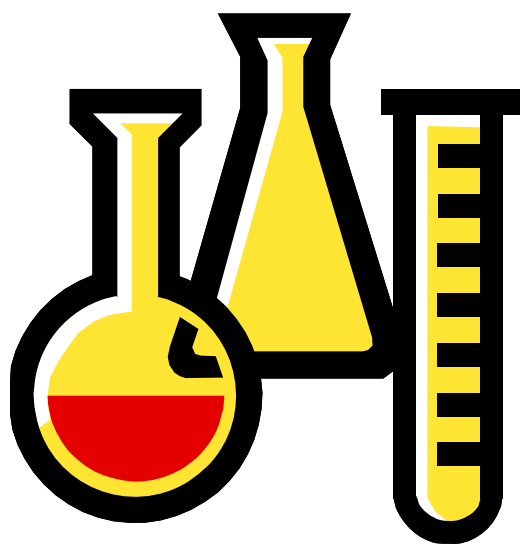


THE OHIO STATE UNIVERSITY

*41st Annual
Mallory-Coleman
Resident Research Day*



Friday, June 7, 2013

Blackwell Hotel and
Conference Center



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:

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

2013 MALLORY-COLEMAN VISITING PROFESSOR AND MODERATOR:

HOWARD AN, M.D.



Dr. An is a renowned spine surgeon and researcher for disorders of the spine. As one of the leading authorities on spinal surgery, Dr. An has published more than 270 articles, 100 chapters and 20 books on spinal surgery and instrumentation. Dr. An holds the inaugural Morton International Endowed Chair position at Rush University Medical Center since 1997, and is currently Director of Spine Surgery and Spine Fellowship Program at Rush. Dr. An served as Director of

Spine Surgery for eight years at the Medical College of Wisconsin. A medical graduate from the Medical College of Ohio in 1982, Dr. An stayed at the school to complete his internship and residency in orthopedic surgery. He followed his internship and residency with a spine surgery fellowship at Rothman Institute-Pennsylvania Hospital and Jefferson Medical College in Philadelphia.

Dr. An is a recipient of the 1990 North American Traveling Fellowship from the American Orthopaedic Association and the 1995 Scoliosis Research Society Traveling Fellowship, Kappa Delta Elizabeth Winston Lanier Award from Orthopaedic Research Society in 2011 and served as the President of International Society for the Study of the Lumbar Spine in 2010.

Dr. An is currently involved in research in the fields of spinal biomechanics and tissue engineering with funding from NIH, industries, and foundations.

PROGRAM

- 7:00 am **Welcome and Introduction**
- 7:15 am **Jeffrey Backes, M.D.**
“Dexamethasone Reduces Length of Hospitalization and Improves Postoperative Pain and Nausea After Total Joint Arthroplasty: A Prospective, Randomized Controlled Trial”
- 7:30 am **Olukemi Fajolu, M.D.**
“Radius of Curvature of the Capitate and Lunate: A Cadaveric Study”
- 7:45 am **Ryan Harrison, M.D.**
“A Biomechanical Comparison of Trochanteric Femoral Nails Used in Stable and Unstable Intertrochanteric Femur Fractures With and Without Distal Interlocking Screws”
- 8:00 am **Val Irion, M.D.**
“The Treatment and Outcomes of Medial Malleolar Stress Fractures: A Systematic Review of the Literature”
- 8:15 am **Erik Kroger, M.D.**
“Patient Specific Total Knee Replacement: How Does it Affect Cost? Experience at a Single Academic Institution”
- 8:30 am **Vincent Nerone, D.P.M.**
“Re-Amputation after Minor Foot Amputation in Diabetic Patients: Risk Factors Leading to Limb Loss”
- 8:45 am **Jonathan Christy, M.D.**
“Pilot Study for the Design and Implementation of a Orthopaedic Surgical Training Laboratory for Basic Motor Skills”
- 9:00 am **Aleksander Tancevski, M.D.**
“Necrotizing Fasciitis in a Pediatric Orthopaedic Population”
- 9:15 am *Break*
- 9:30 am **John Idoine, D.O.**
“Plating of Acute Humeral Diaphyseal Fractures Through an Anterior Approach in Multiple Trauma Patients”
- 9:45 am **Vincent Ng, M.D.**
“Custom Instruments are Superior to Standard for Knee Arthroplasty Evaluated with Computed Tomography”
- 10:00 am **Jill Wilmoth, M.D.**
“Osteosarcoma: A Meta-analysis and retrospective review”
- 10:15 am **Kevin Springer, M.D.**
“Rate of Residual Osteomyelitis after Partial Foot Amputation in Diabetic Patients A Standardized Method for Evaluating Bone Margins with Intraoperative Culture”
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| 10:30 am | Craig Dimitris, M.D.
<i>"Perioperative Morbidity and Mortality of Two-Team Simultaneous Bilateral Total Knee Arthroplasty"</i> |
| 10:45 am | Michael Mariscalco, M.D.
<i>"The Influence of Hamstring Autograft Size on Patient Reported Outcomes and Risk of Revision Following Anterior Cruciate Ligament Reconstruction: A MOON Cohort Study"</i> |
| 11:00 am | Carman Quatman, M.D.
<i>"Novel Methods to Practice Personalized Medicine in an Evidence Based Orthopaedic Setting"</i> |
| 11:15 am | Howard An, M.D., Visiting Professor and Moderator
<i>"Lumbar Degenerative Disorders: Current Treatment and Basic Science Research"</i> |
| 12:30 pm | Lunch |
| 1:30 pm | Dane Hansen, D.O.
<i>"Comparison of Outcomes of Robotic and Manually Implanted Unicompartmental Knee Arthroplasty"</i> |
| 1:45 pm | Benjamin Curtis, M.D.
<i>"Biomechanical Comparison of Intramedullary Nail, Crossed K-wires, and Plate-Screw for Fixation of Metacarpal Shaft Fractures "</i> |
| 2:00 pm | Douglas Lucas, D.O.
<i>"Comparing Complications and Cost for Two Types of Fixation Used for Calcaneal Displacement Osteotomies "</i> |
| 2:15 pm | Julie Samora, M.D.
<i>"Is There Still a Place for Cast Wedging in Pediatric Forearm Fractures?"</i> |
| 2:30 pm | Sohrab Virk, M.D.
<i>"The Cost Effectiveness of Polyetheretherketone (PEEK) Cages for Anterior Cervical Discectomy and Fusion"</i> |
| 2:45 pm | Nathan Formaini, D.O.
<i>"Superior Versus Anterior Plating of Clavicle Fractures: Comparisons and Functional Outcomes"</i> |
| 3:00 pm | Adam Madsen, D.O.
<i>"Perioperative Safety of Two-Team Simultaneous Bilateral Total Knee Arthroplasty in the Morbidly Obese Patient"</i> |
| 3:15 pm | Eric Skinner,
<i>"Gene Expression of Osteoarthritis: A Meta-Analysis"</i> |
| 3:30 pm | Greg Kolovich, M.D.
<i>"Assessing the Impact of Organized Youth Baseball and Youth Climate Differences in Elite Major League Baseball Pitchers"</i> |
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DEXAMETHASONE REDUCES LENGTH OF HOSPITALIZATION AND IMPROVES POSTOPERATIVE PAIN AND NAUSEA AFTER TOTAL HIP ARTHROPLASTY: A PROSPECTIVE, RANDOMIZED, CONTROLLED TRIAL

Authors: Jeffrey Backes, M.D.; Jared Bentley, M.D.; Matthew Clayton, M.D.;
Joel Politi, M.D.; Bryan Chambers, M.D.
Presenter: Jeffrey Backes, M.D.

INTRODUCTION: Controlling postoperative pain and nausea after total joint arthroplasty remains an important challenge. We hypothesized that the addition of perioperative dexamethasone to our multimodal regimen would reduce opioid and antiemetic consumption, improve subjective pain and nausea scores, improve mobilization, and shorten length of hospital stay (LOS)

METHODS: 120 patients undergoing elective, unilateral, total hip or knee arthroplasty were enrolled. Patients were randomized into one of three groups:

--Group 1 received **Zofran** 4 mg IV intraop.

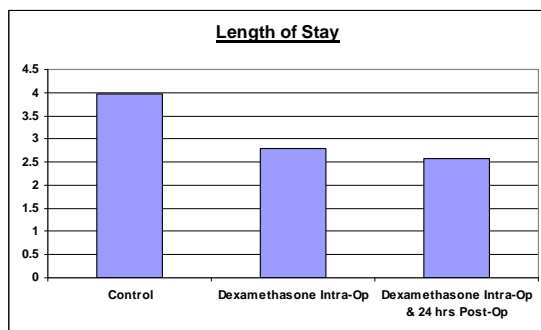
--Group 2 received **dexamethasone** 10 mg IV and **Zofran** 4 mg IV intraop.

--Group 3 received **dexamethasone** and **Zofran** (as administered for Group 2) *and a second dose of dexamethasone* 10 mg IV 24 hours postop. All patients followed an otherwise identical perioperative protocol.

A two sample *t*-test was used to compare group 1 and patients that received dexamethasone intraoperatively (group 2 + 3). Separate comparisons were also made between group 2 and group 3 to determine if the 24-hr postoperative dose of dexamethasone had a continued effect. P-values <0.05 were considered statistically significant.

RESULTS:

Intraoperative dexamethasone (groups 2 + 3) had significantly shorter LOS versus group 1 (3.97 vs 2.78 days, $p < 0.001$). Postop dexamethasone (group 3) further shortened LOS compared to group 2 (2.57 vs 3.0 days, $p < 0.005$).



Compared to group 1, patients receiving intraop dexamethasone (groups 2+3) showed:

--Superior feet ambulated on POD 0, 1, and 2 (20.0 vs 43.4 $p = .001$, 60.1 vs 96.6 $p = 0.005$, 92.4 vs 150.7 $p < 0.001$).

--Less PCA utilization (2.53mg vs 4.26 mg, $p = 0.03$).

--No significant difference in PACU narcotic requirements.

--Lower daily mean subjective VAS pain and nausea scores ($p = 0.000$ for all comparisons).

--Less than half the amount of opioid (mg) consumption on PODs 0, 1, and 2 (15.9 vs 4.2 $p = 0.003$, 47.4 vs 20.2 $p = 0.000$, 59.9 vs 18.7 $p = 0.003$)

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DEXAMETHASONE REDUCES LENGTH OF HOSPITALIZATION AND IMPROVES POSTOPERATIVE PAIN AND NAUSEA AFTER TOTAL HIP ARTHROPLASTY: A PROSPECTIVE, RANDOMIZED, CONTROLLED TRIAL, CONTD.

Presenter: Jeffrey Backes, M.D.

--Less rescue antiemetic medication (mg) consumption in the PACU, and PODs 0, 1, and 2 (2.0 vs 0.49 p=0.006, 3.26 vs 0.75 p=0.000, 2.89 vs 0.039 p=0.000, 1.88 vs 0.25 p= 0.000)

--For diabetics pts only: an increased mean POD 2 blood glucose (137.3 vs 152.9 p=0.012) and pre-op to POD 2 blood-glucose change (-12.1 vs 12.7 p=0.001)

--No change in WBC count

--No adverse events (superficial or deep infections, AVN, DVTs, manipulations)

Compared to group 2, the additional post-op dose of dexamethasone (group 3) resulted in:

--Less opioid (mg) consumption on POD 2 (24.4 vs 15.1 p=0.015)

--Less antiemetic consumption on POD 2 (p=0.007).

--Lower POD 2 VAS pain scores (p=0.000).

--For diabetic pts only: a greater change in mean blood glucose from pre-op to PODs 1 and 2 (p=0.012)

DISCUSSION: The addition of intraoperative dexamethasone 10 mg IV to a comprehensive multimodal regimen improves antiemetic and analgesic control, enhances mobility, and shortens hospital length of stay after total joint arthroplasty. A second, postoperative dose of dexamethasone 10 mg IV provides significant additional pain and nausea control and further reduces length of stay.



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RADIUS OF CURVATURE OF THE CAPITATE AND LUNATE: A CADAVERIC STUDY

Authors: Olukemi Fajolu, M.D.; Lauren MacCormick, B.S.; James Kim, B.S.; Gregory Kolovich, M.D.; Hisham Awan, M.D.
Presenter: Olukemi Fajolu, M.D.

INTRODUCTION:

A proximal row carpectomy (PRC), where the scaphoid, lunate and triquetrum are excised, is used for a variety of wrist conditions. It has been suggested that when the lunate is excised, there is a mismatch with respect to the radius of curvature between the capitate and the lunate fossa of the distal radius. This mismatch is proposed to lead to failure of a PRC with subsequent progressive disease. In addition, the morphology of the lunate may contribute to this mismatch. A type 2 lunate has an extra medial hamate facet as compared to a type 1 lunate. Type 2 lunates are thought to be accompanied by a more pointed capitate, and therefore a less congruous match of the articular morphology.

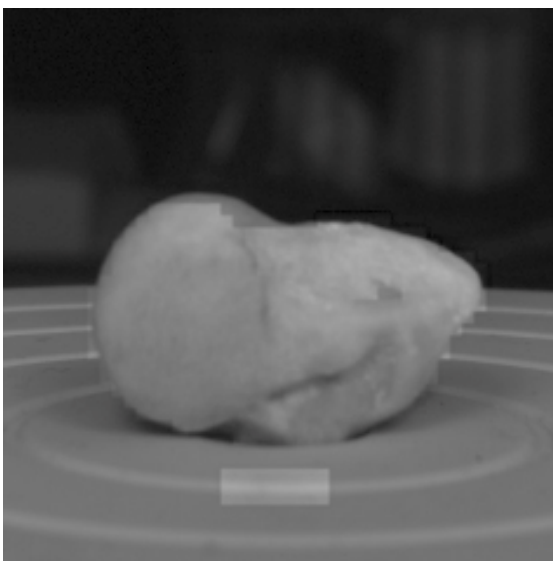
The proposed question to be answered is how closely the radius of curvature (ROC) of the proximal capitate correlates with that of the proximal lunate. The second proposed question is whether or not there is a difference between type 1 and type 2 lunates. This is clinically relevant because it may assist in predicting which patients would benefit from a PRC. The null hypothesis that is being tested is that there is not a statistically significant difference between the curvature of the capitate and that of the lunate. The second null hypothesis is that there will not be a difference in our findings when comparing type 1 and type 2 lunates.

