.4 (5.79, 242)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>8.63 (1.84, 40.4)</td>
<td>0.006</td>
</tr>
</tbody>
</table>

DISCUSSION:
Allogeneic red blood cell transfusion increases SSI risk after shoulder arthroplasty in a dose-dependent manner, likely through an immunomodulatory mechanism. Though we report revision surgery and a prior local infection history as independent risk factors for future SSI, due to the often subtle clinical presentation of infected shoulder implants, an unknown number of supposedly non-infected revision cases reported in our study as well as prior studies may actually represent unrecognized low grade infections. Increased infection rates among men may be due to higher intrinsic bacterial burden of *P. acnes* around the shoulder. Long-term corticosteroid use is a strong independent risk factor for infection that is previously unreported in the shoulder arthroplasty literature. Rheumatoid arthritis patients on chronic steroids had a high infection risk, with an overall infection rate of 18.7%. In our analysis, RA (after controlling for steroid use) did have an association with infection among primary arthroplasties without a history of ORIF, suggesting some intrinsic SSI risk either directly due to the disease process or due to use of immunosuppressive medications other than corticosteroids.

SELECTED REFERENCES:

ACKNOWLEDGEMENTS/DISCLOSURES:
No relevant disclosures/acknowledgements
INTRODUCTION:
First metatarsophalangeal joint (MTPJ) arthrodesis is an accepted and effective procedure for many pathologies of the first ray. It has been used as surgical treatment for endstage arthritis, hallux rigidus, hallux valgus (HAV) with associated arthritic changes, and as a revision surgery for those that have failed previous HAV or hallux rigidus surgeries. Previous authors have noted that arthrodesis of the first MTPJ provides reduction of the angle between the first and second metatarsals. The goal of this study was to evaluate the angular correction between the first and second metatarsals (IMA) and also the hallux valgus angle (HVA) following first MTJP arthrodesis at our institution in order to compare to current literature.

METHODS:
A retrospective review was performed on all patients undergoing a primary first MTPJ arthrodesis by one of the three senior authors from October 2011 to October 2016. Approval from the OSU Institutional Review Board was obtained prior to the study. We identified 83 patients who had undergone a 1st MTPJ arthrodesis (all of which were over the age of 18). We excluded patients who had undergone previous bunion surgery or other surgery to the 1st ray, those without pre or post operative weightbearing dorsoplantar (AP) radiographs, and those with a history of hallux varus deformity. Following exclusion, 49 patients met our initial criteria for inclusion. The indications for arthrodesis included pain with 1st MTPJ ROM, crepitus on 1st MTPJ ROM, radiographic findings consistent with degenerative joint disease, and failure of conservative treatments.

Digital weightbearing AP radiographs were used to evaluate the pre and post operative HVA and the IMA between the 1st and 2nd metatarsals as described by Coughlin. Following initial radiographic evaluation, all feet with a normal preoperative IM angle (<9°) were excluded from the study, leaving 43 patients for evaluation. The preoperative IM angles were then grouped according to severity based on a HAV classification by Coughlin. The data was then analyzed with Microsoft Excel using a student paired t-test to compare significance. (Microsoft, Redmond, WA).

