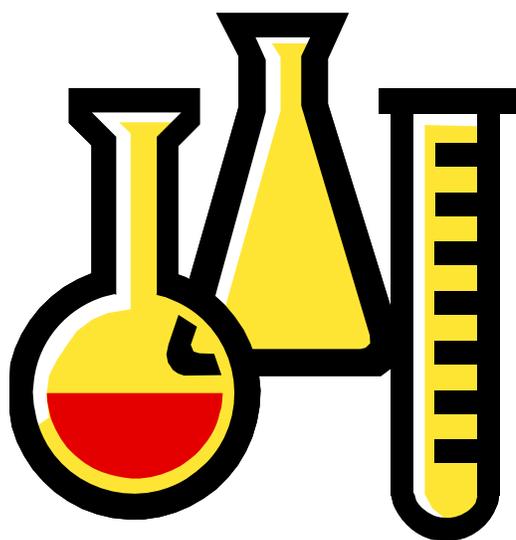


THE OHIO STATE UNIVERSITY

42nd Annual
Mallory-Coleman
Resident Research Day



Friday, May 30, 2014

Fawcett Center
OSU Campus



THE OHIO STATE UNIVERSITY

WEXNER MEDICAL CENTER

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:

2013 Howard An, M.D.
2012 Regis O'Keefe, M.D.
2011 Henrik Malchau, M.D.
2010 Freddie Fu, M.D.
2009 James Heckman, M.D.
2008 Cato Laurencin, M.D.
2007 William Garrett, M.D.
2006 Peter Stern, M.D.
2005 James Goulet, M.D.
2004 Steven Arnoczky, D.V.M.
2003 Joseph Buckwalter, M.D.
2002 Victor Goldberg, M.D.
2001 James Urbaniak, M.D.
2000 Douglas Jackson, M.D.
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
1993 Eric L. Radin, MD

2014 MALLORY-COLEMAN VISITING PROFESSOR AND MODERATOR:

LEESA GALATZ, M.D.



Dr. Galatz is an Associate Professor of Orthopaedic Surgery on the Shoulder and Elbow service at Washington University – Barnes Jewish Hospital in Saint Louis, Missouri. She also serves as the Fellowship Director for the program's Shoulder and Elbow Fellowship. Her primary research interest throughout her career has been basic science of rotator cuff disease and tendon to bone healing as it pertains to cuff repair. She is currently a co-investigator on two projects funded by the National Institute of Health which focus on chronic rotator cuff disease and novel tissue engineering strategies for repair. Her translational research is complemented by clinical studies with the Shoulder and Elbow Service.

Dr. Galatz serves as the faculty member in numerous national and international courses, lecturing on a variety of topics related to shoulder and elbow pathology. In 2007, she was a European Shoulder and Elbow Traveling Fellow, sponsored by American Shoulder and Elbow Surgeons. She was awarded the Neer Award for Basic Science Research at the American Shoulder and Elbow Surgeons Open Meeting in 2009 and was an American British Canadian Traveling Fellow in 2009. She serves as Associate Editor for Basic Science for the Journal of Shoulder and Elbow Surgery and is a peer reviewer for multiple other orthopedic publications. She has served as a Member at Large on the board of American Academy of Orthopedic Surgeons, and is currently a Delegate on the board of American Orthopedic Association.

PROGRAM

- 7:00 am **Welcome and Introduction**
- 7:15 am **Julie Balch Samora, MD, PhD**
“Orthopaedic Graduate Medical Education: A Changing Paradigm”
- 7:30 am **Ryan Harrison, MD**
“Multi-Modal Pain Control in Ambulatory Hand Surgery Patients”
- 7:45 am **Gregory Kolovich, MD**
“Return To Activity Following Medial Patellofemoral Ligament Reconstruction: A Systematic Review”
- 8:00 am **Douglas Lucas, DO**
“Headed Compression Screw Fixation for Calcaneal Displacement Osteotomies: A Retrospective Review of Post-Operative Plantar Heel Pain”
- 8:15 am **Dane Hansen, DO**
“Ankle Fragility Fractures Treated With Primary Retrograde Tibiotalocalcaneal (TTC) Nail”
- 8:30 am **Sameer Jain, MD**
“Neurological Complications in Reverse Total Shoulder Arthroplasty”
- 8:45 am **Michael Anthony, MD**
“Development of Charcot Arthroplasty in Diabetic Transplant Population”
- 9:00 am **Juan Santiago-Torres, BS**
“The Effect of Smoking on Rotator Cuff and Glenoid Labrum Surgery: A Systematic Review”
- 9:15 am *Break*
- 9:30 am **Julie Balch Samora, MD, PhD**
“Trigger Finger: What Is The Least Painful, Most Effective Method of Injection?”
- 9:45 am **B. Collier Watson, DO**
“Arthroscopic Evaluation of Syndesmotic Instability in a Cadaveric Model”
- 10:00 am **Karl Balch, MD**
“Mesenchymal Stem Cell Injection for Intra-Articular Knee Pathology”
- 10:15 am **Justin Munns, MD**
“Trends in Carpal Tunnel Surgery: A Survey of The Members of the American Society for Surgery of the Hand (ASSH)”
- 10:15 am **Darren Woodruff, DPM**
“Longevity of Midfoot Amputations in Diabetic Patients”
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- 10:45 am **Kyle Randall, MD**
"Evaluating Relationship Between Body Mass Index and Outcomes of Meniscal Repair"
- 11:00 am **Gregory Kolovich, MD**
"Pilot Study for the Design and Implementation of an Orthopaedic Surgical Training Laboratory for Basic Motor Skills"
- 11:15 am **James Taylor, MD**
"Tibiotalocalcaneal Arthrodesis Nails: A Comparison of Nails With And Without Internal Compression Utilizing the RAIN Database"
- 11:30 am **Lunch**
- 12:15 pm **Leesa Galatz, M..Professor and Moderator**
"Rotator Cuff Healing: Clinical And Basic Science Considerations"
- 1:15 pm **Steven Niedermeier, BS**
"Predictors of Discharge To An Extended Care Facility After a Single-Level Posterior Spinal Fusion Procedure - Implications For Healthcare System Cost Savings"
- 1:30 pm **B. Collier Watson, DO**
"Obtaining Volar Tilt in Distal Radius Fixation: Use of a Screw As a Proximal Post"
- 1:45 pm **Julie Balch Samora, MD, PhD**
"Microsurgery Instruction in an Orthopaedic Surgery Residency"
- 2:00 pm **Douglas Lucas, DO**
"Arthroscopic Evaluation of Syndesmotic Malreduction and Stability"
- 2:15 pm **Justin Barker, MD**
"Partial Flexor Tendon Laceration Assessment: Inter and Intra-Observer Reliability"
- 2:30 pm **End of Day**
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Julie Balch Samora, MD, PhD is a resident in Orthopaedics at The Ohio State University

ORTHOPAEDIC GRADUATE MEDICAL EDUCATION: A CHANGING PARADIGM

Authors: Julie Balch Samora, MD, PhD, Philip Bashook, EdD, Andrew Jones, MD, PhD, Todd Milbrandt, MD, MS, Augustus D. Mazzocca, MD, MS, Robert H. Quinn, MD **as part of the AAOS Orthopaedic Education Study Group*

Presenter: Julie Balch Samora, MD, PhD

INTRODUCTION:

Orthopaedic surgeons have traditionally been trained using an apprenticeship model. Over the past decade, medical education has undergone a major paradigm shift, with increasing emphasis on teaching toward competence as a specialist.

Evidence in support of current methods to teach and assess knowledge of musculoskeletal medicine and operative skills remains largely anecdotal. No comprehensive literature review has been performed to highlight best educational practices in orthopaedic training. The AAOS created the Orthopaedic Education Study Group with the goal of performing a comprehensive review of published research literature about orthopaedic education. The aim was to determine current status, recommend best practices, and identify potential research questions to determine gaps in orthopaedic graduate medical education and suggest an agenda of research initiatives to improve quality of programs, educational practices, and assessment methods.

METHODS:

The study group worked from March 2012 through September 2013. Inclusion criteria for article selection were all articles published in peer-reviewed journals involving orthopaedic education research in North America and written in English. Medline and EmBase database searches were done for articles cited up to April 2013 with multiple search terms (see full manuscript). Copies of all selected articles were retrieved and electronically stored using Refworks bibliographic software.

A coding form was developed and pilot tested building upon the standards for performing literature reviews developed by Best Evidence in Medical and Health Professions Education (BEME collaboration). The coding sheet was mounted on Qualtrics® survey software to generate summary statistics for further analysis. Each article was judged using the coding questions. The final articles was analyzed by individual study group members and findings recorded on the coding form.

DATA AND RESULTS:

the search of PubMed and Embase databases produced 2027 articles tagged with the key words orthopaedic education and related phrases. Once the Study Group screened articles by titles and abstracts and removed duplicates and irrelevant articles, there were 306 relevant articles overall and 98 articles about orthopaedic residency and fellowship education.

Supportive evidence in most studies (68) was classified as participants' perceptions or shifts in knowledge or attitudes. Nearly half of the studies (48) involved programmatic/curricular activities. There were 23 studies concerning simulation and seven articles addressing or utilizing OITE data. The vast majority of studies used either questionnaires/surveys (33) or reported opinions/observations (29). Eighty-eight studies were from US - based investigators and ten were international. Topics included Program/Curricular Activity (48), Assessment (13), Simulation (23) and the OITE (7).

Of the articles using experimental study designs, very few used controlled randomization or comparison groups. Most were single group prospective designs. The quality of evidence among the articles about orthopaedic education were as follows: Level 1/participant perception: 42; Level 2a: 2; Level 2b: 24, Level 3a: 9; Level 3b: 3; Level 4: 4; Level 5: 0.

Continued on Next Page

ORTHOPAEDIC GRADUATE MEDICAL EDUCATION: A CHANGING PARADIGM, CONTD.

Presenter: Julie Balch Samora, MD, PhD

DISCUSSION:

This was a comprehensive review of the literature pertaining to orthopaedic graduate medical education from the early 1900s through 2013. In general, there were surprisingly few articles addressing orthopaedic education over this extensive timeframe. There were only 19 prospective studies and 11 case control studies, with the majority of studies having no comparison group. With the recent focus on competency-based education, performance assessment has come to the forefront. Simulation and other technical teaching methods are being trialed with the aim of creating a proficiency-based approach that is structured, objective, efficient and safe. There are some promising investigations and interventions, all of which will require further research and validation.

While funding for education has remained flat or decreased, costs have increased dramatically and will continue to do so as increased resources are required to teach and also to comply with increasingly complex and demanding documentation standards. This is particularly true with regard to simulation, which clearly will secure a prominent role in the educational process, but at great expense.

Although challenges abound, the orthopaedic community must collaborate to ensure that we deliver the best educational product possible. Advances in educational philosophy and technology should be incorporated into the education process in the most efficient and effective method possible. Resources should be optimally focused in an effort to develop, measure, and report best practices in orthopaedic education.

REFERENCES:

1. Atesok K, et al. **JAAOS**. 20:410-422. 2012.
2. Dailey SW, et al. **AJO**. 27:563-570. 1998.
3. de Boer PG, et al. **JBJS Am**. 92:1325-1329. 2010.
4. Doyle JD, et al. **Am J Surg**. 193:551-555. 2007.
5. Gofton WT, et al. **Acad Med**. 87:1401-1407. 2012.
6. Gomoll AH, et al. **AJSM**. 35:883-888. 2007.

ACKNOWLEDGEMENTS/DISCLOSURES:

*The AAOS Orthopaedic Study Group includes the authors as well as Edward Akelman, MD, James Heckman, MD, Dawn LaPorte, MD, Valerae Lewis, MD, Alfonso Mejia, MD, Robert Murphy, MD, Denise Santomauro, and Veronica Wadey, MD.