METHODS:

15 sets of cadavers were studied, 5 type 1 and 10 type 2 lunates. The type 1 and type 2 lunates were matched for age and gender. A NextEngine 3D scanner was used to take representative images of the carpal bones. The scans were imported into Rapidform XO, a specialized computer software. The circularity and radius of curvature were measured on each capitate and lunate in a 3D model. The Paired t-test was used for statistical analysis.

DATA AND RESULTS:

The mean radius of curvature of the capitate was found to be 8.62mm as compared to the radius of curvature of the lunate, 10.99mm, which was found to have a statistically significant difference. We did not find a difference between the ROC of capitates associated with type 1 and type 2 lunates. We did, however, notice a statistically significant difference between the lunate and the capitate ROCs among type 2 lunates.



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RADIUS OF CURVATURE OF THE CAPITATE AND LUNATE: A CADAVERIC STUDY, CONTD.

Presenter: Olukemi Fajolu, M.D.

DISCUSSION:

Successful outcomes after a proximal row carpectomy are variable. It would be beneficial to stratify patients based on whether or not they would have a favorable result after this procedure. There have been a few studies looking at radius of curvature, but the majority of these are image based using combination of x-ray and MRI. The majority of data in the literature is 2 dimensional. To our knowledge, this is the first study to evaluate this data in a three dimensional model using cadaveric specimens. One recent study comparing type 1 and type 2 lunates, did not observe a difference in circularity or radius of curvature. In our study, when comparing ROC of capitates to lunates, in the subset of type 2 lunates, there was a noticeable difference.

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ACKNOWLEDGEMENTS

Lyman Jellema

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DISCLOSURES:

No disclosures to present.



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A BIOMECHANICAL COMPARISON OF TROCHANTERIC FEMORAL NAILS USED IN STABLE AND UNSTABLE INTERTROCHANTERIC FEMUR FRACTURES WITH AND WITHOUT DISTAL INTERLOCKING SCREWS

Authors: Ryan Harrison, M.D.; B. Audrey Nguyen; Alan Litsky, M.D., Sc.D.; Michael Quackenbush, D.O.
Presenter: Ryan Harrison, M.D.

INTRODUCTION: Intertrochanteric hip fractures comprise approximately 50% of all hip fractures and 50-60% of these are classified as unstable¹. Intramedullary fixation is a viable option for treating these fractures^{2,7}. Intramedullary devices allow for proximal fixation and can facilitate controlled collapse and compression of the fracture fragments. The implants can be locked distally to control for rotation and translation. Most of the literature discussing unstable intertrochanteric fractures^{2,8} suggest that unstable fracture patterns be treated with a distally locked nail; one recent retrospective study suggests that distal interlocking is unnecessary in unstable fracture patterns⁹. Distal locking can complicate the surgical procedure, increasing operative time and radiation exposure. Foregoing the insertion of distal locking screws distally simplifies the process, reducing operative time and blood loss in a vulnerable patient population.

The goal of this study was to determine if unstable, type OTA 3A2 intertrochanteric femur fractures are more stable to axial loading with distal interlocking screws.

METHODS: Thirty-two fresh frozen human cadaver femurs (16 male and 16 female), age ≥ 65 , were stripped of the soft tissues and Trochanteric Femoral Nails (TFN, Synthes) were inserted according to manufacture's guidelines. Placement of the blade in the center-center position of the femoral head and appropriate tip-apex distance ($<25\text{mm}$) were verified using fluoroscopy. Femora were randomly assigned to one of four groups: stable (OTA 3A1) or unstable (OTA 3A2), with or without distal interlocking. Osteotomies were created in each femur along the intertrochanteric line both anterior and posterior (Fig 1). For the stable fractures, the lesser trochanter and medial calcar were left intact; for the unstable fractures the lesser trochanter and medial calcar were removed (Fig 2). Interlocking was accomplished using the "perfect circles" technique. Screws were placed into the static distal interlocking hole.



Figure 1. Stable Fracture

Each of the femora were secured for testing in the MTS machine in anatomical orientation. The distal femur was potted in Bondo and allowed to set for at least one hour. The specimens were preloaded to 100 N of axial compression. Each specimen was then cyclically loaded from 100 to 300 N at 1 Hz for 10 cycles, then the maximum load was increased in 100 N increments for 10 cycles, up to 2000 N. If the specimen had not failed, it was loaded in a cyclic fashion from 100 to 2000N at 3 Hz until failure which was defined as 10 mm of collapse of the construct. The maximum displacement at each load level was recorded and differences between the groups explored by ANOVA.



Figure 2. Unstable Fracture

RESULTS: The maximum displacement of each specimen was recorded at loads from 300 – 2000 N. The displacement values within each of the four groups were then averaged and compared (Fig 3) using ANOVA. The average displacement for each of the groups except for the unstable-unlocked group remained equivalent until 1300N, where the stable-locked group displayed greater displacement than the other two groups at each successive increase in force. In the unstable/unlocked group, the amount of displacement was significantly greater than each of the other three groups at every level of force above 600N.

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A BIOMECHANICAL COMPARISON OF TROCHANTERIC FEMORAL NAILS USED IN STABLE AND UNSTABLE INTERTROCHANTERIC FEMUR FRACTURES WITH AND WITHOUT DISTAL INTERLOCKING SCREWS, CONTD.

Presenter: Ryan Harrison, M.D.

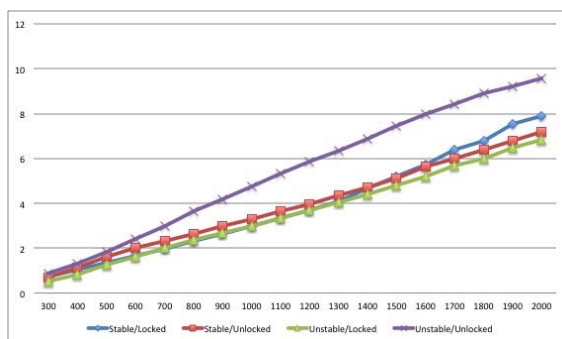


Figure 3. Displacement versus load. The amount of displacement (in mm) for each of the 32 samples was recorded at increasing amount of force from 300 – 2000N. These values were then averaged and compared among groups.

DISCUSSION: When intramedullary fixation of femur fractures is chosen, the gold standard is thought to be a long, statically locked nail. We designed this study in an effort to determine whether such fixation was necessary in any or all intertrochanteric femur fractures treated with intramedullary fixation.

In comparing each of the four groups, static distal interlocking afforded the same stability to the unstable fracture patterns as the stable, unlocked fractures in terms of the amount of displacement. In the stable fractures that were locked distally, however, there was an increase in the amount of displacement measured at levels greater than 1300N. Unstable, unlocked fractures had significantly greater levels of displacement at all levels of force above 600N.

Based on our results, it seems that unstable intertrochanteric femur fractures benefit from distal interlocking. Stable fracture patterns, however, seem to do better without distal interlocking. Further research is necessary to determine the significance of these findings in clinical practice.

ACKNOWLEDGEMENTS: We thank Synthes for their donation of implants and financial support for this project.

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THE TREATMENT AND OUTCOMES OF MEDIAL MALLEOLAR STRESS FRACTURES: A SYSTEMATIC REVIEW OF LITERATURE

Authors: Val Irion, M.D.; Timothy Miller, M.D.; Christopher Kaeding, M.D.
Presenter: Val Irion, M.D.

INTRODUCTION:

Stress fractures are overuse injuries that can be difficult to treat. Stress fractures can be classified as low or high risk based on the ability to heal the injury [1]. The medial malleolus is considered a high risk stress fracture and can be debilitating to the highly active or athletic population [2]. A range of treatment methods have been described with varying outcomes. Currently, there is no gold standard treatment option with optimal results that is described.

Our literature search was based on the following question: "What treatments have been described for stress fractures of the medial malleolus, and what are the outcomes of each treatment type?" Our aim and purpose in this search was to determine if a gold standard for treatment exists for this entity that would optimize treatment outcomes. Our working hypothesis was that there would be no difference in outcomes based on the various treatment options.

METHODS:

Following the guidelines set forth by Wright, et al. [3] in 2007, the authors of this paper performed a systematic review of the literature regarding the treatment of medial malleolus stress fractures. A search of the literature was conducted using OVID/MEDLINE, EMBASE, and the Cochrane Library from 1950 to September 2012. Included studies were level IV evidence or above with mention of treatment and outcomes of medial malleolus stress fractures. Two authors independently reviewed the selected articles and created individual tables which were later compiled into a master table for final analysis. A third author was available to resolve any disputes between reviewers.

DATA AND RESULTS:

10 publications were produced from an exhaustive search. All of the publications were retrospective case series. A total of 35 patients were treated within the 10 papers. 80% of the patients were male with the average age of 23.6 years old. 91.4% of patients were at least involved in recreational athletics and 16/35 (45.7%) were elite level athletes. Plain x-ray, CT, MRI, and bone scan were used for diagnostic purpose with x-ray being the most common diagnostic tool used in 100% of patients. All patients treated were able to return to sport including all the elite level athletes who were able to return to the same level prior to the injury. Complications were seen in both groups ranging from minor stiffness to non-union requiring open reduction internal fixation. Patients who were treated operatively were found to have definitive healing over 2 weeks sooner than the non-operative group after one outlier patient was removed. Time away from sport or training was found to be over 5 weeks less in the operative group compared to the non-operative group.

	Non-Operative	Operative
Total Patients	19	16
Average time to healing	14.1 weeks (range: 5-24)	13.5 weeks (range: 4-32)*
Time missed to activities	8.4 weeks (range: 3-20)	3.2 weeks (range: 2-12)
Complications	3 (15.8%)#	4 (25%)

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THE TREATMENT AND OUTCOMES OF MEDIAL MALLEOLAR STRESS FRACTURES: A SYSTEMATIC REVIEW OF LITERATURE, CONTD.

Presenter: Val Irion, M.D.

*Removal of an outlier patient who failed previous ORIF would reduce the operative average time to healing to 11.9 weeks (range 4-24 weeks).

#One complication was failure to recognize stress fracture on initial films.

DISCUSSION:

Overuse type injuries such as these can be difficult to manage. This review illustrates that medial malleolar stress fractures can be managed successfully both operatively and non-operatively with a low rate of complications and high rate of return to previous activity level. Various factors including fracture displacement, activity level of the patient, elite level athletic participation, and in-season injury should serve as a guide to physicians for operative versus non-operative treatment recommendations. Medial malleolus stress fractures, while uncommon, can be quite debilitating especially for the high level running and jumping athletes. While both non-operative and operative interventions have proven to be successful in regards to healing and return to play, perhaps early operative intervention creates a higher likelihood of early healing, earlier decrease in symptoms, and earlier return to play.

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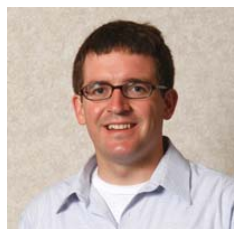
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ACKNOWLEDGEMENTS:

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DISCLOSURES:

The authors have no disclosures or conflicts of interest regarding this paper.



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PATIENT SPECIFIC TOTAL KNEE REPLACEMENT: HOW DOES IT AFFECT COST? EXPERIENCE AT A SINGLE ACADEMIC INSTITUTION

Authors: Erik Kroger, M.D.; Matthew Beal, M.D.
Presenter: Erik Kroger, M.D.

INTRODUCTION:

Total knee arthroplasty is one of the most common surgeries performed in the United States at a rate of more than 500,000 surgeries per year. Hospitals, implant manufacturers, and surgeons have made great efforts to try to improve efficiency and decrease costs associated with surgery. One of these efforts has been to produce patient matched cutting blocks based upon pre-operative 3-D imaging. The theoretical benefits include decreased operative time and decreased costs associated with tray sterilization. However, it is unclear if these theoretical cost savings are realized in practice. Also, there are additional costs to the patient associated with obtaining pre-operative 3-D imaging.

The purpose of this study is to compare costs, both direct and indirect, of patient specific cutting blocks versus standard cutting blocks as they affect patients out of pocket payments and hospital costs at a single academic institution. We hypothesize that there will be no significant difference in terms of cost to either the hospital or to the patient in using patient specific instrumentation.

METHODS:

We conducted a retrospective review of patients who underwent primary total knee replacement using patient specific cutting blocks at the Ohio State University Medical center between January 1, 2012 and March 31, 2013 and a time matched cohort of patients undergoing total knee replacement using standard instrumentation. All patients were treated by the same surgeon (MB) and utilized the same implant system (Zimmer NexGen). All patient specific instrumentation was created based upon pre-operative MRI of the associated knee. We excluded patients undergoing revision surgery, simultaneous bilateral total knee replacements, and those who were participating in a separate research study in which operative time was extended.

We obtained total charges related to surgery, net revenue, total direct cost, total indirect cost, and net gain/loss to the hospital. We also collected total physician related billing, total out of pocket cost to the patient for both surgery and pre-operative 3-D imaging.

We also collected total operative time for each case, as well as estimated implant tray usage and associated costs. We estimated associated costs with regard to operative time and tray sterilization.