DATA AND RESULTS:
The average follow up in the study was 10 months. There were 31 females and 12 males. The average age was 58.27 years (range 25 to 75). The overall mean preoperative IMA decreased significantly from 13.14° to 9.53°, and the overall mean preoperative HVA decreased significantly from 24.02° to 12.33° (p<0.05). When grouping deformities as Mild, Moderate, and Severe; the mean measurements for mild HAV IMA decreased significantly from 9.50° to 8.50° and the HVA for mild HAV also decreased significantly from 13.86° to 8.79° (p<0.05). The measurements for moderate HAV deformities decreased significantly from 13.61° to 9.83° for the mean IMA and the measurements decreased significantly from 26.22° to 13.13° for the mean HVA (p<0.05). The measurements for severe HAV deformities decreased significantly from 19.83° to 10.83° for the mean IMA and the measurements decreased significantly from 39.33° to 17.50° for the mean HVA (p<0.05). The mean change in IMA was 3.60° overall, 1.00° for mild deformities, 3.78° for moderate deformities, and 9.00° for severe deformities. The mean change in HVA was 11.70° overall, 5.07° for mild deformities, 13.09° for moderate deformities, and 21.83° for severe deformities.
DISCUSSION:
The goal of this study was to perform a retrospective radiographic review of HAV correction following 1st MTPJ arthrodesis. Previous studies have noted improvement of the IMA after 1st MTPJ arthrodesis. Mann and Katcherian noted a reduction in the IMA with 1st MTPJ arthrodesis and noted that the change in the IMA was directly proportional to the preoperative IMA. Coughlin noted a reduction of 6.1° of the IMA following 1st MTPJ arthrodesis. The exact mechanism of IMA reduction has not been determined experimentally; however, it is believed that the relief of the retrograde force of the hallux on the metatarsal allows for the decrease in the IMA angle.

In conclusion, in our series of patients undergoing 1st MTPJ arthrodesis for HAV, 1st MTPJ arthrodesis produced a consistent reduction of the IMA and the HVA. Furthermore, our findings are consistent with the values found at other institutions. Our results further support the current belief that 1st MTPJ arthrodesis is a reliable and effective procedure in reducing the IMA that may prevent the need for a more proximal surgical procedure.

REFERENCES:
1. Mann RA, Katcherian DA. Foot Ankle. 10:8-11, 1989
5. Coughlin MJ. Foot Ankle Int. 26:783-792, 2005

ACKNOWLEDGEMENTS:
None

DISCLOSURES:
None
INTRODUCTION:
Clavicle fractures are a common occurrence in the adult and the pediatric population. Traditionally, both displaced and nondisplaced clavicle fractures have been treated nonoperatively with satisfactory results. Multiple recent studies have brought these results into question, and there has been a shift toward operative fixation of 100% displaced clavicle fractures in adults and adolescents.

Unlike adults, the pediatric population has potential to remodel malunited fractures. As children age, the potential for remodelling decreases. It is preferable for the clavicle to heal with maximal length and normal alignment to maximize function of the shoulder girdle, as malunions have been associated with poorer outcomes. While anatomic alignment can be obtained with open reduction and internal fixation of pediatric clavicle fractures, operative intervention carries the theoretical risk of anesthesia and a high incidence of repeat operations for hardware removal.

Previous studies in adults have compared treatment in a simple sling versus a figure of eight brace. No significant differences have been noted in union, shortening, or function. No studies have evaluated the radiographic outcomes of figure of eight bracing versus sling in the management of pediatric clavicle fractures. In this study we sought to determine if figure of eight bracing of displaced midshaft pediatric clavicle fractures decreased shortening when compared to simple sling treatment.

METHODS:
A single pediatric level 1 trauma center patient database was queried for the diagnosis of clavicle fracture between the dates January 2009 – December 2014. A total of 1153 patients were identified. 126 patients met the inclusion criteria (age >9 years, age <18 years, 100% displaced midshaft clavicle fracture (OTA 15-B), closed injury, nonsurgical treatment, initial AP clavicle radiograph within 10 days from injury, follow up AP clavicle radiograph after initiation of treatment).

Initial injury and final radiographs were measured for longitudinal shortening using institutional radiographic software. Measurements were obtained along the longitudinal axis of the clavicle defined as a line drawn from the midpoint of the sternal clavicular joint to the midpoint of the acromial clavicular joint. A perpendicular line was drawn from clavicular axis to the superior cortical margin of the medial segment. This was repeated for the distal segment. Shortening was defined as the distance between these two lines. Change in shortening was calculated as the difference between the measurements performed on the initial injury and final radiographs. Measurements were performed by 3 orthopaedic surgery residents and inter and intrarater reliability was assessed.