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MULTI-MODAL PAIN CONTROL IN AMBULATORY HAND SURGERY PATIENTS

Authors: Ryan K Harrison, MD; Teresa DiMeo, CNP; Ryan Klinefelter, MD;
Hisham M Awan, MD; Michael E Ruff, MD
Presenter: Ryan Harrison, MD

Introduction

Regional anesthesia has been proven safe and effective in patients undergoing ambulatory hand procedures[1-5]. As the regional block wears off, patients can experience a rebound pain effect, making pain control challenging. We sought to determine if an organized, multimodal approach in patients undergoing Thumb CMC Arthroplasty or ORIF distal radius would provide better post-operative pain control. We hypothesized that this approach would significantly reduce post-operative pain and need for narcotic pain medication.

Methods

Patients undergoing Thumb CMC arthroplasty or ORIF distal radius were screened for inclusion. Prior to undergoing their procedure, all patients received a supraclavicular brachial plexus block using 0.75% ropivacaine. Patients were provided with a journal and asked to record medication usage, VAS and any adverse effects for five days after their procedure. Patients were randomly divided into four arms: 1) Percocet only (control), 2) oxycodone and acetaminophen; 3) oxycodone, Oxycontin and acetaminophen; or 4) oxycodone, acetaminophen and ketorolac. Control patients were instructed to take 1-2 tablets every four to six hours as needed for pain. Patients in the experimental groups were given detailed instructions regarding when and how to take their medications. Patients were provided a sliding scale to assist in dosing their medications according to the visual analog scale (VAS) (VAS 0-3: 650 mg acetaminophen, VAS 4-6: 10mg oxycodone, 650 mg acetaminophen, VAS 7-10: 15mg oxycodone, 650mg acetaminophen). In the Oxycontin group, patients were instructed to take 10mg of Oxycontin every 12 hours on a scheduled basis. In the ketorolac group, patients were instructed to take 10mg of ketorolac three times daily for four days.

Results

117 patients agreed to participate. 76 patients completed and returned their summary logs (18 control, 20 oxycodone, 17 oxycontin, 24 ketorolac). 22 patients did not return their logs and were excluded from the study. 19 patients were excluded because of a medication allergy, history of narcotic use/abuse or a medical contraindication to one of the medications used in the study. Average daily VAS and total number of oxycodone tablets over the 5-day study period were recorded (Figure 1).

Patients in the ketorolac group utilized fewer oxycodone tablets (19.3) over the 5-day period than patients in the other three groups (24.2, 23.4 and 24.2 respectively). In addition, the average daily pain score was lower in the ketorolac group during the time in which they were taking the medication. This was statistically significant on POD 0 and 1. Complications were much greater in the non-ketorolac groups. One patient each in the oxycodone and Oxycontin groups required a trip to the ED after their block wore off to help get the pain under control. Nausea and vomiting was a complication present in each of the four groups, but much greater in the Percocet and Oxycontin groups. Eleven of the 18 patients in the Percocet group required additional non-steroidal anti-inflammatories (Naproxen) and still did not achieve pain control similar to the other groups, although this may explain why the average daily pain in the Percocet group is lower than the oxycodone group, where only 4 of the 20 patients supplemented with naproxen. Over-sedation was an issue with four of the patients in the oxycodone and Oxycontin groups. No patients were found to have excessive bleeding, renal or other systemic complications.

Discussion

Ambulatory hand surgery with regional blockade has become a popular approach for many patients[1-5]. We sought to determine whether a more organized approach to treating our patients' post-operative pain would lead to improved pain control and decreased need for opiates. We were able to show that adding ketorolac to our patient's post-operative pain regimen and outlining a more detailed set of instructions could lower their narcotic usage, although pain scores were relatively equal with no significant difference by POD 5. In addition, adding Ketorolac decreased some of the other complications commonly seen with narcotic usage and was shown to be safe in our patient population.

Continued on Next Page

MULTI-MODAL PAIN CONTROL IN AMBULATORY HAND SURGERY PATIENTS, CONTD.

Presenter: Ryan Harrison, MD

References

1. Dufeu, N., et al. J Hand Surg Am, 2014.
2. Kopp, S.L. and T.T. Horlocker. Anaesthesia, 2010. **65 Suppl 1**: p. 84-96.
3. Schug, S.A. and C. Chong. Curr Opin Anaesthesiol, 2009. **22**(6): p. 738-43.
4. Sripada, R. and C. Bowens, Jr. Int Anesthesiol Clin, 2012. **50**(1): p. 26-46.
5. Trompeter, A., et al. Arch Orthop Trauma Surg, 2010. **130**(3): p. 417-21.

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RETURN TO ACTIVITY FOLLOWING MEDIAL PATELLOFEMORAL LIGAMENT RECONSTRUCTION: A SYSTEMATIC REVIEW

Authors: Gregory P. Kolovich, MD, MPH, George T. Matic, BS; Robert A. Magnussen, MD; David C. Flanigan, MD

Presenter: Gregory Kolovich, MD, MPH

BACKGROUND:

Recurrent patellar instability tends to affect a young, athletic population, often inhibiting athletic activities. Reconstruction or repair of the medial patellofemoral ligament (MPFL) has gained favor as increasing evidence shows this ligament as the primary soft tissue stabilizer to lateral patellar displacement. Despite the gaining popularity in MPFL reconstruction, there is limited data on returning to activities in the athletic population.

PURPOSE:

This review sought to report the ability to return to activity following MPFL reconstruction described in the literature and assess the overall success rate of the procedure in an athletic population.

STUDY DESIGN:

Meta-analysis.

METHODS:

A systematic review was performed using multiple databases. Studies reporting outcomes with Tegner scores after repair or reconstruction of the MPFL were included. Surgical technique, Tegner scores, and episodes of recurrent patellar instability were recorded and organized into a database.

RESULTS:

Ten articles with a total of 402 patients were included and reviewed. The mean preoperative Tegner score was 4.7 (2.9-7.5). The mean postoperative Tegner score was 5.8 (4.0-7.7). Forty-nine patients (12.2%) had a recurrent episode of instability, 11 of which required additional corrective procedures.

CONCLUSION:

Medial patellofemoral ligament reconstruction has a success rate of 87.8% in an athletic population, with the majority of patients returning to pre-injury activities. The small increase in preoperative and postoperative Tegner scores was not statistically significant, establishing that most patients return to the same activity level prior to injury

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HEADED COMPRESSION SCREW FIXATION FOR CALCANEAL DISPLACEMENT OSTEOTOMIES: A RETROSPECTIVE REVIEW OF POST-OPERATIVE HEEL PAIN

Authors: Douglas E. Lucas, DO; G. Alexander Simpson, DO; Gregory C. Berlet, MD; Terrence M. Philbin, DO; J. Luke Smith

Presenter: Douglas E. Lucas, DO

INTRODUCTION:

The calcaneal displacement osteotomy is frequently used by foot and ankle surgeons to correct hindfoot angular deformity. Headed compression screws are frequently used for this purpose, but a common complication is post-operative plantar heel pain from prominent hardware. Traditional techniques recommend placing screws away from the plantar surface of the calcaneus but recent literature questions this intuitive recommendation. We sought out to compare hardware removal rates after calcaneal displacement osteotomies and analyze technical factors including screw size, position and angle. A basic cost analysis was also performed comparing the two different styles of screw fixation. We hypothesize that larger screws placed more plantarly will be removed more frequently. We also believe that although two smaller screws cost more initially, when removal rates and cost are accounted for, savings will be demonstrated with this technique.

METHODS:

We reviewed records from four surgeons in a single practice for CPT codes matching a calcaneal osteotomy for hindfoot correction. The choice of fixation was at the discretion of the treating surgeon and not randomized. We collected epidemiologic data, type of fixation used and frequency of removal. We then performed a radiographic analysis of post-operative weight bearing films and mapped the Screw Entry Quadrant (SEQ) as described by Abbasian et al and angle of screw placement related to calcaneal pitch. The categorical data was examined with the chi-square or Fisher's Exact tests. The continuous data (inferior and superior screw angle), was analyzed with a Wilcoxon rank sum test because these values were not normally distributed. A basic cost analysis was performed including hardware and facility costs.

DATA AND RESULTS:

After exclusions we had 30 patients in our screw removal cohort and 119 in our screws retained cohort. The majority of screws were placed in the second Screw Entry Quadrant with no statistical difference between the two cohorts in regard to screw placement location or angle. The small screw group had a removal rate of 9% (4/43) compared to 25% (26/104) of the larger screw group. The cost analysis demonstrated that small screws delivered the same results with a cost of 44% that of larger screws. All osteotomies healed uneventfully with no hardware failures in either group.

DISCUSSION:

Headed compression screws remain a common fixation method for calcaneal displacement osteotomies. This study supports the findings of the recent publication by Abbasian et al that found no correlation with SEQ and removal rates. We did however find a statistically significant difference in screw size and removal rates. The data in this study suggest a lower rate of removal with screws sized 4.5mm or smaller. This group also demonstrated significant cost savings over larger screws despite higher implant costs. While newer fixation methods have come onto the market to avoid the concern for prominent hardware post operatively, this study suggests that technical factors can aid in reduction of removal rates in headed compression screw fixation and that the size of the screw is more important than the SEQ or angle of screw insertion.

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HEADED COMPRESSION SCREW FIXATION FOR CALCANEAL DISPLACEMENT OSTEOTOMIES: A RETROSPECTIVE REVIEW OF POST-OPERATIVE HEEL PAIN, CONTD.

Presenter: Douglas Lucas, DO

REFERENCES:

1. Dwyer F. Osteotomy of the calcaneum for pes cavus. *Journal of Bone and Joint Surgery-British Volume*. 1959;41(1):80.
2. Gleich A. Beitrag zur Operation Plattfussbehandlung. *Arch Klin Chir*. 1893;46:358–62.
3. Krackow KA, Hales D, Jones L. Preoperative planning and surgical technique for performing a Dwyer calcaneal osteotomy. *Journal of Pediatric Orthopaedics*. 1985;5(2):214–hyhen.
4. Joseph TN, Myerson MS. Correction of multiplanar hindfoot deformity with osteotomy, arthrodesis, and internal fixation. *Instructional course lectures*. 2005;54:269–76.
5. Maskill MP, Maskill JD, Pomeroy GC. Surgical management and treatment algorithm for the subtle cavovarus foot. *Foot & ankle international* 2010;31(12):1057–63. doi:10.3113/FAI.2010.1057.
6. Coughlin M, Mann R, Saltzman C. *Surgery of the Foot and Ankle.*; 2007:1141–1142.

DISCLOSURES:

No conflicting financial disclosures



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ANKLE FRAGILITY FRACTURES TREATED WITH PRIMARY RETROGRADE TIBIOTALOCALCANEAL (TTC) NAIL

Authors: Dane C Hansen DO; Doug E Lucas DO; Ben C Taylor MD

Presenter: Dane C. Hansen, DO

INTRODUCTION:

Ankle fragility fractures are very difficult to treat due to poor bone stock and soft tissues, and the likelihood of comorbidities such as diabetes mellitus (DM) and peripheral neuropathy. Conventional open reduction internal fixation in this population has been shown to lead to significant complications. The goal of this study is to show that primary fixation of ankle fragility fractures with a TTC nail is a safe surgical option that leads to satisfactory fracture alignment and union, with minimal complications in this high risk cohort.

METHODS:

We retrospectively reviewed our orthopedic trauma database for all ankle and pilon fractures, as well as all hindfoot fusion CPT codes, treated at our Level 1 trauma institution from 2006-2012. Initially we included all patients over 18 years of age, treated with retrograde TTC nail for primary treatment of any hindfoot/ankle injury, who had over 1 year of follow up. After initial review 13 patients were identified. Two patients were excluded for inadequate length of follow up. Another patient passed away 10 days following surgery due to complications related to polytrauma. Two patients were excluded as they were treated for high-energy, non-reconstructible hindfoot fractures. This left eight patients who had sustained ankle fragility fractures with adequate follow up.