We compared these two groups of data sets utilizing a paired Student's t-test.

DATA AND RESULTS:

Our study demonstrated no significant difference in terms of total charges, indirect cost, or direct costs to the hospital between the two implant systems studied. There was a significant difference between net revenue ($p=0.046$), contribution margin ($p=0.037$), and net gain/loss ($p=0.035$) in favor of patient specific instruments in comparison to standard instruments.

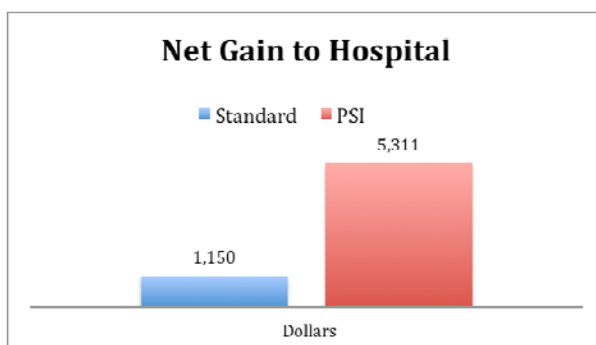
Our data demonstrated significantly higher out of pocket costs to patients utilizing patient specific instrumentation ($p=0.004$) even before factoring in costs associated with the pre-operative MRI.

There was no significant difference in operative time between the two systems. Cost savings achieved through a reduction in the number of implant trays was also minimal.

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PATIENT SPECIFIC TOTAL KNEE REPLACEMENT: HOW DOES IT AFFECT COST? EXPERIENCE AT A SINGLE ACADEMIC INSTITUTION, CONTD.

Presenter: Erik Kroger, M.D.



DISCUSSION:

This study demonstrated statistically significant increase in hospital net revenue, contribution margin, and profit from those patients receiving primary total knee arthroplasty utilizing patient specific instrumentation compared to standard instrumentation. Additionally, there was a statistically significant increased out of pocket patient costs associated with PSI. We did not demonstrate a significant decrease in operative time or costs associated with implant tray sterilization. This data suggests that while patient specific instrumentation may prove cost-effective from the hospital standpoint, they appear to have associated increased costs to patients.

This study has significant limitations including sample size, differences in insurance, and the necessary use of estimates for OR time and tray sterilization. Further studies utilizing larger sample sizes and matched insurance status based on population are needed.

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DISCLOSURES:

The authors have no relevant disclosures with regard to this study.



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RE-AMPUTATION AFTER MINOR FOOT AMPUTATION IN DIABETIC PATIENTS: RISK FACTORS LEADING TO LIMB LOSS

Authors: Said Atway, D.P.M.; Kevin Springer, D.P.M.; Darren Woodruff, D.P.M.;
Vincent Nerone, D.P.M.
Presenter: Vincent Nerone, D.P.M.

INTRODUCTION:

The rate of re-amputation in diabetic patients is alarming. Izumi et al have shown a 26% rate at 1 year, 48.3% at 3 years, and 60.7% at 5 years. (1) Few studies have been performed to evaluate for risk factors for re-amputation and none to stratify between minor foot re-amputation and a major amputation, such as a transtibial or transfemoral amputation. (2-4) Our study set to determine differences between diabetic patients having recurrent minor foot amputations and those going on to limb loss. We believe there will be an increased incidence of tested risk factors in patients going on to limb loss.

METHODS:

In the present retrospective study, we identified 172 patients at our institution who had undergone a minor foot amputation had diabetes mellitus and at least 1 subsequent lower extremity amputation from January 1, 2000 to January 1, 2011. Minor amputations were only included if they were within one of the following categories: partial toe amputation, complete toe amputation, partial or full ray resection, or proximal foot amputation (transmetatarsal, Lisfranc's, Chopart's, and Symes). Transtibial and transfemoral amputations were considered major amputations. The indication for amputation must have been soft tissue infection, osteomyelitis, or gangrene. The patients were separated into 2 groups: a minor LEA (lower extremity amputation) group (patients having recurrent minor foot amputations) and a major LEA group (patients going on to limb loss after a minor foot amputation). We then examined the differences between these 2 groups to determine possible risk factors leading to limb loss. The age, gender, race, diabetes mellitus (type 1 or 2), amputation dates, exact procedure performed, total number of amputations, interval between each amputation, interval to major amputation, follow-up duration, HbA1c, chronic kidney disease (CKD), hemodialysis or peritoneal dialysis, a history of a previous kidney-pancreas transplantation, smoking status, the severity of peripheral vascular disease, and whether peripheral vascular intervention was performed. These possible risk factors were chosen, because they were common risk factors for amputation and re-amputation cited in previous studies. Unpaired t tests were used to compare the major and minor LEA groups for patient age and HbA1c. Chi-square tests were used to compare the categorical variables between the major and minor LEA groups, except for smoking status and transplantation status. Fisher's exact test was used for these 2 variables owing to the small number of patients. To compare the PAD groups, analysis of variance was used. A 2-sided p value less than .05 was considered statistically significant.

DATA AND RESULTS:

No statistically significant difference was found between the minor and major amputation LEA groups for age, gender, race, type 1 and type 2 diabetes, HbA1c, smoking status, CKD, ESRD requiring dialysis, kidney or kidney-pancreas transplant, peripheral vascular intervention. The incidence of severe PAD was 22.23% in the minor LEA group and 71.15% in the major LEA group. This was significant ($p < .001$). When comparing the interval to major amputation, the patients were separated into groups according to the peripheral arterial status (no PAD, mild to moderate PAD, and severe PAD). The interval to major amputation after the initial minor foot amputation was statistically significant between patients with no PAD (1,180.9 days) and those with PAD regardless of severity (591.0 days for the mild to moderate PAD group, and 559.6 days for the severe PAD group).

DISCUSSION:

The present study demonstrates that the only significant risk factor for diabetic patients going on to limb loss after minor foot amputation is severe PAD. Also, the presence of PAD significantly decreases the interval to limb loss after an initial minor LEA. These findings demonstrate the importance of the early detection of PAD in diabetics. Modification of risk factors and vascular intervention should be performed before the onset of critical limb ischemia as this may prevent the loss of a limb.

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RE-AMPUTATION AFTER MINOR FOOT AMPUTATION IN DIABETIC PATIENTS: RISK FACTORS LEADING TO LIMB LOSS, CONTD.

Presenter: Vincent Nerone, D.P.M.

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DISCLOSURES: None



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PILOT STUDY FOR THE DESIGN AND IMPLEMENTATION OF A ORTHOPAEDIC SURGICAL TRAINING LABORATORY FOR BASIC MOTOR SKILLS

Authors: Jonathan Christy, M.D.; Greg Kolovich, M.D.; Joel Mayerson, M.D.; Matthew Beal, M.D.

Presenter: Jonathan Christy, M.D.

Objective: While orthopaedic specific surgical training labs are a relatively new addition to training, we believe it is an underemphasized component in residency education. Our focus in implementing this surgical skills simulation was aimed at junior level orthopaedic residents, specifically PGY 1-3. Our first goal was to set up a surgical skills training session to educate residents in four core areas: comfort with basic power equipment, casting / splinting, suturing and surgical instrument identification. A secondary goal was to objectively evaluate the residents through pre- and post-written examinations as well as a novel pre- and post-ankle fracture model after having completed the skills sessions.

Design: Prospective, uncontrolled, observational

Setting: A major Midwestern tertiary referral center and academic medical center

Participants: Eleven of 15 PGY 1-3 orthopaedic surgery residents in our program completed the skills lab.

Results: For the eleven residents (PGY 1-3) that completed the written examination the overall pre- test percentile mean for the entire group as a whole was 87.3 ± 10.4 . Breaking down individual PGY class pre-scores demonstrated a PGY 1 mean of 80 ± 12.6 , a PGY 2 mean of 89.6 ± 6.7 and a PGY 3 mean of 96 ± 5.7 . The overall post-test percentile mean for the entire group as a whole was 92 ± 8.4 , the median was 96 and the mode 96. Breaking down individual PGY class post-scores demonstrated a PGY 1 mean of 85 ± 10.5 , a PGY 2 mean of 96 ± 4 and a PGY 3 mean of 96 ± 0 . There was a significant difference noted in pre- and post- 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 . Breaking down individual PGY class pre-scores demonstrated a PGY 1 mean of 58.8 ± 9.8 , a PGY 2 mean of 76.1 ± 13.6 and a PGY 3 mean of 69.5 ± 9.8 . The overall post- test percentile mean for the entire group as a whole was 95.2 ± 5.2 . Breaking down individual PGY class post-scores demonstrated a PGY 1 mean of 91.8 ± 6.3 , a PGY 2 mean of 97.1 ± 3.5 and a PGY 3 mean of 97.3 ± 2.4 . There was a large significant difference noted in pre- and post- among all test takers, regardless of level of training ($p = 3.27E-20$).

For the pre- fracture model our kappa between 4 independent observational scorers was 0.1148, which would be considered poor. If you examine the kappa score between faculty 1 and faculty 2 you can see the kappa score is very low, indicating only a 9.09% agreement. If you examine the kappa between residents, you see both residents agree 54.55% of the time. If you remove faculty 1 as an outlier, you find that the kappa score increases dramatically to 0.3125, which would be classified as fair interobserver agreement. For the post-fracture model our kappa between 4 independent observational scorers improved only marginally to 0.1156, which would still be considered poor.

Conclusion: The importance of well trained orthopaedic residents possessing high level surgical skills is obvious and clearly a vital piece in overall high quality patient care. However, with the increased requirements and work hour restrictions in modern medicine, finding time for surgical training through direct observation with feedback has become quite difficult. Orthopaedic training sessions may be our next best option in teaching residents. The use of surgical simulators and training labs has been implemented in a select number of other disciplines, but is a relatively novel idea in the field of orthopaedics. Our report describes our experience in the necessity and implementation of an orthopaedic surgical skills session at a large Midwestern tertiary care residency program. While we did document 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 certainly needed to determine what baseline proficiency should be. While several weaknesses have been identified in our experience, the training lab will allow us to provide direct observation and critique of residents' motor skills in a manner that can be followed longitudinally as their training progresses.

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NECROTIZING FASCIITIS IN A PEDIATRIC ORTHOPAEDIC POPULATION

Authors: Aleksander Tancevski, M.D.; Kevin Klingele, M.D.

Presenter: Aleksander Tancevski, M.D.

INTRODUCTION: Necrotizing fasciitis is a rapidly progressing infection of the fascia and subcutaneous tissues. Correlation of preoperative laboratory values with surgically confirmed necrotizing fasciitis in adults has been documented. However, analysis of preoperative laboratory values in the setting of surgically confirmed necrotizing fasciitis in pediatric orthopedic patients has not been published. Variables such as causative bacteria, antibiotic sensitivities, amputation, and mortality have not adequately been delineated. The goals of this study are two-fold. First, we seek to analyze pre-operative values of several laboratory tests that have been validated in the adult literature in regards to correlating with necrotizing fasciitis in children. We then correlate these values to surgically confirmed necrotizing fasciitis in children in an attempt to provide guidance on the pre-operative laboratory workup of necrotizing fasciitis. Our second goal is to describe the epidemiology, microbiology, morbidity, and mortality of necrotizing fasciitis in children.

METHODS: After obtaining IRB approval, we performed a retrospective chart review of consecutive patients less than 18 years of age with a diagnosis of necrotizing fasciitis treated at a single pediatric hospital (NCH). A total of 20 patients were identified. Operative reports were reviewed to confirm that intra-operative findings and post-operative diagnosis were consistent with necrotizing fasciitis. Inclusion criteria included patients less than 18 years of age on presentation with extremity involvement and intra-operative findings consistent with a necrotizing soft tissue infection. Seven patients were excluded, yielding a total of 13 patients for review.

Part one of our study analyzed the correlation of several pre-operative laboratory variables with surgically confirmed necrotizing fasciitis.

Part two of our study focused on the epidemiology of pediatric necrotizing fasciitis. Analysis of such variables as age, gender, location of infection, physical exam and radiographic findings, possible causative factors, number of debridements, and need for flap coverage or amputation was done. Microbiology results and antibiotic susceptibilities were recorded. Statistical analysis was performed utilizing a non-parametric method Kruskal-Wallis test to compare continuous variables, and a Wilcoxon Two-Sample test to compare groups.

DATA AND RESULTS: A total of 13 patients were reviewed. Ten of the thirteen infections (77%) were found in the lower extremity and three occurred in the upper extremity. All thirteen had documented tenderness and erythema. Twelve of the thirteen had warmth documented on exam (92%). Only one patient had documented bullae and seven patients had appreciable fluctuance (54%). Seven patients had ecchymosis on exam. There were no reports of crepitus or paresthesias.

Six of the thirteen (46%) cases had an antecedent trauma to the area. Two patients had a bite occur at the area. Three (23%) described a previous small abscess or boil that rapidly worsened. One patient had a previous history of an ORIF ankle at the site of infection.

Eleven of the thirteen (85%) had temperature greater than 100.5 degrees upon presentation (mean 102.1 degrees (range 98-104). Eight of the thirteen patients had radiographs available for review with soft tissue/subcutaneous edema seen in all patients. Only 2 of the eight patients (25%) had subcutaneous air.

All patients presented with an elevated WBC. The average WBC count on presentation was 22.9 with an average differential count of: 67% neutrophils, 16% lymphocytes, and 15 % bands. ESR was recorded for six patients and elevated in all, with an average value of 47. The average CRP for eight recorded cases was 10.1 and was above normal in all patients. The average platelet count was 302.

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NECROTIZING FASCIITIS IN A PEDIATRIC ORTHOPAEDIC POPULATION, CONTD.

Presenter: Aleksander Tancevski, M.D.