All statistical analyses were performed using a standard statistical software package (STATA 13.0, College Station, TX).
**DATA AND RESULTS:**

A total of 126 patients were identified that met the above criteria. 97 patients were treated with a figure of eight brace. 29 patients were treated with a sling. Mean initial shortening was 8.8mm and 10.6mm for the figure of eight brace and sling. Change in shortening was -0.4mm and -1.9mm for the figure of eight brace and sling. No significant differences were observed between treatment groups with respect to patient age, side injured, length of radiographic follow-up, initial shortening or change in shortening. For patients with initial shortening >10mm (49 total, 37 figure of eight, 12 sling) there was a trend towards less shortening for the figure of eight group (2.4mm vs. -0.8mm, p =0.07). Reliability for initial fracture shortening was intra-rater r=0.96; inter-rater r=0.76, and final shortening intra-rater r=0.84; inter-rater r=0.62.

**DISCUSSION:**

There is no significant difference in change in shortening for 100% displaced midshaft pediatric clavicle fractures when comparing treatment with a figure of eight brace vs. sling. There is a trend towards approved alignment (3.2mm lengthening) for more significantly displaced fractures (>10mm), however the clinical significance of the finding is indeterminate.

**REFERENCES:**


**ACKNOWLEDGEMENTS:**
none

**DISCLOSURES:**
None
**Introduction:**
Phalangeal fractures are commonplace in children, with an incidence of 184.9 / 100,000 in the 5-14 year age group. Seymour fractures are juxtaepiphyseal distal phalanx open fractures frequently accompanied by nailbed injuries. Some argue that these fractures should be treated non-operatively due to risk of pin tract infection. However, more recent investigations have demonstrated a lower rate of infection and residual osseous deformity with operative treatment compared to non-operative management of Seymour fractures. Delayed treatment (>24 hours after injury) of Seymour fractures demonstrate a 45% rate of infection. No studies have evaluated operative versus medical management of these fractures when they present in delayed fashion.

We hypothesized that operatively treated Seymour fractures, after a delayed presentation, have lower rates of complications (e.g. infections, delayed healing, need for an unplanned operation) compared to those fractures with delayed presentation treated non-operatively.

**Methods:**
A retrospective cohort study was performed of patient electronic records from 2010 to 2017 in our institution. These records were identified from billing data with pertinent ICD-9 and ICD-10 codes. Inclusion criteria were patients less than 18 years of age, clinically and radiographically evident Seymour fracture, and initiation of treatment more than 24 hours after the injury. Operative treatment was defined as irrigation, debridement, fracture reduction, and fixation in the operating room. Non-operative treatment encompassed care outside of the operating room, such as fracture reduction and splinting with antibiotics. Outcomes recorded included superficial or deep infection, fracture healing, malunion, growth disturbance, or need for an unplanned operation. Statistical analysis utilized the Fisher exact method (for categorical data) and Mann-Whitney-Wilcoxon test (for real-valued data). The significance level was \( p < 0.05 \).

**Data and Results:**
A total of 70 patients with a Seymour fracture were identified, with 34 (49%) with chronic injuries (presentation >24 hours). There were 14.7% female patients. The median age was 13.0 years (range 6 – 16). 32 received non-operative treatment and 2 received operative treatment. Patients managed non-operatively tended to present earlier for care than those treated operatively (median of 7 days versus 15 days, respectively) and had shorter follow-up (31 versus 70 days). Non-operative treatment when patients presented to clinic typically consisted of splinting or casting (except for 3 patients’ that refused this) and oral antibiotics. For antibiotics, 14 patients were treated with oral clindamycin and 3 were exclusively treated with oral Keflex, with typical treatment for about 4 weeks.

There were no statistically significant differences in rates of infection, fracture healing, malunion, growth arrest, or need for an unplanned operation (Table 1). In the non-operative group, 3 patients developed a malunion, 5 had nail dystrophy, 11 with physeal disturbance, and required an unplanned operation. There was 1 physeal growth disturbance in the operatively treated patients. One patient with osteomyelitis findings on admission radiographs subsequently underwent formal treatment.