Full hospital, clinical and radiographic review was performed, focusing on comorbidities and complications. Basic means were used for all cumulative variables.

Fig. 1: Post-operative radiographs of a patient who sustained an open ankle fragility fracture treated with retrograde TTC nail who went on to heal without complication

DATA AND RESULTS:

Mean age was 64.8 ± 12.2 (49-80). All eight patients had diabetes mellitus. 6 of the 8 (75%) had sensory neuropathy. Average BMI was 43.0 ± 7.2 (30.5-54.2). All fractures occurred during falls from standing height. Two fractures were open.

Operative time was 70.1 minutes \pm 18.8 (43-103). Average estimated blood loss was 26.3mL \pm 20.5 (5-50). There was one deep infection in a grade IIIa open injury, and no superficial infections. 7 of 8 had gone on to union. Average time to union of fracture was 18.0 weeks \pm 6.2 (11-26). There was one asymptomatic implant failure (12.5%), and 4 of 8 (50%) returned to pre-operative ambulatory status.

DISCUSSION:

There is limited published literature on this treatment protocol. Two similar studies were identified which treated 13 and 12 patients, respectively, with primary retrograde nailing of ankle fragility fractures^{1,2}. Neither study reported any infections, while there was only one revision due to valgus alignment post-operatively. There were also no malunions or nonunions in either study. Both studies reported superior return to function compared to our current data. Lemon et al. did remove all nails at one year post-operatively without any immediate signs of subtalar or tibiotalar arthritis.

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ANKLE FRAGILITY FRACTURES TREATED WITH PRIMARY RETROGRADE TIBIOTALOCALCANEAL (TTC) NAIL, CONTD.

Presenter: Dane Hansen, DO

Our study shows retrograde TTC nail can be a very useful treatment option in fragility ankle fractures, especially in the setting of DM and peripheral neuropathy. Operative time and blood loss are decreased when compared to historical ORIF, soft-tissue dissection is kept to a minimum and patients are allowed to mobilize and weight-bear earlier. There was only one significant complication in this group, and it was in the setting of an open fracture. Return to pre-operative function was not optimal, but the majority of patients went on to solid union with minimal complications.

There are some limitations with this study. First, it is a non-randomized retrospective cohort study without a control group. The study is also small in size, which may make it difficult to draw meaningful conclusions from the data. However, this is partly due to the fact that this is a newer treatment that is not currently in widespread use. Long-term complications were not evaluated in this study due to limited follow up.

In conclusion, we believe retrograde TTC nail is an acceptable treatment in ankle fragility fractures as it can give solid bony stabilization to allow early weight-bearing and mobilization without significant soft-tissue complication, especially in the setting of significant comorbidities. Large, prospective, randomized trials comparing this treatment to standard ORIF would be beneficial to further evaluate its efficacy.

REFERENCES:

1. Amirfeyz R, et al. *Arch Orthop Trauma Surg*. Apr;128(4):423-8, 2008.
2. Lemon M, et al. *JBJS Br*. Jun;87(6):809-13, 2005.

DISCLOSURES:

The authors have no disclosures related to this topic.



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NEUROLOGICAL COMPLICATIONS IN REVERSE TOTAL SHOULDER ARTHROPLASTY

Authors: Sameer Jain MD; Andrew Hills BS; Julie Y. Bishop MD
Presenter: Sameer Jain, MD

INTRODUCTION:

The indications for reverse total shoulder arthroplasty are quickly growing, and as it becomes more prevalent, it is crucial to closely examine the potential pitfalls with this operation. Neurologic injury after reverse total shoulder arthroplasty is a rare but devastating complication that can occur. Very few articles looking at clinically significant neurologic complications after reverse total shoulder arthroplasty exist in the literature. In a systematic review looking at complications after reverse total shoulder arthroplasty Zumstein et al. found a 1.2% (9/782) incidence of neurological injury but did not examine the cases for any common variables¹. Reports of subclinical neurologic injury during shoulder surgery have been previously reported in the literature. The purpose of this study was to look more closely at clinically apparent neurological injury following reverse total shoulder arthroplasty and see if any risk factors could be identified. We hypothesized that a low BMI placed patients at increased risk for neurologic injury during reverse total shoulder arthroplasty.

METHODS

A retrospective chart review looking at reverse total shoulder arthroplasties (rTSA) done by the senior author (JYB) was conducted. 91 cases of rTSA were identified, none were excluded. These cases were then analyzed for any neurologic complications, specifically clinically apparent brachial plexopathies. Sex, height, weight, age, gender, smoking status, presence of diabetes or rheumatoid arthritis, total operative time, history of previous shoulder surgery, pre-operative diagnosis, and size of the poly insert were all recorded into a database for each of the cases. These variables were then analyzed to see if any common factors could be found between those patients who had suffered neurological injury.

RESULTS

2 out of the 91 cases were found to have suffered neurological injury. Both patients suffered partial brachial plexopathies involving all 3 cords that were detected post-operatively. Both patients were presumed to have had a traction injury at the time of surgery and had EMGs that confirmed the diagnosis 2 weeks post op. Both patients had full motor recovery by 3 months, and full sensory recovery by 6 months. The 2 patients with brachial plexopathies had a mean body mass index (BMI) of 19.0 kg/m² vs 30.0 kg/m² for the other 89 patients. A closer look at BMI shows that of the 7 patients with a BMI <22 kg/m², 29% of them (2/7) had brachial plexopathies. Both patients who had neurological injury were females and former smokers. Among the other variables analyzed- no potential risk factors for neurological injury during reverse total shoulder arthroplasty were identified.

DISCUSSION

Our data suggests that females who actively smoke or have a history of smoking with low BMI (<22 kg/m²) may be at increased risk for neurologic injury during reverse total shoulder arthroplasty. The presumed mechanism is a traction injury at the time of surgery that patients with a low BMI are more susceptible to. The exact mechanism of this is not known but it has been previously reported in the literature that patients with low BMIs can be at increased risk for neurologic injury, with both differences in nerve conduction velocities or nerve excursion as potential causes for this². Armed with this knowledge, surgeons can be better prepared to counsel at risk patients pre-operatively on this potentially devastating complication.

REFERENCES

1. Zumstein MA, Pinedo M, Boileau P et al. "Problems, complications, reoperations, and revisions in reverse total shoulder arthroplasty: A systematic review" JSES (2011)20,146-157
2. Warrender WJ, Oopenheimer S, Abboud JA. "Nerve Monitoring during proximal humeral fracture fixation: What have we learned?" CORR Sep 2011; 469(9):2631-2637

DISCLOSURES

None

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DEVELOPMENT OF CHARCOT ARTHROPATHY IN DIABETIC TRANSPLANT POPULATION

Authors: Erik K. Monson DPM; Said A. Atway DPM; Michael L. Anthony, DPM;
Vincent S. Nerone DPM
Presenter: Michael Anthony, DPM

INTRODUCTION:

Charcot Arthropathy is mainly associated with the diabetic population. Unfortunately, the pathophysiology of this devastating joint destruction process remains poorly understood. It is considered to be multifactorial with neuropathy being the common denominator. The prevalence of peripheral neuropathy in the diabetic population is estimated to be 9-32% with 0.09-1.4% developing Charcot Arthropathy. Based on our experience with the diabetic transplant patient, there appeared to be an increased incidence in this specific patient population. There is little research on this specific patient population and the associated risks in the development of Charcot arthropathy and there remains a lot to be learned about the process in the development of Charcot. We hypothesize that there is an increased incidence in the development of Charcot Arthropathy in the diabetic transplant population, specifically the combined kidney/pancreas diabetic transplant patient.

METHODS:

This is a retrospective study evaluating diabetic kidney and kidney/pancreas transplant patients. A 1000 OSU transplant patient charts were reviewed from January 1st, 2000 to January 1st 2011. Patients were excluded if there was less than 2 years post-transplant follow up or if they had some other transplant other than a kidney or combined kidney/pancreas transplant. A total of 515 charts were excluded: 388 as a result of lack of follow up and 127 as a result of not being diabetic and having a transplant other than kidney or combined Kidney/Pancreas. 485 charts met the inclusion criteria with 239 having combined kidney/pancreas and 246 having kidney transplant alone. Charts were reviewed for age, sex, race, history of ulceration with location, amputation, length of follow up with tracking of those who have deceased, type of diabetes mellitus, smoking status, glycemic control, presence peripheral arterial disease (PAD), presence of neuropathy, presence of Charcot foot deformity and rate of development post-transplant, location of Charcot deformity and whether Charcot reconstruction was performed. This data was analyzed to help identify associative risks factors to the development of Charcot Arthropathy in these specific patient populations.

DATA AND RESULTS:

Of the combined kidney/pancreas transplant patients, 44 of the 239 patients developed Charcot Arthropathy for a percentage of 18.41%. Of the isolated kidney transplant patients 27 of the 246 patients developed Charcot Arthropathy for a percentage of 10.97%. Thus, both population subtypes are significantly at higher risk for the development of Charcot Arthropathy in comparison to the general diabetic population which from previous studies was estimated to be with 0.09-1.4%, (almost 10 fold in the isolated kidney transplant population to almost 20 fold in the combined kidney and pancreas). With Charcot deformities comes abnormal foot pressures with potential ulceration. In our population, it was noted that when HbA1c was found to be above 7, there was a significant increase in the development of neuropathy and peripheral arterial disease (PAD) which drastically increased percentage of ulcerations and ultimately amputations which would be as expected in our immunocompromised subject population. Other factors such as sex, type of diabetes and smoking status appeared to play less of a role.

DISCUSSION:

The Charcot foot has been documented to occur as a consequence of various peripheral neuropathies with diabetes being the most common etiology. Although there is no singular cause for the development of the Charcot foot, the current belief is that it is mediated through uncontrolled inflammation leading to osteolysis which is indirectly responsible for the progressive fracture dislocation. Typical clinical findings include markedly swollen, warm and erythematous foot with only mild to modest foot pain and typically resemble cellulitis, DVT or acute gout which in our subject population are all likely possible and must be considered and ruled out. Neuropathy is the universal feature to the development of Charcot Arthropathy. The universal treatment of the acute or active Charcot is off-loading and immobilization although recent studies suggest potentially favorable outcomes with early surgical

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DEVELOPMENT OF CHARCOT ARTHROPATHY IN DIABETIC TRANSPLANT POPULATION, CONTD.

Presenter: Michael Anthony, DPM

correction restoring a more plantigrade foot which is the goal for both treatment modalities. There is a lot yet to be learned about this pathophysiology of this devastating joint destruction process. If we continue to focus our studies on these higher risk subjects, the hope is that maybe some those unknowns will be answered.

REFERENCES:

1. Pakarinen TK, et al. *Scandinavian. JS.* 91:195-201, 2002
2. Rajbhandari SM, et al. *Diabetologia.* 45:1085-1096, 2002
3. Vecchio JJ, et al. *Dia FA.* 4: 1-5, 2013
4. Rangel EB, et al. *Transplantation.* 94:642-645, 2012
5. Boucek P, et al. *Diabetes Care.* 31:1611-1612, 2008
6. Rogers LC, et al. *Diabetes Care.* 34: 2123-2129, 2011
7. Schaper NC, et al. *Dia Met Res Rev.* 24:40-44, 2008
8. Kaynak G, et al. *Dia FA.* 4:1-9, 2013
9. Jeffcoate W, et al. *Clin Pod Med Surg.* 25: 29-42, 2008
10. Frykberg RG, et al. *Clin Pod Med Surg.* 25: 17-28, 2008
11. Nielson DL, et al. *Clin Pod Med Surg.* 25: 53-62, 2008
12. Rogers LC, et al. *Clin Pod Med Surg.* 25: 43-51, 2008
13. Jeffcoate W, et al. *Lancet.* 366: 2058-2061, 2005

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DISCLOSURES:

None



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THE EFFECT OF SMOKING ON ROTATOR CUFF AND GLENOID LABRUM SURGERY: A SYSTEMATIC REVIEW

Authors: Juan E. Santiago-Torres, BS; David C. Flanigan MD; R. Bryan Butler MD; Julie Y. Bishop MD

Presenter: Juan E. Santiago-Torres, BS

INTRODUCTION:

Several orthopaedic conditions, such as nonunions of fractures, risk of infection after surgery, and decreased bone mineral density have been reported to be adversely affected by smoking. Only a few articles have looked at outcomes related to smoking in shoulder surgery. The purpose of this study was to systematically review the literature to determine the effects of tobacco on soft-tissue shoulder surgery. We hypothesized that smoking has a negative influence from both a basic science and clinical outcome perspective on soft-tissue shoulder surgery.