Blood cultures were sent in 12 of 13 patients. Eleven of the twelve patients had negative blood cultures. One of the twelve patients (8.3%) had blood cultures that were positive for MSSA.

Overall, 46% of patients showed presence of Group A beta hemolytic streptococcus on their final culture. All had sensitivity to Clindamycin. Three of the thirteen (23%) patients grew MRSA on surgical cultures. All were sensitive to Clindamycin. Two of the thirteen (15%) grew MSSA. Both of these were sensitive to Clindamycin. The remainder of patients revealed polymicrobial cultures.

All patients were taken to the operating room for debridement within 24 hours of presentation to the emergency room. The average number of debridements was 3.5.

Three of the thirteen patients (23%) went on to necessitate flap coverage of their wounds.

DISCUSSION: There have been few studies analyzing necrotizing fasciitis in children, all of which rely on cases of necrotizing fasciitis in the abdomen, head, and neck region. This study includes only cases involving pediatric extremities and describes several pre-operative laboratory values which correlate with surgically confirmed necrotizing fasciitis. Elevated temperature, WBC, ESR, and CRP values are typically seen with pediatric necrotizing fasciitis. Physical exam, radiographic findings, and laboratory values are highly variable in this patient population. We recommend prompt surgical debridement and early institution of antibiotics, which should include Clindamycin.

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DISCLOSURES: None



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PLATING OF ACUTE HUMERAL DIAPHYSEAL FRACTURES THROUGH AN ANTERIOR APPROACH IN MULTIPLE TRAUMA PATIENTS

Authors: John Idoine, D.O.; Bruce French, M.D.; Judy Opelak, Ph.D.; Lori DeMott, OTR/L
Presenter: John Idoine, D.O.

INTRODUCTION:

Although functional bracing remains the standard of care in low-energy humeral diaphyseal fractures, there remains considerable debate regarding the optimal management of high-energy fractures in multiple trauma patients. When surgery is indicated, the humerus has traditionally been approached posteriorly. The posterior approach requires prone or lateral positioning, which may be difficult or even contraindicated in multiple trauma patients. For this reason, we prefer to approach the humerus anteriorly with the patient in a supine position. This positioning maintains spinal precautions, limits pulmonary complications during surgery, and allows other procedures to be performed without repositioning.

Over the last 10 years, our practice has transitioned from traditional 4.5-mm plates to the smaller 3.5-mm plates when stabilizing diaphyseal fractures. Although clinical success with large fragment fixation is reported in the literature, biomechanical evidence to justify the need for larger, stiffer plates is lacking.

In this study, we present a standard protocol for the operative treatment of humeral shaft fractures using 1) an anterior approach, 2) supine positioning, and 3) small fragment fixation. We believe our post-surgical results will be similar to those reported in the literature for functional bracing and ORIF via a posterior approach.

METHODS:

The study design was a retrospective cohort analysis with long-term prospective follow-up. Our setting was an Urban, Level I trauma center, with 6 fellowship trained orthopedic trauma surgeons participating in the study. Our population included 96 patients with high-energy fractures of the humeral shaft that were treated over a 10-year period. All patients were treated by our standard surgical protocol of open reduction through an anterior approach with small or large fragment fixation in the supine position.

Main outcome measurements were mechanism of injury, time to union, complications, and range of motion during clinical follow-up. We also prospectively assessed long-term strength, range of motion, and perceptions of disability using the Disabilities of the Arm, Shoulder and Hand questionnaire.

Patients who followed up with strength and ROM evaluations, and the DASH questionnaire, were compared with those who did not using the Fisher exact test for binomial outcomes and the Wilcoxon rank sum test for numeric data with a skewed distribution. Comparisons of the injured to the uninjured arms in terms of strength and ROM were done using the Wilcoxon signed ranks test, whereas the Spearman rank correlation statistic was calculated to assess the association between strength and ROM differences between injured and uninjured sides with DASH scores.

DATA AND RESULTS:

The mean time to surgery was 5 days (standard deviation, 11 days), with 97.5% of patients achieving union in an average of 16.9 weeks (range, 6–56 weeks). Complications included two postoperative infections, two nonunions, and three implant failures.

Long-term follow-up (n = 34) averaged 4.75 years (range, 1.4–10.8 years). On average, there were no significant differences between the injured and uninjured extremities in range of motion at the shoulder and elbow, with the exception of shoulder flexion. A modest loss of upper extremity strength in the injured arm was appreciated. The mean Disabilities of the Arm, Shoulder and Hand score was 25.9.

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PLATING OF ACUTE HUMERAL DIAPHYSEAL FRACTURES THROUGH AN ANTERIOR APPROACH IN MULTIPLE TRAUMA PATIENTS, CONTD.

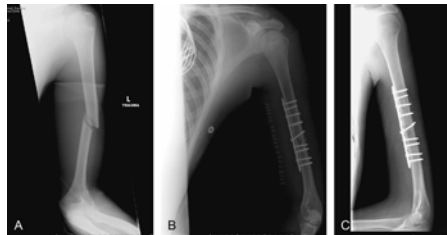
Presenter: John Idoine, D.O.

DISCUSSION:

Our surgical protocol is safe and effective treatment that restores humeral alignment and stability and enables near-normal function at the shoulder and elbow in the long-term. Supine positioning is protective for the multiply injured patient and it eliminates the need for repositioning between procedures, which improves efficiency in the operating room.

Small fragment fixation through an anterior or anterolateral approach yields high rates of bony union, few complications, and a modest loss of elbow and shoulder function. Long-term outcomes, as measured by the DASH questionnaire, are appropriate given the severity of our patients' injuries.

Our results provide the practicing orthopaedist with important information that will help when selecting among surgical options and when counseling patients on expected long-term outcomes after surgery. The quality of our final outcomes, coupled with the advantages listed, make the standard anterior approach the technique of choice when treating humeral fractures in patients with multiple injuries.



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CUSTOM INSTRUMENTS ARE SUPERIOR TO STANDARD FOR KNEE ARTHROPLASTY EVALUATED WITH COMPUTED TOMOGRAPHY

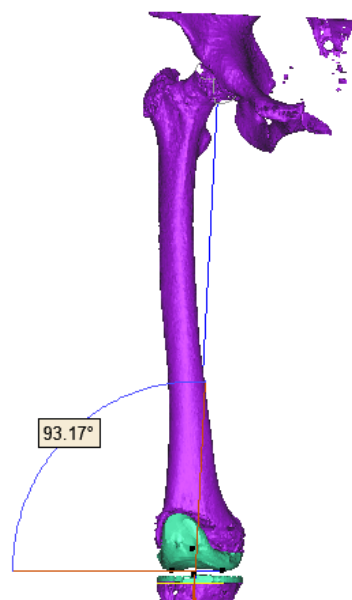
Authors: Vincent Ng, M.D.; Lindsay Arnott, B.S.; Jia Li, B.S.; Ronald Hopkins, P.A.; Jaime Lewis, M.A.; Sean Sutphen, D.O.; Lisa Nicholson, Ph.D.; Douglas Reader, M.D.; Micahel McShane, M.D.

Presenter: Vincent Ng, M.D.

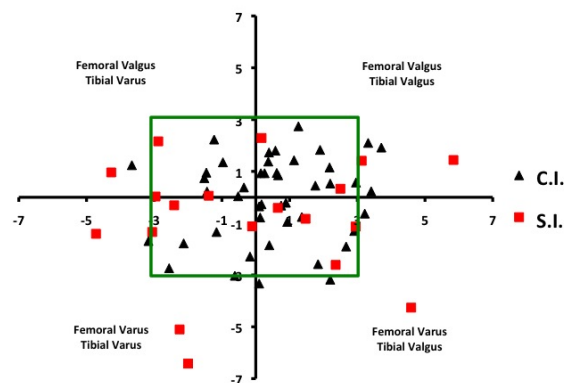
Introduction: There is conflicting evidence whether custom instrumentation (CI) for total knee arthroplasty (TKA) improves component position compared to standard intramedullary instrumentation (SI). Prior studies have relied on long-limb radiographs (LLR) which are limited to two-dimensional (2D) analysis and are subject to rotational inaccuracy. We compared CI to SI in three-dimensions (3D) with computed tomography (CT) scans.

Methods: We prospectively evaluated a high-volume single-surgeon cohort of 77 TKA patients (51 CI, 27 SI) with postoperative CT scans using 3D reconstruction and contour-matching technology to preoperative imaging. Mechanical alignment of each component was measured in coronal, sagittal and axial planes. Surgical details were recorded. Clinical outcome scores were obtained preoperatively, at 3 wks and at 3 mos. Further follow-up and LLR are reportable at 1 yr.

Results: The CI and SI groups were similar in preoperative knee deformity and clinical scores. Tourniquet time with CI (mean, 30 min) was significantly longer ($p < 0.01$) than with SI (mean, 25 min). There were no significant differences in femoral notching or component overhang. There were 2 complications for CI (deep infection; arthrofibrosis) and 1 for SI (death). The magnitude of femoral component rotational error relative to the transepicondylar axis was significantly greater ($p < 0.01$) for SI (3.3° , mean 0.8° internally rotated) than CI (1.2° , mean 0.2° IR). Femoral sagittal (mean, SI 1.5° , CI 1.7° flexion) and coronal (mean error, SI 1.7° ; CI 1.3°) mechanical axis alignment were similar. The magnitude of tibial component coronal error was significantly greater ($p < 0.01$) for SI (2.8° , mean 0.2° valgus) than CI (1.5° , mean 0.5° valgus) (Fig 3). Post-



Coronal Mechanical Alignment of TKA Components



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OSTEOSARCOMA; A META-ANALYSIS AND RETROSPECTIVE REVIEW

Authors: Jill Wilmoth, M.D.; Jeffrey Peck, M.D.; Corey Beals, M.D.; Joel Mayerson, M.D.
Presenter: Jill Wilmoth, M.D.

INTRODUCTION:

Over the years, advances in treatment and the addition of neoadjuvant chemotherapy has led to improved 5 year survival in patients with osteosarcoma. Tumor necrosis has been found to be an important predictor of patient prognosis, and necrosis of greater than 90% correlates with an overall good prognosis. With modern therapies, research has shown that 45% of patients are expected to achieve >90% tumor necrosis. However, more recent literature suggests the overall prognosis remains highly variable with little improvement over the past several decades. It also seems that patients at the author's center have increasingly been experiencing inferior necrosis responses. Therefore, we performed a meta-analysis of the current literature from 2000 to 2011 and we also performed a retrospective review of patients with primary osteosarcoma treated at The Ohio State University Wexner Medical Center (OSUWMC) from 2000 to 2011. Our hypotheses include that; overall survival of patients with osteosarcoma has not improved over the past several decades and fewer patients are achieving 90% necrosis than previously thought.

METHODS:

For the meta-analysis, MEDLINE, Pubmed, and Cochrane databases were searched for eligible studies published in English between 2000 and 2011. We applied the following search strategy: ["osteosarcoma" OR "osteogenic sarcoma"] AND ["prognosis" OR "treatment" OR "survival"]. Reports were selected specifically addressing factors predicting survival in osteosarcoma patients. Inclusion was limited to patients with primary osteosarcoma of the pelvis or extremity which reported the 5 year overall survival. Abstracts of the resulting list of articles were independently reviewed, and the inclusion and exclusion criteria were applied.

Statistical Analysis

The number or proportion of patients with 5-year overall survival and number or proportion of patients with 90% necrosis were extracted from each study. The proportion of patients with 5-year overall survival and the 95% CIs and the proportion of patients achieving 90% necrosis and the 95% CIs were derived from each trial. We also calculated the proportion of patients with 5-year overall survival and the proportion of patients with 90% necrosis with corresponding 95% CIs of studies including non-metastatic disease patients.

For the retrospective review, 52 patients met all eligibility requirements and were included in the analysis. We examined the percent necrosis achieved on pathology as well as overall survival.

DATA AND RESULTS:

The literature search yielded 597 articles. The abstracts of these articles were then reviewed in detail. Forty articles met the inclusion criteria and were included in the study. These 40 articles included patients with both metastatic and non-metastatic osteosarcoma. Because of the significant difference in overall survival of patients with metastatic disease, we performed separate analyses on articles that included only patients with non-metastatic disease. Sixteen articles were included in the analysis of patients with non-metastatic disease.

Analysis was performed in order to determine the 5-year overall survival for all studies based on the weight given to each study. By using a random-effects model for this analysis (heterogeneity test: $Q=656.23$; $P<0.001$; $I^2=93.4\%$). The 5-year overall survival ranged from 19% to 94%. The 5 year overall survival for studies including patients with metastatic and non-metastatic osteosarcoma was 63% (95% CI, 60% to 66%). The 5 year overall survival for studies including only patients with non-metastatic disease was 71% (95% CI 67% to 76%). Studies of patients with non-metastatic osteosarcoma had 50% of patients achieve 90% necrosis on histology.

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**OSTEOSARCOMA; A META-ANALYSIS AND RETROSPECTIVE REVIEW,
CONTD.**

Presenter: Jill Wilmoth, M.D.

Review of patients at OSUWMC revealed 53% of patients achieved >90% necrosis on pathology. Overall survival was 72%.

DISCUSSION:

The overall 5 year survival and the number of patients achieving 90% necrosis is consistent with previous reports, however also emphasizes that these numbers have remained constant over the past several decades. This study stresses the importance of rigorous retrospective reviews in order to continually evaluate the effectiveness of treatment regimens and patient's outcomes. It also identifies those areas needing improvement in order to increase patient prognosis. Future research is needed in order to improve on current treatment regimens and make advances in patient outcomes.