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**Table 1: Outcomes of Operative versus Non-Operative Treatment of Chronic Seymour Fractures**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Non-Operative</th>
<th>Operative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Fracture Healing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Malunion</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Growth Arrest</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Need for Unplanned Op</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Continued on Next Page
irrigation, debridement, open reduction, and pinning 3 days following a bedside irrigation and debridement. Another patient had malalignment after closed reduction and subsequently required nailbed repair, open reduction, and percutaneous pinning nine days after initial treatment in the emergency department.

**DISCUSSION:**
Non-operative and operative methods to treat delayed presentations of Seymour fractures achieve similar outcomes and rates of complications. Our study is limited by the relatively low numbers of patients with chronic Seymour fractures. More data will be necessary, particularly with those treated acutely with an operative intervention, in order to affirm these findings. This would ideally be in the form of a prospective randomized controlled trial.

**REFERENCES:**

**ACKNOWLEDGEMENTS:**
The authors thank Teaya Rough for her efforts in facilitating resource allocation for this study and Satbir Singh and Rory Eustace for their efforts in data collection and organization.

**DISCLOSURES:**
No conflicts of interest to disclose.
INTRODUCTION:
Superior Labral Anterior to Posterior tears are a common cause for disability in the overhead athlete. Various treatment methods such as repair, debridement, and bicep tenodesis have been discussed in the literature to varying results. The goal of this study was to systematically review all available literature regarding the treatment of SLAP tears in overhead athletes and outcomes of bicep tenodesis in this population.

Our hypothesis is that bicep tenodesis is an acceptable and beneficial treatment for SLAP tears in the overhead athlete.

METHODS:
The database of PubMed was used and search performed on “labral tear” to capture the maximum number of relevant articles. 1181 results were obtained and reviewed for topic relevancy. Articles were screened for keyword inclusion of “SLAP tear”, “biceps tenodesis” resulting in 212 articles. Full abstracts were reviewed and included if met certain criteria, specifically isolated primary SLAP tears treated with bicep tenodesis in overhead athletes with return to sport and functional outcomes reported. 23 abstracts met this criteria, or were unable to be excluded, and therefore the full articles were individually reviewed with the same set of criteria. Only 4 articles met full inclusion criteria.

DATA AND RESULTS:
The four studies included for data analysis were a cohort study (Boileau), retrospective review (Gupta), laboratory study (Chalmers), and case series (Gottschalk).

<table>
<thead>
<tr>
<th>Study Design</th>
<th>Evidence</th>
<th>N Athletes</th>
<th>Study date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boileau et al</td>
<td>Cohort</td>
<td>III</td>
<td>12</td>
</tr>
<tr>
<td>Chalmers et al</td>
<td>Controlled laboratory</td>
<td>IV</td>
<td>5</td>
</tr>
<tr>
<td>Gottschalk et al</td>
<td>Case series</td>
<td>IV</td>
<td>26</td>
</tr>
<tr>
<td>Gupta et al</td>
<td>Retrospective</td>
<td>IV</td>
<td>8</td>
</tr>
</tbody>
</table>

Continued on Next Page
Boileau et al performed a comparative cohort study looking at SLAP repair vs Biceps tenodesis in Type 2 SLAP tears. 15 athletes, 5 collegiate and 6 professional, were included. The arthroscopic biceps tenodesis group had Constant score improvement from 59-89, with 93% (14/15) of patients satisfied or very satisfied. 13 patients (87%) returned to sport. ROM and strength testing returned to normal post-operatively.

Chalmers et al reported on 18 pitchers either having undergone SLAP repair or BT (Subpec) for type 2 SLAP tears. Functional outcomes, ROM, return to sport, post-operative throwing motion, and EMG testing were evaluated. They found all participants had returned to sport at the time of study (7 uninjured controls), 6 SLAP repair vs 5 BT group. Functional outcome scores were worse in SLAP repair group (ASES: P=.004; DASH: P=.006; DASH-Sport: P=.003; VAS: P=.021), but no difference existed in constant scores. BT group more closely mirrored normal throwing pattern of muscular activation within the long head biceps than did SLAP repair.