METHODS:

A systematic review of multiple medical databases was performed evaluating clinical and basic science studies to determine the effects of smoking on tendinous, ligamentous, and cartilaginous shoulder surgery. Search strategy was based on “shoulder AND [smoke OR smoking OR nicotine OR tobacco].” English language clinical outcomes or basic science studies following soft-tissue surgery of the shoulder were included. Studies excluded consisted of Level V evidence, partial or total shoulder arthroplasty, fracture reduction and fixation, oncologic mass excision, and osteotomy around the shoulder.

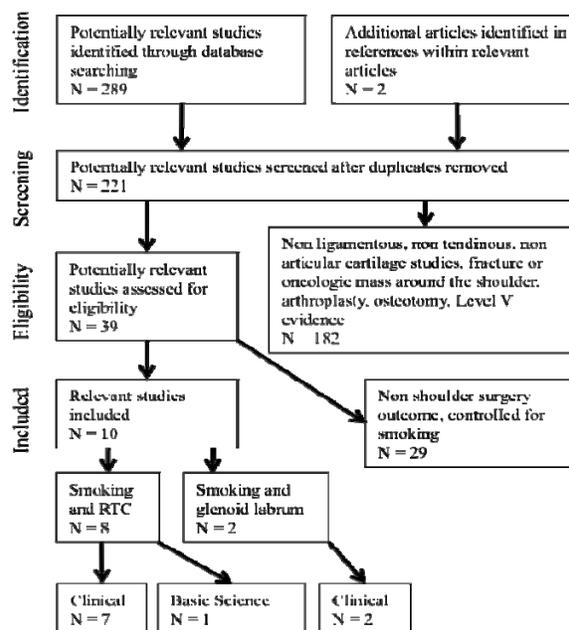


Figure 1. Search strategy according to PRISMA guidelines. Ten studies were identified for inclusion. No studies analyzing outcomes after shoulder articular cartilage surgery were identified.

DATA AND RESULTS:

Ten studies were identified for inclusion and analysis. Eight of these studies, which include one basic science study, investigated the relationship between smoking and outcomes of rotator cuff repair (RCR) and two examined the effects of smoking on outcomes of glenoid labrum repair. No studies were found that specifically explored the effects of smoking on cartilaginous shoulder surgery. The basic science study and three of the seven clinical studies investigating smoking and rotator cuff surgery outcomes found a statistically significant negative association resulting in decreased rotator cuff tendon repair quality, decreased biomechanics, poorer clinical outcomes, and impaired

THE EFFECT OF SMOKING ON ROTATOR CUFF AND GLENOID LABRUM SURGERY: A SYSTEMATIC REVIEW, CONTD.

Presenter: Juan E. Santiago-Torres, BS

healing of small-medium RTC tears as assessed by magnetic resonance imaging. In addition, one of two clinical studies examining smoking and glenoid labrum repair reported an increased need for surgical revision of superior labral tear from anterior to posterior (SLAP) in smokers. No basic science studies were found that investigated the effects of smoking on glenoid labrum surgery.

DISCUSSION:

Smoking has a negative influence on RCR clinical outcomes and is associated with decreased healing of small-medium RTC tears after repair. The current literature suggests a negative influence of nicotine and of smoking on RCR from both a basic science and clinical outcomes perspective. Smoking cessation would benefit patients undergoing RCR and improve clinical outcomes. The relationship of smoking and labral/SLAP repair or articular cartilage is less clear. Further research is needed to evaluate associations with these surgeries and outcomes.

REFERENCES:

1. Balyk, *et al.* **Clin Orthop Relat Res.** 466(12):3025-3033, 2008
2. Djahangiri, *et al.* **J Shoulder Elbow Surg.** 22(1):45-51, 2013
3. Galatz, *et al.* **J Bone Joint Surg.** 88A(9):2027-2034, 2006
4. Mallon, *et al.* **J Shoulder Elbow Surg.** 13(2):129-132, 2004
5. Neyton, *et al.* **Arthroscopy.** 29(1):10-17, 2013
6. Nho, *et al.* **J Shoulder Elbow Surg.** 18(1):13-20, 2009
7. Park, *et al.* **Arthroscopy.** 27(10):1335-1340, 2011
8. Prasad, *et al.* **Acta Orthop Belg.** 71(6):662-666, 2005
9. Provencher, *et al.* **Am J Sports Med.** 2013
10. Tashjian, *et al.* **Am J Sports Med.** 38(12):2435-2442, 2010

DISCLOSURES:

The authors declare that they have no conflicts of interest in the authorship of this contribution.



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TRIGGER FINGER: WHAT IS THE LEAST PAINFUL, MOST EFFECTIVE METHOD OF INJECTION?

Authors: Julie Balch Samora, MD, PhD; Nikki Benvenuti, MPAS, PA-C; Hisham Awan, MD; Ryan Klinefelter, MD; Michael E. Ruff, MD

Presenter: Julie Balch Samora, MD, PhD

INTRODUCTION:

Stenosing tenosynovitis, also known as trigger finger, is a common occurrence in the hand and occurs when there is a mismatch between the volume of the retinacular flexor tendon sheath and its contents. Patients complain of pain, catching, or locking of their digit, and will present with tenderness over the A1 pulley, pain with passive extension, or reproduction of triggering.

There are many treatment methods, all with the goal of producing smooth and painless range of motion in the affected digits. Corticosteroid injections are commonly utilized in the management of stenosing tenosynovitis. It is unclear, however, if one approach is more effective or less painful.

We compared pain perception to three different methods of injection for symptomatic trigger fingers: a palmar proximal approach, a palmar distal approach, and a webspace approach. We hypothesized that all three methods would have equivalent functional outcomes, but that the web space approach would result in lower pain scores.

The specific aims were:

1. To determine, using the visual analog scale (VAS), whether patients find one method of injection less painful for the treatment of trigger finger.
2. To determine whether one method of injection leads to better outcomes.

METHODS:

This is a prospective, non-blinded randomized study with three separate groups. Inclusion criteria were: age 18 and older, single idiopathic trigger digit in Patel & Moradia grades 1-3, no prior injection into the affected digit, patient able to understand English, and symptoms less than 12 months. Exclusion criteria were: endocrine disorder, rheumatoid arthritis, renal dialysis, age <18 or symptoms >12 months.

Patients were classified according to the Patel and Moradia classification⁸ (Fig. 1). Each patient filled out a VAS immediately post-injection. DASH questionnaires were collected pre- and post-injection.

Based on a t-test comparing pain on a continuous scale between three locations and adjusted for multiple comparisons, $\alpha=0.0167$ (.05/3), we hypothesized a difference of two on the VAS with a standard deviation of 4 for each group. To adjust for pre-injection triggering symptoms based on Patel & Moradia's classification, we utilized a linear regression to compare pain by location. In order to determine the efficacy of the treatment groups and comparing location, an ordinal logistic regression model was used based on the outcome measures (1. complete resolution, 2. improved, 3. improved, but unsatisfactory result, 4. no response). Statistical significance was defined as $p < 0.05$.

Figure 1. Patel and Moradia Classification⁸

Grade 1: Uneven movements, no locking

Grade 2: Clicking, no locking

Grade 3: Locking, actively or passively

Grade 4: Locked, cannot be unlocked

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TRIGGER FINGER: WHAT IS THE LEAST PAINFUL, MOST EFFECTIVE METHOD OF INJECTION?, CONTD.

Presenter: Julie Balch Samora, MD, PhD

DATA AND RESULTS:

We have thus far enrolled 36 patients with an average presentation of symptoms of 2.5 ± 1.3 months. There were 5 patients with grade 1 triggering symptoms, 7 with grade 2, and 24 with grade 3. There was no difference in VAS score between the palmar proximal (6.4 ± 2.7), palmar distal (8.0 ± 4.7), or webspace (6.8 ± 1.8) approaches. There were no differences in pre-injection or post-injection DASH scores between methods (27 before and after for palmar proximal, 10 to 27 for palmar distal, and 9.3 to 18.4 for webspace). A majority of patients, regardless of injection method, either opted for a repeat injection (16) or surgical release (11).

DISCUSSION:

Stenosing tenosynovitis is a painful condition for which patients often seek relief. Prior studies have demonstrated good outcomes with high cure rates with corticosteroid injections. Our data suggest that injection approach does not affect patient pain perception scores or outcomes. The technique which is most comfortable to the surgeon may be utilized, with the understanding that one injection has a low likelihood of relieving symptoms.

REFERENCES:

1. Fahey, et al. *JBJS Am.* 36-A(6):1200-18, 1954
2. Marks, et al. *J Hand Surg Am.* Vol#:14(4):722-7, 1989
3. Murphy, et al. *J Hand Surg Am.* 20(4):628-31, 1995
4. Anderson, et al. *Arch Intern Med.* 151(1):153-6, 1991
5. Freiberg, et al. *J Hand Surg Am.* 14(3):553-8, 1989
6. Hueston, et al. *Hand.* 4(3):257-60, 1972
7. Howard, et al. *JBJS Am.* 35-A(4): 994-1002, 1953
8. Patel, et al. *J Hand Surg Am.* 22(1):150-5, 1997
9. Saldana, et al. *JAAOS.* 9(4):246-52, 2001
10. Peters-Veluthamaningal, et al. *Cochrane Database Syst Rev.* Jan 21;(1),2009
11. Lambert, et al. *J Hand Surg.* 17(1):69-70, 1992

ACKNOWLEDGEMENTS:

None

DISCLOSURES:

None



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ARTHROSCOPIC EVALUATION OF SYNDESMOTIC INSTABILITY IN A CADAVERIC MODEL

Authors: B. Collier Watson, DO; Douglas E. Lucas, DO; G. Alex Simpson, DO; Gregory C. Berlet, MD; Christopher Hyer, DPM, MS

Presenter: B. Collier Watson, DO

INTRODUCTION:

Ankle fractures are among the most common lower extremity injuries in adults. Proper care for these injuries requires that orthopedic surgeons evaluate for syndesmotic ligament disruption, because injury to this ligamentous complex can lead to a non-concentric ankle mortise. Diagnosing syndesmotic injuries remains controversial in the literature. Traditionally, diagnosis of syndesmotic instability is evaluated with radiographic parameters, particularly stress radiographs. Computed tomography (CT) has been shown to be more sensitive for syndesmotic malreduction but can rarely be used intra-operatively. Ankle arthroscopy has been proposed as an intra-operative tool that can be used in acute ankle injuries to not only evaluate stability, but also reduction after fixation. To our knowledge, no other studies have focused on the amount of force that it takes to show syndesmotic instability under arthroscopic evaluation with an intact or partially disrupted syndesmosis. In the present study, our focus is to evaluate the amount of displacement produced in the coronal, sagittal, and transverse planes with a graded, objective force visualized through ankle arthroscopy.