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None

DISCLOSURES:

None



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RATE OF RESIDUAL OSTEOMYELITIS AFTER PARTIAL FOOT AMPUTATION IN DIABETIC PATIENTS: A STANDARDIZED METHOD FOR EVALUATING BONE MARGINS WITH INTRAOPERATIVE CULTURE

Authors: Said Atway, D.P.M.; Vincent Nerone, D.P.M.; Kevin Springer, D.P.M.; Darren Woodruff, D.P.M.
Presenter: Kevin Springer, D.P.M.

INTRODUCTION: Approximately 75% of foot amputations are performed on patients with diabetes mellitus. The high rate of lower-extremity reamputation in diabetic patients is well documented. There have been questions as to where the appropriate resection margin should be performed for osteomyelitis in the diabetic foot. Determining the level of amputation is based on removing all infected bone and soft tissue while leaving the most functional foot possible. Any residual osteomyelitis can carry an increased risk for re-amputation and longer duration of post-operative antibiotics.

Based on clinical experience, we hypothesized that a review of diabetic patients who underwent foot amputation for infection would demonstrate a similar rate of positive margins as previous studies; a higher rate of positive margin culture with partial metatarsal and transmetatarsal amputations; and worse short-term outcomes for patients with positive margin culture. We also demonstrate our standardized method for evaluating intraoperative bone margins.

METHODS: This was a retrospective study observing all type 2 diabetic patients who underwent toe, partial metatarsal, or transmetatarsal amputation for diabetic foot infection with underlying osteomyelitis at The Ohio State University Wexner Medical Center from January 1, 2010, to August 1, 2011. 184 patients between the ages of 18 and 90 years were identified using ICD-9 codes for diabetes as well as CPT codes for toe, partial metatarsal, or transmetatarsal amputation. Patient charts were reviewed until the patient's most recent follow up. We considered it a favorable outcome when the amputation site healed without wound dehiscence and the patient returned to full weightbearing. A poor outcome was defined as wound dehiscence, recurrent ulceration, re-amputation, or death. Culture results obtained at the time of amputation were recorded.

Outcomes were compared for statistical significance. First, the rate of positive bone margin cultures was compared between toe amputation with joint disarticulation and partial metatarsal resection. Second, the rate of poor outcomes in patients with positive bone margins and those with negative bone margins were compared. Also the incidence of CKD, glycemic control, Wagner grade, smoking status, and PAD were compared between groups. Variables were compared using a 2-tailed Fisher's exact test. A p-Value of less than .05 was considered statistically significant.

DATA AND RESULTS: The overall rate of residual osteomyelitis was 40.7% (11/27) based on bone margin culture. Patients who underwent toe amputation with joint disarticulation had a positive bone margin culture rate of 23.1% (3/13). Patients who underwent partial metatarsal or transmetatarsal amputation had a positive margin culture rate of 57.1% (8/14). This was not considered to be statistically significant ($p=1201$). There was no significant difference between groups for Wagner grade, incidence of CKD, HbA1c, smoking status, or presence and severity of PAD. Overall, 48.2% (13/27) of patients were considered to have poor postoperative outcomes; and 81.8% (9/11) of patients with a positive bone margin had poor outcomes.

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RATE OF RESIDUAL OSTEOMYELITIS AFTER PARTIAL FOOT AMPUTATION IN DIABETIC PATIENTS: A STANDARDIZED METHOD FOR EVALUATING BONE MARGINS WITH INTRAOPERATIVE CULTURE, CONTD.

Authors: Said Atway, D.P.M.; Vincent Nerone, D.P.M.; Kevin Springer, D.P.M.; Darren Woodruff, D.P.M.

Patient	Gender	Age (y)	Vascular Status (PAD)	Amputation Level	Preoperative Antibiotics	Postoperative Antibiotics	Imaging	+ Bone Culture	Culture Result	Outcome	Length of Follow-up
1	M	59	Severe	L TMA	None	PO linezolid 1 wk	MRI	Yes	<i>Citrobacter koseri</i> /CoNS	Dehiscence	14 mo
2	F	76	None	R p5th ray	IV vancomycin 3 wk	PO sulfamethoxazole/trimethoprim 14 d	MRI	Yes	<i>Propionibacterium</i>	Amputation of toes 3,4	21 mo
3	M	47	None	L p1st ray	IV vancomycin/piperacillin and tazobactam 6 d	IV piperacillin and tazobactam 4 wk	MRI	No		Dehiscence	5 mo
4	M	63	Moderate	R p1st ray	PO sulfamethoxazole/trimethoprim 1 wk	PO ciprofloxacin 10 d	MRI	No		Healed	6 mo
5	M	61	Severe	L p4th & 5th ray	PO amoxicillin and clavulanate 1 wk	PO moxifloxacin 14 d	MRI	Yes	<i>C. koseri</i>	TMA	2 mo
6	F	65	Severe	L TMA	None	PO amoxicillin and clavulanate 14 d	MRI	No		Healed	4 mo
7	F	56	None	L p5th ray	IV linezolid/piperacillin and tazobactam/clindamycin 1 d	IV cefazolin 6 wk	MRI	No		Re-ulceration	11 mo
8	M	66	None	R p5th ray	PO amoxicillin and clavulanate 1 wk	IV daptomycin/ertapenem 6 wk	MRI	Yes	<i>Enterobacter cloacae</i> / <i>Enterococcus raffinosus</i>	Dehiscence, healed with skin graft	5 mo
9	M	71	Severe	R TMA	IV vancomycin/cefepime 5 d	IV vancomycin/ertapenem 6 wk	MRI	Yes	<i>Pseudomonas aeruginosa</i> / <i>P. mirabilis</i> /Enterococcus faecalis	Deceased	6 mo
10	F	51	None	R p2nd ray	IV vancomycin/piperacillin and tazobactam 4 d	PO ciprofloxacin/sulfamethoxazole and trimethoprim 2 wk	MRI	No		Healed	24 mo
11	M	61	Moderate	L TMA	None	PO sulfamethoxazole/trimethoprim 2 wk	MRI	Yes	CoNS/Diphtheroids	Dehiscence	9 mo
12	M	59	Severe	L p1st ray	IV vancomycin/piperacillin and tazobactam 2 d	IV daptomycin/moxifloxacin 6 wk	Radiograph	Yes	VRE	TMA	5 mo
13	M	51	None	L p4th & 5th ray	IV ciprofloxacin/meropenem 2 d	IV vancomycin/ertapenem 6 wk	Radiograph	Yes	Alpha Streptococcus	Healed	15 mo
14	M	72	None	L p1st ray	IV ofepime/daptomycin 6 d	PO minocycline 14 d	Int 11/Tc99MDP	No		Healed	15 mo
15	F	55	None	L 3rd toe	PO sulfamethoxazole/trimethoprim 8 d	None	MRI	No		Healed	14 mo
16	M	55	Moderate	R great toe	IV vancomycin/piperacillin and tazobactam 2 d	PO amoxicillin and clavulanate 2 wk	Radiograph	No		Healed	8 mo
17	M	50	None	L great toe	PO sulfamethoxazole/trimethoprim 14 d	IV ertapenem 6 wk	Radiograph	Yes	<i>Propionibacterium</i> / <i>Bacteroides</i>	Healed	1.5 mo
18	M	80	Mild	R 2nd toe	None	None	Radiograph	No		Healed	15 mo
19	M	49	None	L great toe	IV vancomycin/piperacillin and tazobactam 4 d	PO sulfamethoxazole/trimethoprim 2 wk	MRI	No		Healed	17 mo
20	M	46	Mild	R great toe	IV ertapenem/vancomycin 3 d	IV ceftazidime 6 wk	MRI	Yes	Group B Streptococcus	Dehiscence	5 mo
21	F	55	None	L 5th toe	IV vancomycin 5 d	PO sulfamethoxazole/trimethoprim 1 wk	MRI	No		Healed	3 mo
22	F	42	None	L 2nd toe	PO moxifloxacin 10 d	None	MRI	No		Dehiscence	4 mo
23	M	68	None	R 5th toe	IV vancomycin/piperacillin and tazobactam 5 d	None	MRI	No		Dehiscence	8 mo
24	F	71	None	L great toe	PO amoxicillin and clavulanate 17 d, PO levofloxacin 4 d	None	Int 11/Tc99MDP	No		Healed	1.5 mo
25	F	75	None	R 2nd toe	IV daptomycin 3 d	None	MRI	No		Healed	13 mo
26	M	51	None	R great toe	IV vancomycin/piperacillin and tazobactam 3 d	PO amoxicillin and clavulanate 10 d	MRI	No		Healed	6 mo
27	F	32	None	R 3rd toe	None	PO sulfamethoxazole/trimethoprim 14 d	MRI	Yes	MSSA	Re-ulceration	11 mo

Abbreviations: CoNS, coagulase-negative staphylococcus; F, female; Int 11, indium-111; IV, intravenous; L, left; M, male; MDP, methylene diphosphonate; MRI, magnetic resonance imaging; MSSA, methicillin-sensitive *Staphylococcus aureus*; PAD, peripheral artery disease; p1st, partial first ray; p4th, partial fourth ray; p5th, partial fifth ray; PO, orally; R, right; Tc99, technetium-99; TMA, transmetatarsal amputation; VRE, vancomycin-resistant enterococcus.

DISCUSSION:

The gold standard treatment for osteomyelitis of the diabetic foot is complete removal of all infected and devitalized bone and soft tissue with wide resection. Most reports recommend using intraoperative inspection of the soft tissues as well as the bone to evaluate for extent of infection. Tissue should be debrided to bleeding, granular soft tissue, and dense, hard bone with positive pinpoint bleeding. This study demonstrates an increase in positive residual margins in patients who underwent partial metatarsal resection (either partial ray or transmetatarsal) compared with joint disarticulation. Our results do suggest that there is a high incidence of residual osteomyelitis with associated poor outcomes. Based on our data, we recommend routine standardized bone margin culture after thorough debridement and irrigation. Based on these initial findings, a prospective study is planned with a sample of approximately 100 patients and a minimum follow-up of 1 year. Clearly, additional clinical research is needed in order to further clarify the best way to manage pedal osteomyelitis in diabetic patients.

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DISCLOSURES: None.



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PERIOPERATIVE MORBIDITY AND MORTALITY OF TWO-TEAM SIMULTANEOUS BILATERAL TOTAL KNEE ARTHROPLASTY

Authors: Craig Dimitris, M.D.; Benjamin Taylor, M.D.; John Mowbray, M.D.; Robert Steensen, M.D.; Steven Gaines, M.D.
Presenter: Craig Dimitris, M.D.

INTRODUCTION: Many patients suffer from painful arthritis in both knees. Options include bilateral total knee arthroplasty simultaneously or sequentially at one operative setting or arthroplasty of one knee and staging of the contralateral arthroplasty either during the same hospitalization or more often months later.

There has been much debate in the literature over the safety of bilateral total knee arthroplasties, despite poor agreement over what constitutes "simultaneous." Our hypothesis was that the morbidity and mortality of two-team simultaneous bilateral total knee arthroplasty was not significantly different as compared to unilateral total knee arthroplasty at our institution.

METHODS: The medical records of patients who underwent two-team simultaneous total knee arthroplasty were compared to the those who underwent unilateral total knee arthroplasty by the senior authors. Data was collected retrospectively from 1997-2003 and prospectively from 2003-2007. Unicompartmental and revision cases were excluded.

Perioperative data on tourniquet time, total operative time, estimated blood loss, pre-operative and discharge hemoglobin values, transfusion amounts, and length of stay data from the hospital, ICU, and skilled nursing facility on discharge was collected. Physician office records were reviewed for range of motion values as well as to ensure all perioperative complications, readmissions and reoperations were captured.

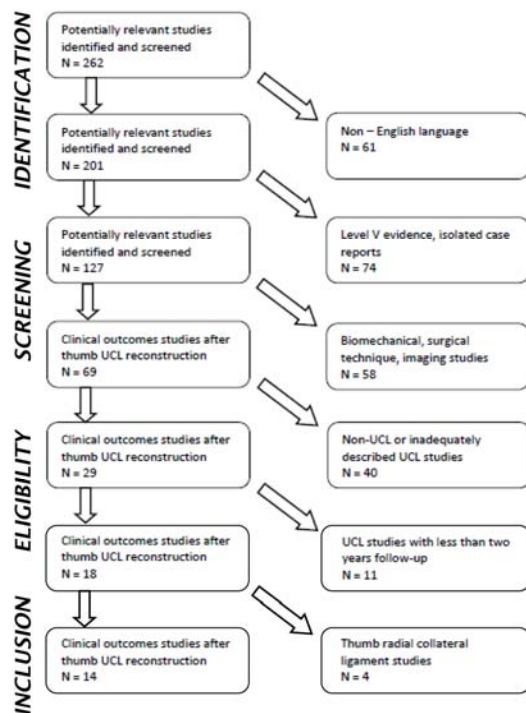
RESULTS: Demographic data including age, sex and body mass index (BMI) were not significantly different among the two groups.

Intraoperative blood loss was significantly higher in the bilateral group (161.7 ± 214.2 mL) compared to the unilateral group (105 ± 154.1 mL; $p=0.002$). There was higher rate at which bilateral patients required post-operative blood transfusion (65% vs. 14.4%) as well as a significantly higher average amount of blood transfused (1.4 ± 1.3 units PRBCs vs. 0.3 ± 0.8 units PRBCs); $p<0.001$).

The bilateral total knee arthroplasty patients had a longer length of stay (3.71 ± 1.3 days vs. 3.38 ± 0.98 days; $p=0.002$). They also required placement in an extended care facility (skilled nursing facilities or inpatient rehabilitation) more frequently (76% vs. 27%; $p<0.001$).

There were no mortalities in either group. Major and minor complications were slightly higher for the bilateral group, though neither reached statistical significance ($p=0.108$ and $p=0.263$, respectively).