Gottschalk et al reported a case series on 29 athletes (24 recreational, 5 amateur) who underwent subpec BT for SLAP tears. Significant improvement was seen in ASES from 48.1 to 87.5, and VAS 6.4 to 1.5 at time of follow-up. 26/29 (89.66%) returned to sport. No differences were reported in SLAP type, patient age or sex.

Gupta et al retrospectively evaluated 28 patients - 8 athletes (7/8 overhead, 5 recreational, 1 high school, 2 collegiate) who had undergone subpec BT for SLAP tears. VAS, DASH were reported on entire cohort not specifically athletic population. Return to sport analysis: 5 (50%) returned to same level of play, 1 (13%) returned to lower level of play, 1 (13%) unable to return due to knee injury, 2 (26%) unknown.

DISCUSSION:
This study aimed to review all existing literature regarding bicep tenodesis in the treatment of SLAP tears in overhead athletes. Four articles met inclusion criteria and universally support BT in recreational and collegiate athletes regardless of the overhead nature of the sport. Return to sport and shoulder function scores for BT all demonstrated statistically significant improvement compared to SLAP repair.

REFERENCES:

ACKNOWLEDGEMENTS:
None

DISCLOSURES: None
INTRODUCTION:
Reverse total shoulder arthroplasty (RTSA) is a well-established surgical solution for rotator cuff deficient shoulders in the setting of glenohumeral arthritis. We reviewed the literature pertinent to the following questions: (1) Is RTSA effective in treatment of massive and irreparable rotator cuff tears in the absence of arthritis?; and (2) Is RTSA safe for treatment of massive and irreparable rotator cuff tears in the absence of arthritis?

METHODS:
A systematic search was performed using PubMed MEDLINE (from 1966) and EMBASE (from 1974) databases. Each manuscript and its bibliography were independently evaluated by two separate reviewers, level of evidences (I-V) were assigned.

Inclusion Criteria: (1) human shoulder; (2) massive or irreparable RCT, defined as >5 cm with multiple tendon involvement or prior unsuccessful repair; (3) minimum one-year follow-up; (4) functional outcome variables or patient-reported outcomes provided; (5) patient data without glenohumeral arthritis separated from those with arthritis; and (6) English or translated.

Exclusion Criteria: (1) presence of glenohumeral osteoarthritis, defined as Hamada IV or V; (2) deltoit deficiency; (3) review articles or lectures; (4) pre-existing neuromuscular deficits; and (5) presence of fracture, infection or inflammatory arthropathy.

DATA AND RESULTS:
One level II and five level IV studies were identified that met inclusion criteria and provided information related to RTSA for the treatment of massive, irreparable rotator cuff tears in the absence of glenohumeral arthritis. The mean patient age for RTSA in these studies was approximately 65 years. Pain and functional outcome scores reliably improved. Patients gained an average of 36 points in Constant scores as well as an average gain of 50° of forward flexion (final 133°) and 60° of abduction (final 119°). The overall reported complication rate varied, ranging between 11% to 38%. All six studies had a mean follow-up of at least five years, and overall implant survival rate ranged as high as 91% at a mean duration of 7 years.
**DISCUSSION:**

RTSA is an acceptable option for patients with massive, irreparable rotator cuff tears without glenohumeral arthritis, and consistent improvement was seen in multiple clinical and patient-reported outcome scores. These results are similar to those obtained in arthritic patients, and the survivorship is comparable between the two groups.

The complication rate, however, is substantial, with as many as 38% having a reported postoperative complication. While a number of complications carried minimal morbidity, there remained a large number of more serious complications such as scapular notching, dislocation, infection or component disassembly requiring repeat operative interventions.

Few options are currently available for failed RTSA; therefore, appropriate patient selection and pre-operative counseling are key in order to ensure successful patient outcomes.

**REFERENCES:**

1. Boileau, et al. JSES. **18:**600-606, 2009
2. Ek, et al. JSES. **22:**1199-1208, 2013
4. Mulier, et al. JBJS. **92:**2544-2556, 2010

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Director of Orthopaedic Research
For coordinating the scientific presentations

Zimmer Biomet, Inc.

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