METHODS:

Seven below knee specimens were used in this study. The specimens were mounted in a traction tower to simulate a traditional ankle arthroscopy setup. Our syndesmosis disruption model was designed to identify gradual disruption of the lateral ankle ligaments. Four groups were included with the first having a superficial dissection but no ligamentous disruption. The second group underwent disruption of the Anterior Inferior Tibiofibular Ligament (AITFL) and Interosseous Ligament (IL). The third group had AITFL and IL disruption plus Anterior Talofibular Ligament (ATFL) and Calcaneofibular Ligament (CFL) disruption. The fourth group included Posterior Inferior Tibiofibular Ligament (PITFL) and Transverse Ligament (TL) disruption. Force was applied to and measured in each specimen using a digital scale. The amount of displacement was viewed and measured under arthroscopic evaluation.

DATA AND RESULTS:

Group 1 served as a control group. As anticipated, an intact syndesmosis and lateral ankle ligaments provided multiplanar stability. In group 2, syndesmosis diastasis was appreciated particularly in the transverse/external rotation plane with as little as 6 pounds of force. In Group 3, a greater amount of displacement was appreciated with less force administration. Multi-plane instability was visible in every specimen with as little as 2 pounds of force. Group 4 was the completely disrupted model and the specimens were so grossly unstable in this condition that our setup was unable hold the fibula reduced in the incisura and as such testing was impossible.

DISCUSSION:

In conclusion, ankle arthroscopy clearly has the potential to evaluate even partial disruption of the syndesmotic ligament complex. Based on the results of our study, evaluation of subtle displacement in multiple planes may assist the surgeon in understanding the extent of the syndesmotic injury. Further studies are necessary to determine to what extent instability requires fixation as well as the role for arthroscopy in assessing anatomic reduction of the syndesmosis after fixation is performed.

REFERENCES:

1. Takao M, Ochi M, Naito K, et al. Arthroscopic diagnosis of tibiofibular syndesmosis disruption. *Arthroscopy*. 17:836-843, 2001.
2. Sagi HC, Shah AR, Sanders RW. The functional consequence of syndesmotic joint malreduction at a minimum 2-year follow-up. *J Orthop Trauma*. 26:439-443, 2012.

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ARTHROSCOPIC EVALUATION OF SYNDESMOTIC INSTABILITY IN A CADAVERIC, CONTD.

Presenter: B. Collier Watson, DO

3. Lui TH, Ip KY, Chow HT. Comparison of radiologic and arthroscopic diagnoses of distal tibiofibular syndesmosis disruption in acute ankle fracture. *Foot Ankle Int.* 21(11): 1370-1374, 2005.
4. Beumer A, van Hemert WL, Niesing R. Radiographic measurement of the distal tibiofibular syndesmosis has limited use. *Clin Orthop Relat Res.* 423:227-234, 2004.
5. Takao M, Ochi M, Oae K, et al. Diagnosis of a tear of the tibiofibular syndesmosis disruption. The role of arthroscopy of the ankle. *J Bone Joint Surg Br.* 85:324-329, 2003.
6. Ebraheim NA, Lu J, Yang H, Mekhail AO, Yeasting RA. Radiographic and CT evaluation of tibiofibular syndesmotom diastasis: a cadaver study. *Foot Ankle Int.* 18(11): 693-698, 1997.

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DISCLOSURES:

No conflicting interests.



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MESENCHYMAL STEM CELL INJECTION FOR INTRA-ARTICULAR KNEE PATHOLOGY

Authors: Karl Balch, MD; David Flanigan, MD
Presenter: Karl Balch, MD

INTRODUCTION:

Mesenchymal stem cells (MSCs) can be a source of multiple cell lineages that have potential to be beneficial in healing intra-articular pathology. Research has begun to look into whether or not MSCs can be applied to defects in cartilage and knee pathology without any need for visualization or surgical placement of cells or scaffolds.

While much of this research has remained in vitro and in vivo in experimental models, a small number of physicians in the United States and in some international clinics now offer "stem cell injections" for a multitude of medical problems including treating defects in cartilage, meniscus, ligaments, and osteoarthritis in the knee.

The purpose of the present study was to determine whether the current animal and human literature supports the injection of MSCs into the knee joint to address (1) cartilage injury, (2) meniscal injury, (3) ligamentous injury, (4) and / or osteoarthritis.

METHODS:

We conducted a systematic review of the available literature according to PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) guidelines dictated in the PRISMA 2009 checklist [1].

The following databases were utilized: Medline/Pubmed (1950 – March 1st, 2013), and Cochrane Central Register of Controlled Trials (1994 – March 1st). Search terms were run in different combinations using: *knee injection, stem cells, mesenchymal, cartilage, osteoarthritis, ligament, meniscus, and human*. There were no limitations on length of follow-up or level of study to allow greater inclusion in analysis. References from identified papers were also searched for potential studies/articles for inclusion.

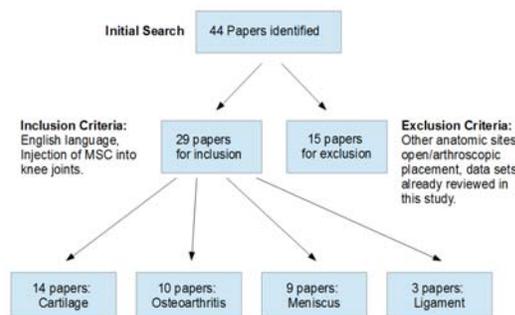


Figure 1: Inclusion and exclusion flow chart identifies initial papers identified using search terms, numbers excluded, then breakdown by tissue target. Some studies included more than one target investigated so the data from these are included for each tissue subset separately.

Potentially inclusive papers were discussed among the authors and inclusion and exclusion criteria were agreed upon. Inclusion criteria were English language and injection of MSCs into the knee joint or a knee analogue in the case of ex-vivo studies. Papers reviewing MSC injection after other cartilage restoration procedures such as microfracture were included. Studies that focused on other joints, relied on surgical placement of MSCs, or data sets already included in other discussed papers were excluded.

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MESENCHYMAL STEM CELL INJECTION FOR INTRA-ARTICULAR KNEE PATHOLOGY, CONTD.

Presenter: Karl Balch, MD

Sources for MSCs could be either bone allograft or xenograft (using human bone marrow as source of MSCs for animal transplantation) and this was noted in review of the papers. Studies were grouped by cell type targets for intra-articular pathology to try and show effectiveness for different types of pathology.

DATA AND RESULTS:

The search performed identified papers reviewing MSC injection for cartilage, meniscus, ligamentous injury, and osteoarthritis.

14 different papers were identified investigating cartilage injury treatment with MSC. A small number of human studies and a lack of efficacy research beyond case reports with limited outcome data make it difficult to recommend MSC injection before additional research can further delineate any potential benefit. Safety research is currently ongoing to define the risks of MSC injection [2].

Osteoarthritis, meniscus, and ligamentous injury were also reviewed yielding 10, 9, and 3 papers for inclusion. These studies also yielded inadequate human data and a general lack of sufficient data to make claims in regards to efficacy for MSC for management of these problems. The studies reviewed show some promise for further investigation but do not meet the scientific rigor to justify wide-spread implementation and use of MSC injection for treatment of knee pain and knee pathology.

DISCUSSION:

Although there is promising in vitro and in vivo animal data the current literature does not provide enough evidence to support mesenchymal stem cell injection for cartilage repair, or treatment of other forms of intra-articular pathology. Promising early studies need to be followed up with more extensive research to justify the high cost and risk of using biologic agents in treating knee pain.

REFERENCES:

1. *Harris JD, et al. Am J Sports Med.* 2013
2. *Centeno CJ, et al. Current Stem Cell Research & Therapy.* 6:368-378 2011

DISCLOSURES:

No external funding was utilized in this project. There are no financial disclosures.



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TRENDS IN CARPAL TUNNEL SURGERY: A SURAVEY OF MEMBERS OF THE AMERICAN SOCIETY FOR SURGERY OF THE HAND (ASSH)

Authors: Justin Munns, MD; Hisham Awan, MD
 Presenter: Justin Munns, M.D.

INTRODUCTION:

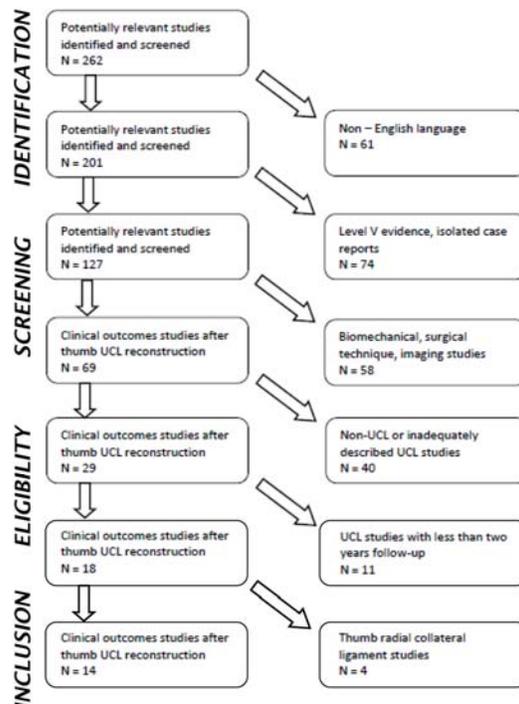
Carpal tunnel syndrome (CTS) represents one of the most common compression neuropathies of the upper extremity, and over 200,000 procedures are performed annually to treat the condition. Despite its prevalence, there is no clear consensus on several elements of surgical practice, preoperative testing, surgical approach, and postoperative management. Our survey study aimed to investigate the current treatment patterns used by members of the American Society for Surgery of the Hand (ASSH) and investigate how several elements of practice vary by surgeon location and experience.

METHODS:

An online survey consisting of 10 questions was created and sent electronically to members of the ASSH. Permission was granted by the ASSH Website Committee to distribute the survey to members using the electronic mailing list. Active, candidate, and international practicing members of the ASSH (n=2413) were invited to participate in completion of the online survey. A brief description of the study and a link to obtain the study via a pop-up window were sent to participants by the investigators. Results of the survey were anonymously uploaded to an online spreadsheet that allowed for tabulation of results. Results were given 3 months to respond to the survey and subsequently tabulated by the authors.

DATA AND RESULTS:

716 surgeons responded to the survey, yielding a response rate of 29.7%. Surgeons were nearly equally represented by region, with the South (24%) most common, and 11% practicing internationally. A wide variation in surgeon experience existed, with the largest representation by surgeons in their 11-20th years of practice (32%), with the smallest representation in those with <3 years of experience (10%) and >30 years (9%). A majority of respondents perform most of their carpal tunnel surgery at an outpatient surgical center (65%)



With regard to elements of surgical workup and management, preoperative electrodiagnostic testing (EMG and nerve conduction studies) were utilized, at least occasionally, by 90% of surgeons. Approximately one-half of respondents (49%) did not provide preoperative antibiotics at the time of surgery, with the remainder prescribing antibiotics at least a portion of the time. For sedation, intravenous sedation with local anesthesia was the most common practice (43%), followed by use of a Bier block (18%). For the incision, a mini-open incision was most commonly used (50%), with 26% performing a 1-incision or 2-incision endoscopic approach most commonly.

For postoperative management, only a minority of surgeons admitted to using a splint postoperatively (29%), and they rarely prescribed a course of therapy postoperatively (12%). Postoperative pain management was variable, with hydrocodone and derivatives given most commonly (61%), with a combination of agents used by 14% of respondents.

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TRENDS IN CARPAL TUNNEL SURGERY: A SURVEY OF MEMBERS OF THE AMERICAN SOCIETY FOR SURGERY OF THE HAND (ASSH), CONTD.

Presenter: Justin Munns, MD

DISCUSSION:

The current study updates a previously performed CTS study performed by Duncan et al in 1987 of members of the ASSH. Though no firm conclusions can be drawn from a survey study, several interesting trends emerged. Smaller incisions are more common: in contrast to the original study in which 65% of surgeons used a wide open incision (>4cm), 50% of current respondents used a mini-open incision. Postoperative immobilization is now much less commonly used (37% of respondents vs 82% previously). Electrodiagnostic testing has become increasingly popular, as approximately 90% of respondents use for preoperative evaluation. Use of surgical centers (65%) is common among hand surgeons performing carpal tunnel surgery, and use of perioperative antibiotics (51%) though controversial is commonly employed. Some variability in surgeon practice also exists when results are broken down by surgeon location, expertise, and practice type.