In the unilateral group there was one non-ST elevation myocardial infarction in the hospital, from which the patient recovered. The bilateral TKA group had a trend toward more major complications, but did not reach statistical significance. The most noticeable of which were five non-fatal pulmonary emboli, four diagnosed on computed tomography and one with a ventilation-perfusion study. All of these patients went on to recovery and were discharged on long term anticoagulation.



Continued on Next Page

PERIOPERATIVE MORBIDITY AND MORTALITY OF TWO-TEAM SIMULTANEOUS BILATERAL TOTAL KNEE ARTHROPLASTY, CONTD.

Presenter: Craig Dimitris, M.D.

DISCUSSION: Our data shows that two-team simultaneous bilateral total knee arthroplasty performed at our institution has similar complication rate to unilateral knee replacement, and remains a safe option for the appropriately selected, motivated patient. Simultaneous bilateral total knee arthroplasty offers the potential benefits of decreased overall recovery time, decreased overall cost and decreased number of anesthetic administrations and less time off work. It also allows simultaneous correction of significant deformities that could impair rehabilitation if only one knee deformity is addressed and one remains.

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THE INFLUENCE OF HAMSTRING AUTOGRAFT SIZE ON PATIENT REPORTED OUTCOMES AND RISK OF REVISION FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A MOON COHORT STUDY

Authors: Michel Mariscalco, M.D.; Joshua Mitchell; Angela Pedroza, M.S.; Morgan Jones; Jack Andrish; Richard Parker; Christopher Kaeding, M.D.; David Flanigan, M.D.; Robert Magnussen, M.D.
Presenter: Michael Mariscalco, M.D.

INTRODUCTION:

- Unlike bone-patellar tendon-bone autografts, the diameter of a hamstring autografts is quite variable.
- The ideal hamstring graft size remains undefined in the literature, but recent studies suggest increased failure rates in younger patients with grafts less than or equal to 8 mm in diameter.

HYPOTHESES:

- 1) Smaller hamstring autograft size will be associated with poorer patient-reported outcome scores.
- 2) Smaller hamstring autograft size will be associated with increased revision rates.

METHODS:

- 320 patients were identified through the use of prospectively collected data from the Multicenter Orthopaedic Outcomes Network (MOON) collected at two academic medical centers.
- Data collected at pre-op/surgery
 - Graft size
 - Patient demographics
 - Associated chondral /meniscal injuries
 - Patient reported outcome scores (KOOS and subjective IKDC)
- Data collected at 2 years post-op
 - KOOS and Subjective IKDC
 - Revision surgery
- Summary statistics including mean and standard deviations were calculated for continuous variables. The relationship between graft size and patient-reported outcome scores at two years post-operatively was determined by multiple linear regression analysis.
- The relationship between graft size and risk of revision was determined by dichotomizing graft size at 8mm and stratifying based on patient age.

DATA AND RESULTS:

- Complete data, including graft size and patient reported outcomes at two years post-op were available for 263 patients (82.2%)
- Mean age at ACLR was 25.6 years (range: 13-58 years old)
- 54.8% male, 45.2% female
- Roughly 75% of patients had an 8 mm graft or smaller
- Mean graft size = 7.9 +/- 0.8 mm (range 6-10 mm)

Continued on Next Page

THE INFLUENCE OF HAMSTRING AUTOGRAFT SIZE ON PATIENT REPORTED OUTCOMES AND RISK OF REVISION FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A MOON COHORT STUDY

Presenter: Michael Mariscalco, M.D.

DISCUSSION:

- Smaller hamstring autograft size is a predictor of poorer patient reported outcome scores (KOOS and IKDC).
- There is an increased risk of revision 2 years following primary ACL reconstruction in those < 18 years old with grafts ≤ 8 mm.
- Whether the findings of this study are more related to decreased failure loads and/or footprint coverage of smaller ACL grafts or age/activity level of the patient remains unclear.

DISCLOSURES: None

FUNDING: MOON is funded by - NIH NIAMS, NFL Charities, OREF, Aircast, Smith and Nephew, DJO, and Vanderbilt Sports Medicine

Table 1: Results of multiple linear regression analyses of the correlation between graft size and patient-reported outcome scores			
Outcome Score	Regression Coefficient of Graft	Standard Error	Significance
KOOS-Symptom	2.26	1.32	p = 0.089
KOOS-Pain	3.00	1.13	p = 0.009
KOOS-ADL's	1.70	0.98	p = 0.079
KOOS-Sport/Re	4.56	1.82	p = 0.015
KOOS-	2.11	2.02	p = 0.30
IKDC	2.92	1.48	p = 0.05
Marx	0.35	0.43	p = 0.42

Table 2: Revision rates by graft size (total cohort)				
Graft Size	Patient Age (Mean \pm SD,	Number	Revisions	Percent Revised
Over 8 mm	29.2 \pm 10.9	61	0	0%
8 mm	24.3 \pm	83	7	8.4%
Under 8 mm	24.8 \pm 10.2	119	7	5.9%
All	25.6 \pm	263	14	5.3%

Table 3: ACL graft revision rates according to patient age and graft size			
		Patient Age (Years)	
		18 and under	Over 18
Graft Size	Greater than 8 mm	0 / 14 (0%)	0 / 47 (0%)
	8 mm and under	13 / 71 (18.3%)	1 / 131 (0.8%)



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NOVEL METHODS TO PRACTICE PERSONALIZED MEDICINE IN AN EVIDENCE BASED ORTHOPAEDIC SETTING

Authors: Catherine Quatman-Yates, M.S.; Carmen Quatman, M.D.; Angela Pedroza, M.S.; Timothy Hewett, Ph.D.; Marcelo Lopetegui; Phillip Payne; Christopher Kaeding, M.D.
 Presenter: Carmen Quatman, M.D.

INTRODUCTION:

Current models for evidence generation in the field of orthopaedic surgery often appear to be in conflict with direct application of evidence to individual patients. Conventional evidence generation and evidence based practice hierarchies encourage and value studies with strict inclusion/exclusion criteria meant to represent the “average” patient. However, it is difficult to know how to apply population-based predictions of outcomes to a single patient who may not be similar to the sample used to create the population estimates. Recent technologic advances and the generation of large outcomes datasets have created new and greater opportunities to explore how to remedy this challenge.¹

Purpose: Develop a clinical outcomes calculator that utilizes a patient-centered approach that when applied to a clinical outcomes dataset can improve clinicians’ abilities to provide more individualized, specific prognoses for patients. More specifically, the purpose was to compare and contrast a conventional analysis approach (variable-centered) with a complex systems analysis strategy (patient-centered).

Hypothesis: Patient-centered analyses allows for improved identification of how an *individual patient* relates to a large surgical outcome database.

Clinical Significance: A variable-centered strategy describes associations between **variables**, while patient-centered analysis compiles **patient profiles** that retain all the information about the variables for each patient.

METHODS: A single surgeon’s outcomes database ($n = 276$) regarding the incidence of graft failure 2 years status post anterior cruciate ligament reconstruction (ACLR) was analyzed with both a variable-centered approach (previously reported in Kaeding et al).² and a patient-centered approach. Data available for each patient included: sex, age, graft type (allograft versus autograft), Marx Activity Scale Score and graft failure/no failure at two years post-reconstruction.

The dataset was previously analyzed with a variable-centered approach that used multivariate logistic regression to create a parsimonious prediction model with the variables that best accounted for the variance in graft failures.² For the current study, the dataset was re-analyzed using a patient-centered approach that created patient profile characterizations representing all subjects that matched a particular combination of the variables.

DATA AND RESULTS:

Variable-Centered Approach: Conventional statistical results of this dataset were previously reported in Kaeding et al.² Age, graft type and Marx activity score were all found to be predictive of graft failure. However, due to high collinearity with age, Marx activity score was dropped from the final model. The model indicated that the odds of graft failure for a patient with an allograft was 2.84 times higher than a patient with an autograft, regardless of age ($P=0.04$). When graft type is held constant, a 10 year increase in age reduces the odds of ACL graft rupture by 43% ($P < 0.001$). No significant differences were observed between sexes in terms of graft failure.

Continued on Next Page

NOVEL METHODS TO PRACTICE PERSONALIZED MEDICINE IN AN EVIDENCE BASED ORTHOPAEDIC SETTING, CONTD.

Presenter: Carmen Quatman, M.D.

Patient-Centered Approach: The results of the patient-centered approach yielded an array of patient-characteristic profiles that allowed for calculation of graft failure ratios for all patients that fall within a particular profile. Many of the profiles were too small to achieve statistical power that would enable direct comparisons of odds ratios with the variable-centered approach. However, the graft failure ratios were consistent with age and graft type playing a large role in failure across the profiles. In addition, the ratios provided some indications for how the dataset could be analyzed in the future that might yield differences between sexes in terms of graft failure. While the specifics of the patient-profile groupings are too extensive to report here, an example of how it might be used would be: Of all female patients that this surgeon operated on that were age 25 years or younger with an allograft and went on to participate in high-level cutting and pivoting activities, 4 out of 22 (approximately 18%) experienced graft failure within two years. In addition, these analyses identified the patient profile types with very limited data available.

DISCUSSION AND CLINICAL IMPLICATIONS:

To our knowledge, this is the first report of patient-centered surgical outcomes analyses for orthopaedic outcome data. The results from this study demonstrate that patient-centered analyses may complement and even extend conventional statistical results by providing richer profiles that characterize the similarities and dissimilarities among patients within large clinical outcome datasets. Development of clinician-friendly tools that utilize patient-centered analytical techniques may provide a platform for a more comprehensive understanding and enhanced ability to practice EBM and “personalized health care.”

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COMPARISON OF OUTCOMES OF ROBOTIC AND MANUALLY IMPLANTED UNICOMPARTMENTAL KNEE ARTHROPLASTY

Authors: Dane Hansen, D.O.; Ryan Palmer, D.O.; Ray Wasielewski, M.D.; Sharat Kusuma, M.D.
Presenter: Dane Hansen, D.O.

INTRODUCTION:

Medial unicompartmental knee arthroplasty (UKA) for isolated medial knee arthritis is a highly successful and efficacious procedure. However, UKA is technically challenging. Research has shown that surgical technical errors may lead to high early failure rates^{1,2}. Haptic robotic systems have recently been developed with the goal of improving accuracy, reducing complications, and improving overall outcomes. There is little research comparing robotic-assisted UKA to standard UKA². The goal of this study was to compare clinical and radiographic outcomes for matched cohorts who received robotic-arm assisted UKA or standard instrumentation UKA.

METHODS:

We performed a non-randomized, retrospective review of 30 robotic-arm assisted UKA and 32 manual UKA performed by a single fellowship-trained joint arthroplasty surgeon (SKK) over 2.5 years. All procedures were completed through a medial parapatellar approach. All components were cemented. All tibial components were a metal-backed onlay design. Average follow-up was 10.1 months (range 5-36).

A full clinical/hospital chart review of demographic, intra- and post-operative measures was performed. Radiographic analysis of pre- and post-operative images evaluating sagittal and coronal alignment, as well as accuracy of component positioning was performed by a single observer (DCH), using OsiriX imaging system (Pixmeo; Geneva, Switzerland). Statistical analysis was performed using SPSS v. 20. Comparison between group means was performed, as well as calculation of variance in component placement within groups.



Figure: Example of a post-op radiographic evaluation.

DATA AND RESULTS:

No demographic differences were seen between groups. Operative time was significantly longer in the robotic group compared to the manual group. Minimal clinical post-op differences were seen between groups. The robotic group showed some early advantage in ambulation/ROM during inpatient stay. This ROM difference reversed at 2 weeks post-op. Continued medial-sided knee pain was reported more commonly in robotic group.

Radiographic results showed no difference between groups in pre-op mechanical alignment. The robotic group was significantly more accurate at recreating femoral axis. Accuracy in recreation of tibial slope was similar between groups. Accuracy of tibial component placement in the coronal plane was not significantly different between groups. The robotic group did have significantly larger variance in coronal alignment of the tibial component. Medial overhang of tibial component was significantly greater and more variable in the manual group. There was a non-significant decrease in resection depth found in robotic group.

Continued on Next Page

COMPARISON OF OUTCOMES OF ROBOTIC AND MANUALLY IMPLANTED UNICOMPARTMENTAL KNEE ARTHROPLASTY, CONTD.

Presenter: Dane Hansen, D.O.

DISCUSSION:

There were minimal clinical and radiographic differences between techniques. Clinically, both cohorts did very well. We believe that the continued medial knee pain in the robotic group is possibly due to implant design and a decrease in cement interdigitation.

Radiographically, both groups had quite accurate placement of components, with the most obvious difference being the increased tibial component overhang in the manual group. A recent study showed that greater than 2mm of overhang may cause MCL impingement and lead to medial knee pain³. The robotic group had zero patients beyond this threshold, while the manual group had 7 (23%) beyond the threshold. The increased variance in tibial component coronal alignment seen in the robotic group is most likely due to the ability to more precisely fine-tune component placement to the patient's varying anatomy using the computer software.

In conclusion, our cohorts had very similar clinical and radiographic outcomes. Our data suggests that the purported benefits of robotic UKA may be obviated in the hands of a surgeon with training and experience in manual UKA implantation.

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BIOMECHANICAL COMPARISON OF INTRAMEDULLARY NAIL, CROSSED K-WIRES, AND PLATE-SCREW FOR FIXATION OF METACARPAL SHAFT FRACTURES

Authors: Benjamin Curtis, M.D.; Olukemi Fajolu, M.D., Michael Ruff, M.D., Alan Litsky, M.D., Sc.D.

Presenter: Benjamin Curtis, M.D.