REFERENCES:

1. Harness et al. Rate of Infection after Carpal Tunnel Release Surgery and Effect of Antibiotic Prophylaxis. **J Hand Surg** 2010; 35A: 189-96.
2. Duncan KH, Lewis RC Jr, Foreman KA, Nordyke MD. Treatment of carpal tunnel syndrome by members of the American Society for Surgery of the Hand: results of a questionnaire. **J Hand Surg** 1987;12A:384-391.
3. Leinberry et al. Treatment of carpal tunnel syndrome by members of the American Society for Surgery of the Hand: A 25-year perspective. **J Hand Surg** 2012; 37A: 1997-2003.

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LONGEVITY OF MIDFOOT AMPUTATIONS IN DIABETIC PATIENTS

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Presenter: Darren Woodruff, DPM

INTRODUCTION:

One of the most devastating complications of diabetes mellitus is the loss of a limb due to severe infection and gangrene. When extensive infection and tissue necrosis have affected the forefoot, a midfoot amputation must be performed in an attempt to prevent sepsis and limb loss. Previous literature has demonstrated that the most distal amputation will provide the most balanced lever arm for functional gait, thus preventing increased metabolic demand on the patient. Various levels of midfoot amputations have been described in the literature. There is little research reporting long term outcomes of these amputations and no studies directly comparing them to the tried and true TMA. We hypothesize that Lisfranc and Chopart amputations will have similar limb salvage rates as the transmetatarsal amputation.

METHODS:

This is a retrospective study evaluating all diabetic patients ages 18-90 years that underwent a midfoot amputation at OSU between January 1st, 2000 to January 1st 2011. Patients were included if they had a midfoot amputation at the transmetatarsal (TMA), tarsometatarsal (Lisfranc), or midtarsal (Chopart) level. Sixty-six TMAs were identified and ten were excluded, 33 Tarsal amputations were identified and four were excluded. Charts were reviewed for age, sex, race, level of amputation, length of follow up, type of diabetes mellitus, smoking status, glycemic control, presence and severity of peripheral arterial disease (PAD), incidence of chronic kidney disease (CKD), incidence of end stage renal disease requiring dialysis, incidence of kidney or kidney – pancreas transplant, and presence of Charcot foot deformity. Outcomes included recurrent ulceration, revision, and limb salvage at 1 year and at last follow up, as well as contralateral limb loss.

DATA AND RESULTS:

Mean follow up in the TMA group was 2.31 years and 1.85 years in the tarsal group. There were no statistically significant differences between the TMA group and the tarsal group for age, sex, or race. There was no predominance of type of diabetes mellitus in either group. There were no significant differences for the incidence of chronic kidney disease, ESRD requiring dialysis, prior transplant, or smoking status. Mean HbA1c was 8.14% in the TMA group and 8.87% in the tarsal group. There was an increased incidence of PAD in the TMA group compared to the tarsal group which was statistically significant. When looking at outcomes, there was no significant difference in wound dehiscence or recurrent wounds, but there was an increased rate of amputation revision in the tarsal group which was statistically significant. The TMA group and the tarsal group had almost identical limb salvage rates at 1 year. Limb salvage at last follow up declines in the tarsal group but remains steady in the TMA group. This change in limb salvage was not statistically significant. When excluding severe PAD, the TMA group had an 88% limb salvage rate at follow up, and the tarsal group had a 57.9% limb salvage rate which was statistically significant. There were similar rates of contralateral limb loss between the TMA and tarsal groups.

DISCUSSION:

The current study data shows similar limb salvage rate as previous studies initially, but as we continue to follow these patients, success declines. It is interesting that the major risk factor for failure of the TMA is severe PAD. When excluding this factor, limb salvage was obtained in 88% of patients at follow up. It appears other factors may be at play in failure of Lisfranc and Chopart amputations. When excluding severe PAD in this arm, limb salvage rates do increase but from 48.28% to only 57.9%. Other factors are likely at play, potentially the equinovarus deformity that may develop leading to breakdown of the amputation stump. Unfortunately our study is retrospective and these findings are not well documented. Attempts at balancing were performed as all patients had Achilles tendon lengthening or tenotomy. Performing routine transfers when possible may prevent these deformities and possibly increase limb salvage rates. Further study into this area would be beneficial. We also note

Continued on Next Page

LONGEVITY OF MIDFOOT AMPUTATIONS IN DIABETIC PATIENTS, CONTD.

Presenter: Darren Woodruff, DPM

the 17% incidence of contralateral limb loss. This is another factor to consider prior to proceeding with tarsal amputations. Every attempt should be made to salvage a limb in patients with contralateral limb loss as bilateral amputations will leave a patient non-ambulatory. The present study does show that Lisfranc and Chopart amputations are viable options for limb salvage when TMA is not feasible. Further study should be given to surgical techniques and prosthetic management to continue to increase limb salvage rates.

REFERENCES:

- Waters RL, et al. JBJS. 58:42-46, 1976*
Belmont PJ, et al. J Am Coll Surg. 213:370-378, 2011
DeCotiis MA. Clin Pod Med Surg. 22:385-393, 2005
Christie J, et al. JBJS. 62:473-474, 1980
Toursarkissian B, et al. Ann Vasc Surg. 19:769-773, 2005
Hosch J, et al. JFAS. 36:430-434, 1997
Krause FG, et al. FAI. 30:486-493, 2009
Younger ASE, et al. FAI. 30:1177-1182. 2009
Anthony T, et al. Am J Surg. 192:e8-e11. 2006
Dudkiewicz I, et al. The Foot. 19:201-204. 2009
Dillon MP, et al. JRRD. 45:1317-1334, 2008
Dillon MP, et al. FAI. 27:110-116, 2006
Larsson ULF, et al. JBJS. 60:126-130, 1978
Roach JJ, et al. Arch Surg. 122:931-934, 1987
Stone PA, et al. Ann Vasc Surg. 19: 805-811, 2005
Elsharawy, MA. Ann Vasc Surg. 25:778-782, 2011

ACKNOWLEDGEMENTS:

None

DISCLOSURES:

None



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EVALUATING RELATIONSHIP BETWEEN BODY MASS INDEX AND OUTCOMES OF MENISCAL REPAIR

Authors: Kyle Randall, MD; David Flanigan, MD; Robert Magnussen, MD
 Presenter: Kyle Randall, MD

Introduction:

It has been well established that excess body weight increases loads through the knee and can lead to accelerated breakdown. Obese individuals go on to develop knee arthritis at a higher rate and younger age than normal weight people [1]. The knee menisci are important structures that are important to knee cartilage preservation. A shift from meniscectomy to preservation of as much meniscus as possible has become a primary goal of treatment. Recent evidence tells us that only ~23% of meniscus repairs fail by 5 years [2]. It is currently unknown if body weight or body mass index (BMI) or weight influences the outcomes of meniscus repair. The null hypothesis for our study was that the body weight or body mass index of patients who had failed meniscal repair (resulting in need for revision repair or partial meniscectomy) would not be significantly different than patients who did not need further surgery.

Methods:

We retrospectively investigated 118 patients in which meniscal repair was performed from 2006-2012, all with at least one year of follow-up. A chart review and phone interviews were used to determine which patients required additional surgery to treat the meniscus tear originally repaired. The primary outcome measure used to determine failure was the need for further surgery by final follow up. The patients were then categorized into two groups; those that failed meniscus repair and those that did not fail. The body weights and BMI were averaged and a t-test was performed with p values <0.05 being significant.

Data And Results:

Results of the review show that 21 patients required further surgery for a retear of the repair (17.8%) and 97 did not require further surgery (82.2%). The mean body weight and BMI of patients with meniscus repair failure was 183.57 and 28.25 respectively. The mean body weight and BMI of patients without the need for further surgery were 184.62(p=0.92) and 27.08 (p=0.42) respectively.

	Total	Did Not Fail	Failed	p values
	118	97 (82.2%)	21 (17.8%)	
Average Weight		184.6 ± 46.9	183.6 ± 38.2	0.92
Average BMI		27.1 ± 6.1	28.2 ± 5.2	0.42

Discussion:

Our findings demonstrate that body weight and BMI of the patient may not be a factor in the need for further surgery in patients who undergo meniscal repair, thus supporting the null hypothesis. To our knowledge there has not been any studies to evaluate the possible relationship between weight, BMI, and meniscus failure. Often when considering repairing a meniscus, patient factors can come into play. This information can serve to give confidence to surgeons attempting an indicated meniscus repair in patients who have an elevated body weight or BMI.

References:

Gelber AC, Hochberg MC, Mead LA, et al. Body Mass Index in Young Men and the Risk of Subsequent Knee and Hip Osteoarthritis. *Am J Med.* 1999; 107:542-548.
 Nepple JJ, Dunn WR, Wright RW. Meniscal Repair Outcomes at Greater Than Five Years, A Systematic Literature Review and Meta-Analysis. *J Bone Joint Surg Am.* 2012; 94:2222-7.

The authors have no financial disclosures related to this study.

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PILOT STUDY FOR THE DESIGN AND IMPLEMENTATION OF AN ORTHOPEDIC SURGICAL TRAINING LABORATORY FOR BASIC MOTOR SKILLS

Authors: Gregory P. Kolovich, MD, MPH; Jonathan M. Christy, MD; Matthew D. Beal, MD; Joel L. Mayerson, MD
Presenter: Gregory Kolovich, MD, MPH

OBJECTIVE:

Our goal was to create a surgical skills training session to educate junior-level orthopedic residents in four core areas: comfort with basic power equipment, casting/splinting, suturing, and surgical instrument identification. We also evaluated residents through pre- and post-written examinations and a novel pre- and post-ankle fracture model after completing skills sessions.

DESIGN:

Prospective, uncontrolled, observational.

SETTING:

A major Midwestern tertiary referral center and academic medical center.

PARTICIPANTS:

Eleven of 15 PGY 1-3 orthopedic residents completed the skills lab.

RESULTS:

For the 11 residents (PGY 1-3) who completed the written examination, the pre-test percentile mean for the group was 87.3 + 10.4. The post-test percentile mean was 92 + 8.4, the median 96, and the mode 96. There was a significant difference noted in pre- and post-testing among all test takers, regardless of level of training ($p = 0.019$). In the ankle fracture model, the overall pre-test percentile mean for the entire group was 68.6 + 13.9. The overall post-test percentile mean for the group was 95.2 + 5.2. There was a significant difference noted in pre- and post-among all test takers, regardless of level of training ($p = 3.27E-20$).

CONCLUSION:

Orthopedic training sessions may be our next best option in teaching residents. While we documented improvement in objective outcomes, we acknowledge little is known or published regarding what the average resident skills are and what is acceptable for graduation. More work is needed to determine what baseline proficiency should be.

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James Taylor, DO is a resident in Orthopaedics at Doctors Hospital

TIBIOTALCALCANEAL ARTHRODESIS NAILS: A COMPARISON OF NAILS WITH AND WITHOUT INTERNAL COMPRESSION UTILIZING THE RAIN DATABASE

Authors: James Taylor DO; Douglas E Lucas DO; Aimee Riley DO; G. Alex Simpson DO; Terrence Philbin DO

Presenter: James Taylor, DO

INTRODUCTION:

Hindfoot arthrodesis using a tibiotalocalcaneal (TTC) intramedullary nail is an increasingly popular treatment modality in combined ankle and subtalar arthritis and other hindfoot pathology. Adequate compression at the arthrodesis site is paramount to avoid nonunion and fatigue fracture of the distal interlocking screws ¹. Arthrodesis systems with internal compression have proved to provide compression superior to those that rely on manual methods ². There are no known previous studies that have compared intramedullary arthrodesis nails containing internal compression methods to those that do not. The objective of this study was to retrospectively examine the hindfoot fusion rate in TTC arthrodesis nail systems with internal compression over those systems requiring compression through external means. Our hypothesis is that arthrodesis nails with internal compression will have higher fusion rates and shorter time to fusion when compared to nails relying on external compression only.

METHODS:

TTC arthrodesis using a retrograde intramedullary nail was performed in 198 patients from 2003-2011. A retrospective chart and radiographic review using the RAIN (Retrograde Arthrodesis Intramedullary Nail) database was performed to identify nail type, fixation mode, preoperative deformity, as well as complication rate. Radiographs were evaluated to determine time to union of the subtalar joint (STJ) and tibiotalar joint (TTJ) independently, when comparing nail type.

DATA AND RESULTS:

The average time to STJ fusion in the group without internal compression was 146 days, compared with 116 days in the group with internal compression ($p < 0.05$). The average time to TTJ fusion in the group without internal compression was 169 days, compared with 153 days in the group with internal compression ($p > 0.05$).

Internal Compression	# of Cases	Avg Time to STJ Union (days)	Avg Time to TTJ Union (days)
No	145	146	169
Yes	53	116	153

DISCUSSION:

As retrograde intramedullary nails have continued to evolve for TTC arthrodesis, the importance of adequate, sustained compression has been integrated into nail design. First generation nails were designed to compress the fusion site manually or with the addition of an external fixator. In a synthetic and cadaveric biomechanical study by Yakacki, et al, they found that first generation IMN compression forces decreased by 90% with less than 1 mm of resorption ³. In an effort to provide sustained compression, second-generation nails added a nail-mounted compression device. A cadaveric study by Berson, et al evaluated and compared manual compression with first generation nails, compression by external fixation in a first generation nail, compression by external fixation in a second generation nail, and nail-mounted internal compression in a second generation nail. They found that the only construct

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TIBIOTALOCALCANEAL ARTHRODESIS NAILS: A COMPARISON OF NAILS WITH AND WITHOUT INTERNAL COMPRESSION UTILIZING THE RAIN DATABASE

Presenter: James Taylor, DO

able to maintain compression at the fusion site was the internally compressed second generation nail, which maintained 60% of its initial compression 1.

Intramedullary hindfoot arthrodesis nail is a viable treatment option in combined degenerative disease of the tibiotalar and subtalar joints. Obtaining adequate compression across the fusion mass is important to patient outcomes. There appears to be a lower rate of nonunion and a faster time to union in intramedullary hindfoot arthrodesis systems containing internal compression compared to those without internal compression.

REFERENCES:

1. *Berson, et al. Foot and Ankle International.* 23:992-995, 2002.
2. *Muckley, et al. Foot and Ankle International.* 28:224-231, 2007.
3. *Yakacki, et al. Foot and Ankle International.* 31:76-85, 2010.

ACKNOWLEDGEMENTS:

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Natalie M. Henke, Research Coordinator, OFAC

DISCLOSURES:

Dr. Philbin is a consultant for Biomet, the manufacturer of one of the TTC arthrodesis systems analyzed in this study.



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PREDICTORS OF DISCHARGE TO AN EXTENDED CARE FACILITY AFTER A SINGLE-LEVEL POSTERIOR SPINAL FUSION PROCEDURES: IMPLICATIONS FOR HEALTHCARE SYSTEM SAVINGS

Authors: Steven Niedermeier, BS; Ryle Przybylowicz, BS; Sohrab Virk, MD; Kari Stammen, ATC and Safdar N. Khan, MD

Presenter: Steven Niedermeier, BS

INTRODUCTION:

With the advent of patient-centered healthcare and value-based treatment, it has become essential that all stakeholders in patient care work to develop an efficient postoperative discharge strategy [1]. Vague postoperative disposition plans lead to a delay in postoperative discharge planning, increase in length of stay, decreased patient satisfaction and increased healthcare costs. The purpose of this study was to determine characteristics of patients undergoing single level spinal fusion surgery that could help predict discharge to an inpatient rehabilitation facility (IRF).

METHODS:

A retrospective comparative study was utilized to investigate the relationship between discharge to IRF and gender, age, body mass index (BMI), Charlson Comorbidity Index (CCI), insurance provider, length of stay (LOS), intra- and postoperative outcomes and readmission rates in patients undergoing single level spinal fusion surgery.

RESULTS:

Demographic, peri- and postoperative characteristics were reviewed for 107 patients who underwent single level spinal fusion surgery between 2011 and 2013 at a high volume orthopaedic level I trauma center. 21.5% (n=23) of these patients were discharged to an IRF. By using unpaired and paired *t* test, it was determined that age, BMI, CCI, LOS [Table 1] and insurance provider were all correlated with a higher probability of being discharged to an ECF [Table 2].

	BMI		Private Insurer		Medicare Insurer	
Mean (SD)	Home (22)	IRF (22)	Home (45)	IRF (6)	Home (23)	IRF (16)
SEM	6.8	7.3	3.62	16.7	7.08	8.1
95% CI	15.53 – 59.70		5.69 – 90.55		(-)2.01 – 56.77	
Paired <i>t</i> -test	<i>p</i> = 0.0019		<i>p</i> = 0.0332		<i>p</i> = 0.0567	

Disposition (n)	Age (years)	BMI	10 yr Survival	LOS (days)
Home (84)	55.5 ± 10.96	30.34 ± 5.73	73.90 ± 28.88	3.70 ± 1.53
IRF (23)	62.65 ± 14.88	38.40 ± 4.76	32.18 ± 33.80	6.17 ± 4.13
Unpaired <i>t</i> -test	<i>p</i> = 0.0120	<i>p</i> < 0.0001	<i>p</i> < 0.0001	<i>p</i> < 0.0001

CONCLUSIONS:

Statistically significant differences were seen regarding age, BMI, CCI, LOS and insurance provider when determining the necessity of a patient being discharged to an IRF. These characteristics can be used to begin the process of setting up discharge disposition preoperatively rather than postoperatively. There were no peri-operative characteristics that were statistically significant in determining discharge disposition; therefore, physicians can utilize these preoperative demographics in deciding and organizing discharge even before the day of surgery, which can diminish LOS and lead to substantial health system savings.

REFERENCES:

- Godil SS, et al. Determining the quality and effectiveness of surgical spine care: patient satisfaction is not a valid proxy. Spine J, 13 (2013), pp. 1006-1012.
- McCarthy IM, et al. Total hospital costs of surgical treatment for adult spinal deformity: an extended follow-up study. Spine J, (2014) [Epub ahead of print].

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Collier Watson, DO is a resident in Orthopaedics at Doctors Hospital

OBTAINING VOLAR TILT IN DISTAL RADIUS FIXATION: USE OF A SCREW AS A PROXIMAL POST

Authors: B. Collier Watson, DO; Freddie D. Persinger, DO; Adam A. Madsen, DO; Benjamin C. Taylor, MD

Presenter: B. Collier Watson, DO

INTRODUCTION:

Volar plating of distal radius fractures was introduced as a means to circumvent some of the issues with dorsal-based plating. Although successful clinical use of volar plating is widely reported, full restoration of palmar tilt is often not obtained. The normal palmar or volar tilt has been reported to be a mean of 10-12°, but multiple clinical reports note that the volar tilt is often restored to an average of 5° or less with volar-based fixation^{1,2}. The true clinical significance of this is unknown, but evidence exists that wrists characterized with a low volar tilt angle are subjected to maximum joint reactive forces up to 50% greater than those with a normal volar tilt angle³.

In our study, we report our technique of utilizing a locking screw as a proximal peg in order to reliably obtain the volar tilt in a simple fashion.

METHODS:

Fifty-one patients underwent open reduction and internal fixation with the use of a volar locking plate for a distal radius fracture. Our technique of using a locking screw as a proximal peg was used in fifteen of the fifty-one patients (29.4%). Radial inclination and volar tilt were measured on the injury and intraoperative radiographs of all patients. The data collected was used to compare those patients in whom the peg screw was used to those patients in who in was not used.

DATA AND RESULTS:

No significant differences were noted for the initial injury parameters measured. Intraoperative radiographs revealed a statistically significant improvement in the volar tilt with the peg group measuring 9.1 ± 2.6 degrees and the non-peg group measuring 7.0 ± 3.4 degrees (p=0.03). This difference equals 2.1 degrees more of volar tilt in the peg group compared to the non-peg group.

Variable	Distal Peg	Non-Peg Fixation	P Value
Injury Parameters			
Radial Inclination (degrees)	16.7 ± 6.8 (1-26)	13.8 ± 8.7 (-7-29.5)	0.22
Volar Tilt (degrees)	-18.6 ± 15.0 (-54.5-10.5)	-10.0 ± 22.4 (-39.5-44.5)	0.13
Intraoperative Parameters			
Radial Inclination (degrees)	22.3 ± 4.0 (15-30.5)	21.9 ± 5.1 (14-35)	0.71
Volar Tilt (degrees)	9.1 ± 2.6 (5-13.5)	7.0 ± 3.4 (-2.5-13)	0.03

Table 1. Radiographic fracture characteristics.

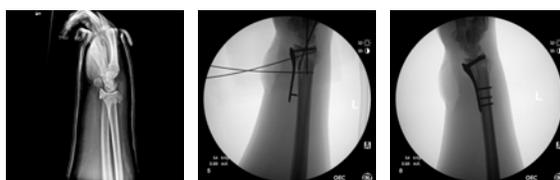


Figure 1.

Figure 1. Figure 1 is a lateral radiograph of a distal radius fracture with loss of volar tilt; our technique of using a screw as a proximal post; the final construct with restoration of the volar tilt.

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OBTAINING VOLAR TILT IN DISTAL RADIUS FIXATION: USE OF A SCREW AS A PROXIMAL POST, CONTD.

Presenter: B. Collier Watson, DO

DISCUSSION:

Anatomic restoration of the distal radius and ulna is imperative for normal wrist function, and open reduction has become increasingly useful in obtaining this goal. McLawhorn et al. recently described a similar technique by using an electrocautery scratch pad deep to the proximal aspect of a volar plate⁴. Unfortunately, no clinical evidence was given along with their technique description, so no evidence exists to help determine if this concept is associated with improved radiographic parameters.

In our series, we used an 8 mm proximal locking screw as a peg after anecdotally recognizing this as an appropriate length during previous procedures. After insertion of this screw into the 2 mm thick proximal plate, 6 mm of threads are exposed through the undersurface of the plate. The 6 mm of exposed threads on the proximal screw leads to a calculated change in volar tilt of 11.3 degrees, according to the formula $\tan^{-1}(b/d)=\theta$, where b is the length of the proximal locking screw and d is the distance to the volar bend in the plate, which serves as a fulcrum during compression of the proximal plate to the bone.

We were able to obtain 2.1° more of volar tilt with the use of a locking screw as a proximal post as compared to those patients whom we did not use a proximal post. Placement of a locked screw in the proximal hole of the plate allows for a reproducible elevation of the proximal aspect of the plate, and therefore, a more reproducible alteration of volar tilt.

REFERENCES:

1. Friberg S, et al. Radiographic measurements of the radiocarpal joint in normal adults. *Acta Radiol.* 1976;17:249.
2. Ginn TA, et al. Use of a distraction plate for distal radius fractures with metaphyseal and diaphyseal comminution. Surgical technique. *J Bone Joint Surg Am.* 2006;88(Supp 1):29-36.
3. Karnezis IA. Correlation between wrist loads and the distal radius volar tilt angle. *Clin Biomech.* 2005;20(3):270-276.
4. McLawhorn AS, et al. Leveraging the plate: Reliably restoring volar tilt of distal radius fractures. *Orthopedics.* 2013;36(12):918-921.

DISCLOSURES:

Dr. Taylor is a consultant for Biomet, speakers' bureau for DepuySynthes, and editorial board for orthobullets.com.