INTRODUCTION:

Metacarpal (MC) fractures are very common—accounting for 18% of all fractures distal to the elbow¹. There are multiple methods to stabilize these fractures including plates, crossed K-wires, the "bouquet" technique, and proximally-locked intramedullary metacarpal nails (IMN). Few studies have evaluated the IMN. This device is designed to provide a minimally invasive, proximally locked option for MC fracture stabilization.

Orbay² studied this device and had excellent outcomes with few complications in 95 pts. Ozer³ et al compared non-locked IMN and plate fixation for MC fractures. They found no differences in post-healing ROM, time to union, or DASH scores. Surgical time was less in the IMN group. However, in the IMN group they also found a 13% (5/38) loss of fixation rate as well issues with nail penetration into the MP joint and need for hardware removal in the OR.

We identified no published studies on the biomechanical stability provided by the IMN. This study investigated the biomechanical stability of metacarpal fractures stabilized using three different methods—plate-screw construct (plate), crossed K-wires (XK-wires), and the IMN.

We hypothesize that plates will have a significantly higher load to failure than crossed K-wires or the IMN. We also hypothesize that crossed K-wires will have statistically equivalent load to failure as the IMN.

MATERIALS AND METHODS:

36 fourth-generation synthetic MCs (Sawbones; Pacific Research Laboratories, Vashon, WA) were obtained. A mid-diaphyseal transverse fracture was created, reduced, and randomly assigned into one of three fixation groups—IMN, XK-wires, or plates. There were 12 specimens in each group. In the IMN group, the 0.062" nail (Small Bone Fixation System, Hand Innovations, Biomet, Warsaw, IN) was implanted with the distal end impacted into the distal metaphysis and the proximal end locked with a locking sleeve.

In the XK-wire group, two 0.062" diameter, K-wires were implanted in a crossed fashion. In the plate group, a standard, straight, Hand Innovations, 2.5 mm F3 plate was cut to 6 holes and positioned dorsally. 2.5 mm non-locking cortical screws were inserted with bi-cortical fixation. Positioning of hardware was confirmed with mini-C fluoroscopy.

3-point bending was performed on a servohydraulic materials test frame (Bionix 858, MTS Corp., Eden Prairie, MN). Force was applied at the fracture site in an apex-dorsal direction at a velocity of 10 mm/min. This protocol was based on previously published studies^{3,4,5}



DATA AND RESULTS:

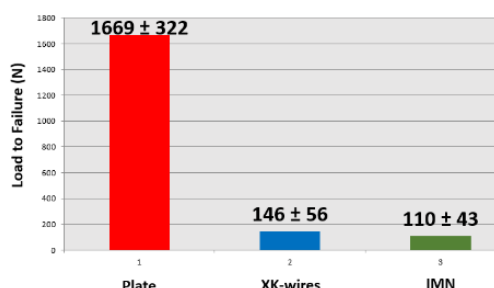
Statistical analysis was performed using a single factor ANOVA to detect differences between groups. Student t-test was utilized to compare XK-wires and IMN. Statistical significance was defined as $p \leq 0.05$. Average load to failure was significantly greater in the plate group ($1669 \text{ N} \pm 322$) than the XK-wire ($146 \text{ N} \pm 56$) or IMN ($110 \text{ N} \pm 43$) groups ($p \leq 0.05$). The XK-wire group load to failure was statistically equivalent to the IMN ($p=0.09$). (Table 1)

Continued on Next Page

BIOMECHANICAL COMPARISON OF INTRAMEDULLARY NAIL, CROSSED K-WIRES, AND PLATE-SCREW FOR FIXATION OF METACARPAL SHAFT FRACTURES

Presenter: Benjamin Curtis, M.D.

Table 1. Average load to failure (in Newtons)



DISCUSSION:

MC fractures are common and can be stabilized in multiple ways. The biomechanical stability of the proximally-locked IMN for MC fractures had not previously been compared to other commonly utilized fixation techniques. The data supports both of our hypotheses and suggests that plate-screw constructs are 11-15X more stable than either XK-wires or the IMN. XK-wire stability was statistically equivalent to the proximally-locked IMN ($p = 0.09$).

Strengths of this study include use of composite bones to eliminate inter-specimen variability, standardization of biomechanical testing, and investigation of a subject not previously studied. Limitations include lack of in vivo testing and no testing specimens in torsion, with apex-volar load, or with axial load. The effect of repeated sub-maximal forces was also not investigated and no soft-tissues were present to provide additional stability. Clinical correlation of these results to fracture healing and outcomes is needed.

In conclusion, plate fixation provides a very stable construct that is 11-15X as stable as the other methods tested. However, if minimally-invasive techniques are indicated, the current study's data suggests that IMN may be as stable as commonly-used XK-wires.

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COMPARING COMPLICATIONS AND COST FOR TWO TYPES OF FIXATION USED FOR CALCANEAL DISPLACEMENT OSTEOTOMIES

Authors: Douglas Lucas, D.O.; Alex Simpson, D.O.; Terrence Philbin, D.O.
Presenter: Douglas Lucas, D.O.

INTRODUCTION:

The calcaneal displacement osteotomy is a procedure used for hindfoot angular deformity. Traditional techniques utilize compression screw fixation that results in prominent hardware near the posterior plantar aspect of the calcaneal tuberosity. A common concern for patients and surgeons alike is the development of plantar heel pain related to prominent hardware. The incidence of pain is significant enough to result in a second surgery to remove hardware was recently reported in the literature as 47% in one series.¹ A locked lateral compression plate (LLCP) is an alternative fixation method that may provide advantages over traditional fixation. Currently no studies compare this type of device to traditional fixation methods. The purpose of this study is to compare these fixations in regards to post-operative complications, time to healing and frequency of return trips to the operating room (OR) for hardware removal. We hypothesize a decreased incidence of plantar heel pain in the LLCP group and as a result a decrease in return trips to the OR for hardware removal.

METHODS AND MATERIALS:

Records were reviewed from 4 surgeons for CPT code (28300) calcaneal osteotomy for hindfoot correction from June 2010 to January 2012 with a minimum 12 month follow up. Neuropathic patients, previous ipsilateral calcaneus surgery, trauma to heel pad and incomplete radiographic follow up were excluded. We compared 2 cohorts, traditional fixation with cannulated headed compression screws of any size to the LLCP for fixation. We used The EdgeLock plate as the LLCP for each patient in this group. Variables included: duration of follow up, time to radiographic healing, hardware removal frequency and complications. A cost analysis was performed of the LLCP with respect to implant cost alone as well as implant cost with additional cost of returning to the OR for removal when necessary..

DATA AND RESULTS:

282 patient charts were reviewed. Patients meeting our inclusion criteria were placed in two groups that were similar in epidemiologic distribution with age and BMI difference not statistically significant ($p=0.74$ and 0.45) respectively. There were 32 patients (19.4%) that required hardware removal from the screw fixation group compared to 1 (1.6%) of the LLCP group ($p<0.05$) and delivers an Odds Ratio of 14.92. The time to radiographic healing was not significantly different ($p=0.87$). The screw fixation group required more follow up visits over a longer period of time ($p<0.05$ for duration of follow up). The average cost of implants for screw fixation alone was \$247.12, compared to the LLCP with associated screws \$1,175.59. The cost of screws with associated removal averaged \$11,184.14. The average savings per patient in a comparison group was \$1,040.19 when the LLCP was used.



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COMPARING COMPLICATIONS AND COST FOR TWO TYPES OF FIXATION USED FOR CALCANEAL DISPLACEMENT OSTEOTOMIES, CONTD.

Presenter: Douglas Lucas, D.O.

DISCUSSION:

This study demonstrates that this device provides adequate stabilization for healing in equivalent time to screw fixation. We also demonstrate that significantly fewer patients require hardware removal and as such have fewer post-operative visits over a shorter period of time. A cost analysis demonstrates significant savings in the LLCP group despite the higher cost of the implant.

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LLCP courtesy of OrthoHelix Surgical Designs, Medina, OH.

DISCLOSURES:

Dr. Philbin is a consultant for OrthoHelix.



Julie Samora, M.D. is a resident in Orthopaedics at The Ohio State University

IS THERE STILL A PLACE FOR CAST WEDGING IN PEDIATRIC FOREARM FRACTURES?

Authors: Julie Samora, M.D.; Kevin Klingele, M.D.; Allen Beebe, M.D.; John Kean, M.D.; Jan Klamar, M.D.; Matthew Beran, M.D.; Leisel Willis, Bs.C.; Han Yin, Ph.D., M.S.; Walter Samora, M.D.

Presenter: Julie Samora, M.D.

INTRODUCTION:

Forearm fractures are common skeletal injuries in childhood, occurring in approximately 1 of 100 children each year and representing ~30% of fractures seen in the upper extremity. There has been a substantial increase in incidence over the past few decades. The goals of treatment include restoration of anatomic alignment, recovery of motion, and attainment of full function.

In the majority of cases, closed reduction, immobilization, and close monitoring has been successful in reducing deformity and allowing return of function. Recently, trends toward operative treatment of forearm fractures in children have emerged, with some institutions reporting a 10-fold increase over the past decade.

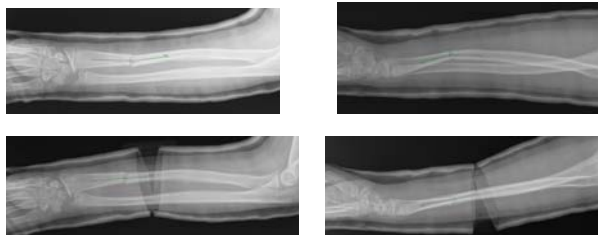
Cast wedging is a simple, non-operative, non-invasive method for treatment of excessive angulation in long-bone fractures. We aim to demonstrate the safety of cast wedging for treatment of forearm fractures in children that have lost reduction. Our hypothesis is that cast wedging is a safe and effective method to decrease angulation of forearm fractures. The significance of this study is that it provides orthopaedic surgeons an alternative to surgery when presented with children who have sustained forearm fractures that have lost acceptable reduction.

METHODS:

This is a prospective chart review of patients with forearm fractures (BBFF), including distal radius (DR) fractures, treated with cast wedging at a single large pediatric hospital from June 2011 to September 2012. Inclusion criteria specified open distal radial physis, closed injury, loss of acceptable reduction, and availability of clinical and radiographic data from injury to cast removal. Exclusion criteria included pathologic fractures, neurovascular injury, fracture-dislocations, open fractures, and closed DR physis. Reductions were performed and patients followed according to standard protocol at our institution, including placement into long arm casts, initial follow-up visit within 5-10 days post-injury, and weekly visits for 2 weeks thereafter. If alignment were deemed unacceptable within 3 weeks of injury, cast wedging was utilized. Radiographic measurements of alignment included both radius and ulna on the injury film, post-reduction, pre-wedge, post-wedge, and final films. Radiographic technique was standardized, with repeatability testing demonstrating a precision of $\pm 2^\circ$.

DATA AND RESULTS:

Over fifteen months, our hospital treated 2,124 forearm or DR fractures with closed reduction and casting. There were 60 fractures treated either with percutaneous fixation (36) or open treatment (24). A total of 79 BBFF or DR fractures were treated with cast wedging secondary to loss of reduction, of which 70 patients had complete clinical and radiographic data. Average age was 8.4 years (range 4-14), with 25 females and 45 males. Significant improvement in angulation for BBFF from pre-wedge to final films was seen in all children, with no major complications. One patient failed wedging and required surgical reduction and fixation.



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IS THERE STILL A PLACE FOR CAST WEDGING IN PEDIATRIC FOREARM FRACTURES?, CONTD.

Presenter: Julie Samora, M.D.

Distal Radius Fractures	pre-wedge AP radius	Final AP radius	pre-wedge lateral radius	Final lateral radius
younger	9.1°	4.4°	23°	7.4°*
older	5.3°	2.3°	19.1°	5.2°*

*p<0.05

DISCUSSION:

Loss of reduction in DR and BBFF has been reported to occur anywhere from 10-90% of the time, with patients older than 10 years most at risk to fail angulation criteria. We had one older child out of 70 children fail cast wedging secondary to unacceptable angulation, which is an incidence of 1.4%.

There is a recent trend toward more surgical fixation of forearm fractures in children, but complications can include hardware failure, infection, loss of reduction, reoperation, nerve injury, loss of motion, osteomyelitis, CRPS, and synostosis. Cast wedging is another treatment option when patients present with loss of reduction, and may obviate the need for re-reduction under an anesthetic or surgical intervention.

In our study, we had excellent radiographic outcomes. Three patients had some mild pain post-wedging, which responded to OTC analgesics. Our findings provide some guidance to orthopaedists seeking to avoid surgery when confronted with children who have lost reduction of forearm fractures. Cast wedging remains a safe, effective alternative treatment option.

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ACKNOWLEDGEMENTS/DISCLOSURES: None.



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THE COST EFFECTIVENESS OF POLYETHERETHERKETONE (PEEK) CAGES FOR ANTERIOR CERVICAL DISCECTOMY AND FUSION

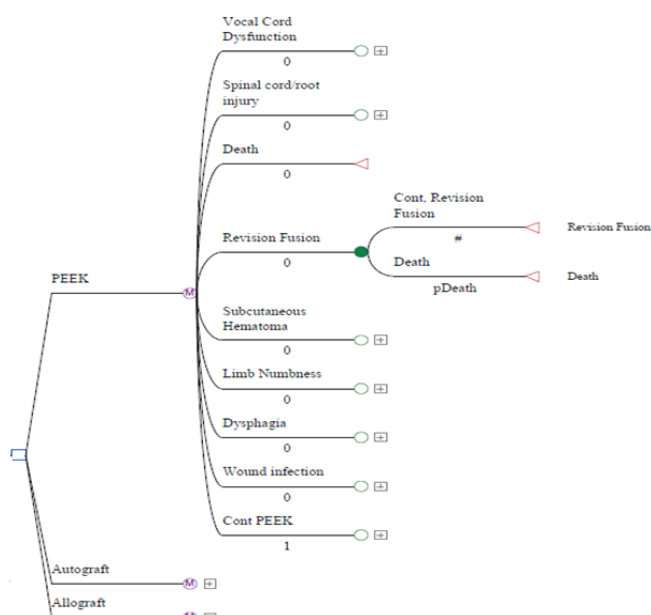
Authors: Sohrab Virk, M.D.; Harvinder Sandhu, M.D.; Safdar Khan, M.D.
Presenter: Sohrab Virk, M.D.