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MICROSURGERY INSTRUCTION IN AN ORTHOPAEDIC SURGERY RESIDENCY

Authors: Julie Balch Samora MD, PhD; Stephanie Stradley PA-C,ATC; Hisham Awan MD; Michael Ruff MD; Ryan Klinefelter MD

Presenter: Julie Balch Samora, MD, PhD

INTRODUCTION:

There has been heightened public concern for patient safety, such that medical providers are under increased scrutiny to demonstrate adequate knowledge, diagnostic capabilities, and expertise in decision-making ability. In surgical fields, it is critically important to demonstrate competence, aptitude, and dexterity, as operative proficiency has been shown to influence outcomes. Therefore, objective assessment of technical skill utilizing valid and reliable tools is of paramount importance.

It is difficult to impartially judge surgical aptitude; clinical observation tends to be subjective with poor interrater reliability. In fact, objective assessment of technical skill has been considered the weakest measurement in surgical training. There is a need for validated assessment tools to determine surgical ability.

Our objective was to create and implement a proficiency-based training curriculum in microvascular surgery for orthopaedic residents rotating on the hand service that would be cost-effective, maintainable, reliable and valid. We hypothesized that all residents would improve their microsurgical skill by the end of the intervention. We also hypothesized that the more senior residents would perform better than the junior residents. The ultimate goals of the curriculum were to enhance the surgical education of orthopaedic residents, and to improve overall performance in the operating room.

METHODS:

Participants were OSU orthopaedic surgery residents rotating on the hand service. There were four phases of training. At the start of the hand rotation, each resident was provided a questionnaire regarding their operative experience. They were provided a brief orientation to the microsurgery laboratory and asked to perform an initial skills exam. They were scored on completion time of the task. The residents were then provided with a one hour training session. They were provided access to the Acland Practice Manual for Microvascular Surgery and the associated videos, and had unlimited access to the laboratory and equipment throughout the duration of the rotation.

At the end of the data collection period, the videotaped sessions were assessed and graded by the hand faculty on a task-specific checklist (which utilized a 3 point scale from 0 to 2), and on a six-domain global rating scale (GRS). All scores were analyzed parametrically using a multivariate analysis of variance. Significant differences were analyzed using a Tukey's post hoc test. Pearson correlation coefficients were used to establish the concurrent validity of our test criteria with the previously validated task-specific checklist and GRS.

DATA AND RESULTS:

We have had a total of eight residents participate in the training to date and not all of the data are yet available for analysis. In general, residents appeared to view the intervention as valuable to their education. Before the intervention, residents had either no comfort performing microsurgery or only some comfort with basic skills. Most residents changed their response to either comfort with basic concepts or comfort with advanced concepts on the post-intervention questionnaire. A majority of residents believed that the course was beneficial (85.7%). All of the residents (100%) would recommend this training to their colleagues. Furthermore, every resident (100%) believed that they were not only better microsurgeons, but better overall surgeons after the training.

At the start of the rotation, the average score on the task-specific checklist was 0.97 for each task. This improved to 1.58 by the end of the rotation, with notable improvements in how instruments were held, in the ability to hold the needle appropriately, and the ability to produce square knots. Not enough data have been collected to determine if there is construct validity.

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MICROSURGERY INSTRUCTION IN AN ORTHOPAEDIC SURGERY RESIDENCY, CONTD.

Presenter: Julie Balch Samora, MD, PhD

DISCUSSION:

Traditionally, there has not been a significant emphasis in orthopaedic residencies to provide training in microsurgical techniques. However, microsurgical skill has become more important in the era of advancing technology, and hand and spine specialists regularly work under a microscope. Hand-eye coordination, manual dexterity, spatial orientation, and good clinical judgment are absolute requirements for a good microsurgeon, and these skills would readily translate to other orthopaedic specialties.

It is imperative to have a reliable and validated assessment tool for objective evaluations of technical ability. We are in the preliminary stages of this teaching program, but have determined thus far that a microsurgical laboratory course does appear to be an effective method to educate residents and improve their overall surgical skill, and is perceived by the housestaff as a valuable aspect of training.

REFERENCES:

1. *Chan, et al. Microsurgery.* 27(5):494-9, 2007
2. *Darzi, et al. BMJ.* 318:887-8, 1999
3. *Kalu, et al. Microsurgery.* 25(1):25-9, 2005
4. *Martin, et al. Br J Surg.* 84(2):273-8, 1997
5. *Reznick, et al. Am J Surg.* 165(3):358-61, 1993

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ARTHROSCOPIC EVALUATION OF SYNDESMOTIC MALREDUCTION AND STABILITY

Authors: Douglas E. Lucas, DO; B. Collier Watson, DO; G. Alex Simpson, DO; Gregory C. Berlet, MD; Christopher F. Hyer, DPM, MS

Presenter: Douglas Lucas, DO

INTRODUCTION:

Ankle fractures are a common injury treated by orthopedic surgeons. The distal tibiofibular syndesmosis can be injured during these fractures and proposes a significant challenge in regard to the diagnosis of instability as well as evaluating reduction after fixation. Fixation of the syndesmosis when unstable is critical to establish ankle stability as well as anatomic force transmission through talus. Failure to do so results in inferior clinical outcomes. Multiple studies have demonstrated that traditional radiographic analysis fails to accurately identify syndesmotiic diastasis, instability and malreduction. Ankle arthroscopy has been proposed as an alternative to traditional radiographic analysis to evaluate both instability and malreduction.

METHODS:

10 trans-tibial amputation cadavers were utilized for this study. Two distinct analyses were undertaken. The first, analysis of instability, utilized two distinct dissections of the ankle. One with a superficial dissection and the syndesmosis intact, the second with a direct disruption of the anterior inferior tibiofibular ligament (AITFL) and the distal 10cm of the interosseous ligament (IOL). The second analysis was of syndesmotiic malreduction. For this all 10 specimens underwent complete disruption of the syndesmosis and subsequent fixation in either anatomic alignment or were malreduced in either 5mm of sagittal plane or 15 degrees of internal or external rotation displacement. All specimens were placed into a traction tower with non-invasive traction applied. Both analyses were performed by surgeons blinded to the condition of the syndesmosis.



DATA AND RESULTS:

Two groups of surgeons were able to identify syndesmotiic instability a combined 75% of the time. Malreduction diagnosis was mixed with a 100% accurate diagnosis of sagittal plane displacement but only 50% accuracy for rotation and 17% for an anatomic reduction.

DISCUSSION:

Syndesmotiic injury during ankle fracture presents a significant problem to the treating surgeon. Intra-operative radiographic analysis has been shown to be ineffective at diagnosing both instability and malreduction. Many studies have focused on additional radiographic images or intra-operative CT to help decrease malreduction rates. Other authors have focused on open reduction

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ARTHROSCOPIC EVALUATION OF SYNDESMOTIC MALREDUCTION AND STABILITY, CONTD.

Presenter: Douglas Lucas, DO

and direct visualization with fixation and shown improved outcomes. Ankle arthroscopy has been shown in the literature to be highly sensitive for diagnosing instability but has not been evaluated in diagnosing malreduction. The current study shows moderate success in diagnosing both malreduction and instability. More studies are needed to completely elucidate the role of ankle arthroscopy for this injury.

REFERENCES:

1. Gardner M. Malreduction of the tibiofibular syndesmosis in ankle fractures. *Foot and Ankle International* 2006;27(10):787–92.
2. Lui TH, Ip K, Chow HT. Comparison of radiologic and arthroscopic diagnoses of distal tibiofibular syndesmosis disruption in acute ankle fracture. *Arthroscopy*. 2005;21(11):1370.
3. Miller A, Carroll E, Parker R. Direct visualization for syndesmotom stabilization of ankle fractures. *Foot ankle Int*. 2009;30(5):418–26.
4. Shah A, Kadakia A. Radiographic evaluation of the normal distal tibiofibular syndesmosis. *Foot and Ankle International* 2012;33(10):870–876.
5. Sagi HC, Shah AR, Sanders RW. The functional consequence of syndesmotom joint malreduction at a minimum 2 -year follow-up. *J. Orthop. Trauma*. 2012;26(7):439–43.
6. Takao M, Ochi M, Oae K, Naito K, Uchio Y. Diagnosis of a tear of the tibiofibular syndesmosis. The role of arthroscopy of the ankle. *J. Bone Joint Surg. Br*. 2003;85(3):324–9.

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DISCLOSURES:

Funding for this cadaveric study was provided by DJO Global.



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PARTIAL FLEXOR TENDON LACERATION ASSESSMENT: INTER-AND INTRA OBSERVER RELIABILITY

Authors: B. Justin Barker MD; Greg Kolovich MD; Ryan D. Klinefelter MD

Presenter: B. Justin Barker, MD

INTRODUCTION:

The treatment of partial flexor tendon lacerations is controversial with no clear consensus in the literature. The majority of hand surgeons indicate that they would perform tenorrhaphy for a laceration that involves >50% of the cross-sectional area of a tendon. Accurate assessment of partial-thickness flexor tendon lacerations in the hand however, is difficult due to the subjectivity of evaluation. The purpose of this study was to determine the inter- and intra-observer reliability of surgeons in assessing the percentage of cross-sectional area injured in partially lacerated digital flexor tendons. We hypothesized that accuracy and agreement would be poor among participants.

METHODS:

Using 1 fresh-frozen human cadaver arm, partial transverse incisions were made in the volar substance of 8 FDP and 4 FDS tendons. Two PGY-I, two PGY-III, two PGY-V orthopaedic residents, and four fellowship-trained hand surgeons were then asked to determine the percentage of total cross-sectional area lacerated. They also indicated whether or not they would perform tenorrhaphy on the affected tendon. The participants then repeated the exercise with the same specimen on a separate occasion.

The tendons were then dissected free and measurements of the tendons were taken using a digital micro-caliper at both the injured and uninjured portions. Cross-sectional area was calculated assuming a regular ellipsoid shape of the tendons. Statistical analysis was then used to determine accuracy, inter-observer and intra-observer agreement.



DATA AND RESULTS:

Overall estimates for all ten participants differed significantly from calibrated measurements ($p < 0.0006$). Grouped estimates for residents ($p < 0.0025$) and fellowship-trained hand surgeons ($p < 0.0002$) also differed significantly. Third year residents were the most accurate among residents and there was no difference in accuracy between residents and fellowship-trained hand surgeons. Overall interobserver agreement was poor for both initial (15.83%) and secondary (15.52%) readings. There was moderate overall intraobserver agreement (45.83%). Fellowship-trained hand surgeons and first year residents had the highest intra-observer agreement (50.0%).

DISCUSSION:

The assessment of partial flexor tendon lacerations is subjective at best. One study indicated that fellowship-trained hand surgeons use naked eye assessment 86% of the time and additional aids such as loupe magnification (39%) or rulers / calipers (11%) infrequently to help guide clinical decision making when treating partial lacerations. This difficulty was highlighted in our study despite examining our specimen under an operating microscope with a digital micro-caliper accurate to 0.01mm.

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PARTIAL FLEXOR TENDON LACERATION ASSESSMENT: INTER-AND INTRA OBSERVER RELIABILITY, CONTD.

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CONCLUSION:

Both accuracy and inter-observer agreement were poor among residents and fellowship-trained hand surgeons, however, moderate intra-observer agreement was demonstrated. Third year residents were the most accurate among residents while fellowship-trained hand surgeons and residents achieved an equivalent accuracy. These results highlight the difficulty of accurate assessment of flexor tendon lacerations due to the subjective nature of independent evaluation which does not appear to improve with surgeon experience. Given this difficulty, the decision for tenorrhaphy may be better made based on mechanical symptoms such as catching or triggering of partially lacerated flexor tendons.

REFERENCES:

1. *McCarthy D, et al. J Hand Surg. 20(2):273-75, 1995*
2. *Grewal R, et al. J Hand Surg. 21(6):978-83, 1996*
3. *Manning D, et al. J Hand Surg. 35(1):11-8, 2010*

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