INTRODUCTION:

A cost-effectiveness analysis was performed comparing polyetheretherketone (PEEK) cages, autograft and allograft options for use in anterior cervical discectomy and fusion (ACDF). As a result of the movements toward more cost-effective treatments, research into the "value" of medical technologies and procedures has increased. The goal of this study was to evaluate autograft, PEEK cages, and allograft in terms of cost effectiveness.

METHODS:

A review of current literature was performed to provide accurate inputs into a Markov decision model to determine the most effective graft or hardware option for one level ACDF. Specifically, data regarding the rate of complications, quality adjusted life years gained (QALYs), and cost for each procedure type was collected. The Markov model was first run in a base case, using all currently available data. The model was then tested using 1 way and 2 way sensitivity analyses to determine the validity of the model's conclusions if specific aspects of model were changed. This model was run for 10 years post-operatively.



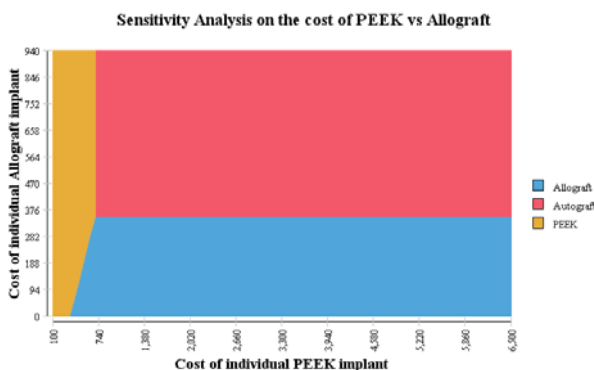
DATA AND RESULTS:

The cost per QALY for each graft option in the base case analysis was \$3,320/QALY for PEEK, \$2,413/QALY for autograft, and \$2,358/QALY for allograft. Therefore, all graft/hardware options are cost effective ways to improve outcomes for patients living with chronic neck pain. When comparing graft / hardware options the most cost-effective option was allograft. The incremental cost-effectiveness ratio (ICER) for PEEK compared to autograft or allograft was greater than \$50,000/QALY.

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THE COST EFFECTIVENESS OF POLYETHERETHERKETONE (PEEK) CAGES FOR ANTERIOR CERVICAL DISCECTOMY AND FUSION, CONTD.

Presenter: Sohrab Virk, M.D.



In the above figure there is a two way analysis of cost of PEEK and cost of allograft. If the cost of PEEK goes below \$1,000 it becomes the most cost-effective option.

DISCUSSION:

Based upon the current body of literature, allograft is the most cost effective graft/hardware option for ACDF. Compared to living with cervical myelopathy and/or radiculopathy, ACDF using any graft or hardware option is a cost-effective method of improving the quality of life of patients. PEEK is not a cost effective option when compared to allograft or autograft for use in ACDF.

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DISCLOSURES:

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SUPERIOR VERSUS ANTERIOR PLATING OF CLAVICLE FRACTURES: COMPARISONS AND FUNCTIONAL OUTCOMES

Authors: Nathan Formaini, D.O.; Benjamin Taylor, M.D.; Jeffrey Backes, M.D.;
Thomas Bramwell, D.O.
Presenter: Nathan Formaini, D.O.

INTRODUCTION: Plate fixation of displaced clavicle fractures has proven to be reliable and reproducible, leading to high union rates coupled with a low rate of associated complications.^{1,2} The decision whether to place the plate superiorly or anteroinferiorly on the clavicle, however, has remained controversial. Recent studies suggest biomechanical advantages and reduced implant prominence with an anteroinferior plate position.^{3,4}

This study was designed to retrospectively review a consecutive series of patients having undergone either superior or anteroinferior plate fixation of a displaced midshaft clavicle fracture. We hypothesized that anteroinferior plating may have benefits over superior plating in regards to decreased complications, improved patient outcomes, and a reduced incidence of implant removal after fracture union.

METHODS: We performed a retrospective review on a consecutive series of patients having undergone plate fixation of a displaced midshaft clavicle fracture at a single Level 1 urban trauma center.

Patients were included in the study if had (1) an acute completely displaced midshaft clavicle fracture, (2) a fracture amenable to plate fixation with at least three screws in the proximal and distal fragment, (3) an age of 18 years or older, and (4) sufficient follow-up to confirm fracture union.

A total of 105 patients were included in our analysis (62 superior plates vs. 43 anterior plates). Chart review was initiated and a database was created recording multiple subjective and objective variables for each patient. Patients were also asked to complete an Oxford Shoulder Score (OSS) questionnaire and Visual Analog Scale (VAS) assessment.

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

DATA AND RESULTS: Both superior and anterior techniques led to similar time to radiographic union (12.6 ± 4.8 weeks vs. 11.3 ± 5.2 weeks) and identical union rates at 95%. At the time of final follow-up, patient-reported implant prominence was nearly double in patients with a retained superior plate (54% vs. 29%, $P=0.04$). There was no significant difference in the mean VAS at an average of 2.77 years postoperatively, although there was a significant difference in the Oxford Shoulder Score questionnaire with a mean score of 41.4 in the superior group and 44.4 in the anterior group ($P=.008$). Implant removal occurred more frequently after superior plating (19% vs. 9%) but was not determined to be significant.

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SUPERIOR VERSUS ANTERIOR PLATING OF CLAVICLE FRACTURES: COMPARISONS AND FUNCTIONAL OUTCOMES, CONTD.

Presenter: Nathan Formaini, D.O.

Table 3. Patient-reported complaints and subjective outcome scores.

	Superior (N = 62)	Anterior (N = 43)	P value
Length of follow-up (years)	3.34 ± 2.01	2.00 ± 1.57	0.003*
Patient-reported implant prominence	54%	29%	0.039*
Peri-incisional numbness or dyesthesias	38%	36%	0.818
Visual Analog Score	1.87 ± 1.69	1.29 ± 1.58	0.151
Oxford Shoulder Score	41.38 ± 4.42	44.36 ± 4.34	0.008*

DISCUSSION: Both superior and anteroinferior plating are safe methods of treatment for displaced midshaft clavicle fractures demonstrating high rates of union and few perioperative complications. Superior plating leads to an increased rate of patient-reported implant prominence and may prompt more requests for implant removal.

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ACKNOWLEDGEMENTS: We would like to thank the following surgeons for allowing use of their patients into our study: Bruce French, M.D.; Kevin Pugh, M.D.; Joaquin Castaneda, M.D.; Sanjay Mehta, M.D.; Attila Poka, M.D.; Abraham Appleton, M.D.; Gary Millard, D.O.

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PERIOPERATIVE SAFETY OF TWO-TEAM SIMULTANEOUS BILATERAL TOTAL KNEE ARTHROPLASTY IN THE MORBIDLY OBESE PATIENT

Authors: Adam Madsen, D.O.; Benjamin Taylor, M.D.; Craig Dimitris, M.D.; Robert Steensen, M.D.; Steven Gaines, M.D.

Presenter: Adam Madsen, D.O.

INTRODUCTION:

There is an increase in morbid obesity as well as demand for total knee arthroplasty (TKA). Up to one-third of those undergoing unilateral TKA have symptomatic contralateral knee arthritis.¹ Morbidly obese are 32 times more likely to require TKA than those with a BMI less than 25², and from 1990 to 2005 this population saw a significant increase in TKAs being performed.³ For those with bilateral knee arthritis, physicians must help patients make an informed decision as to performing staged, sequential, or simultaneous total knee arthroplasty and be aware of the perioperative safety of operating on this population.

The purpose of this study was to evaluate the perioperative complications of two-team simultaneous bilateral TKA in the morbidly obese.

We are not aware of any published studies on simultaneous TKA in the morbidly obese population. We hypothesized that, as compared to the non-obese, the morbidly obese population would have a higher perioperative morbidity. We also hypothesized that bilateral TKA in the morbidly obese would have increased rates of blood transfusion, hospitalization, and complications as compared to the unilateral TKA in this same population.

METHODS:

After IRB approval, we performed a retrospective review of the records at a single tertiary hospital from 1997-2007 and identified 35 morbidly obese (BMI >40) patients who had undergone unilateral TKA, as well as 42 morbidly obese and 79 non-obese (BMI <30) who underwent simultaneous bilateral TKA. Clinical, operative, and postoperative variables were recorded along with complication rates.

Continuous variables were analyzed for significance using the Student t test with Microsoft Excel software (Redmond, WA). A Fisher exact test or chi-square analysis was used for analysis of dichotomous variables. All confidence intervals were calculated at the level of 95% and significance was determined as $P < .05$.

DATA AND RESULTS:

Clinical variables were similar between the morbidly obese TKA patients. The bilateral group had significantly increased operative times (132.4 vs. 115.5 min, $P < .01$), intravenous fluids (2556.1 vs. 2114.7 mL, $P = .03$), patients transfused (64.2% vs. 11.4%, $P < .01$), days in the hospital (3.6 vs. 3.2 days, $P = .03$), and discharge rate to rehabilitation facility (72.7% vs. 48.6%, $P = .01$). The morbidly obese groups were similar in knee range of motion (ROM) at the final follow-up evaluation. Major and minor complications were few and comparable with need for manipulation under anesthesia in unilateral TKA (11.4%, $P = .04$) as the only significant difference between groups.

When comparing the non-obese and morbidly obese patients undergoing bilateral TKA, the non-obese group had a significantly shorter operative time (120.7 vs. 132.4 min, $P < .01$), lower ASA scores (2.6 vs. 3.0, $P < .01$), increased knee ROM (119.3° vs. 107.5°, $P < .01$), but a non-significant higher percentage transfused (70.1% vs. 64.2%, $P = .28$). There was one major complication in both obese and non-obese bilateral TKA groups, but no deep infections. The non-obese group had non-significantly more manipulations ($n=3$, 3.8% vs. $n=0$, $P = .19$).

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PERIOPERATIVE SAFETY OF TWO-TEAM SIMULTANEOUS BILATERAL TOTAL KNEE ARTHROPLASTY IN THE MORBIDLY OBESE PATIENT, CONTD.

Presenter: Adam Madsen, D.O.

DISCUSSION:

We believe that our infection rate was not increased in our bilateral group due to our tourniquet time only averaged 6 minutes longer ($P=.13$) and our surgery time, though statistically significant, averaged only 17 minutes longer ($P<.01$). Also, each team in the simultaneous bilateral TKA used its own set of instruments.

The non-obese group also had no deep infections and a non-significant 2.5% superficial infection rate.

Our data comparing non-obese and morbidly obese bilateral TKA show there is more blood loss in the morbidly obese, though not significant; however, the transfusion rate was higher in the non-obese. This would suggest that the morbidly obese may not be at a higher transfusion risk than the non-obese undergoing bilateral TKA.

Regardless of BMI, patients should be informed of the increased risk when proceeding with simultaneous bilateral TKA. We feel that 2-team simultaneous bilateral TKA carries a low morbidity and mortality in the morbidly obese population and that the benefits outweigh the risks in those with bilateral knee disease and desire to undergo one simultaneous surgery.

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DISCLOSURES:

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Eric Skinner is a graduate student in Veterinary Medicine at The Ohio State University

GENE EXPRESSION OF OSTEOARTHRITIS: A META-ANALYSIS

Authors: Eric Skinner, B.S.c.; Alicia Bertone, D.V.M., Ph.D.
 Presenter: Eric Skinner, B.S.c.

INTRODUCTION

Osteoarthritis (OA) is a mounting debilitating disease that is progressive and currently incurable¹. Treatment of early OA is less invasive and provides a better long-term outcome². Biologic and gene therapies have shown progress at hindering OA and shown effectiveness in treatment³. There are limitations to this treatment:

Redundancy in interconnecting pathways

Immense number of factors to regulate

Multiple etiologies⁴

Meta-analyses permit the comprehensive analysis of existing information and inclusion of many gene expression studies that could not otherwise be compared.

METHODS

Conducted a comprehensive literature search for differentially expressed OA genes

Ranked the differentially expressed genes by intensity and occurrence

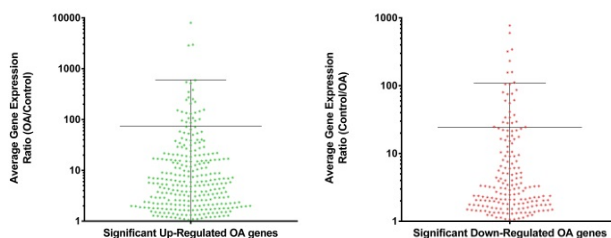
Identified ontologies (cellular component and biological process) and interrelatedness of the identified differentially expressed genes

Created a visual network layout, driven by primary cellular location

Statistical analysis was performed using Stata Statistical Software 12. A Chi-squared test was used to compare up and down regulation at the various cellular locations and Wilcoxon sign-rank test for the biological processes within the cellular location.

RESULTS

A stringent literature search was performed and 70 papers with nearly identical protocols met the standards for inclusion in the study. Data for 473 unique genes that was significantly differentially expressed was exported for further analysis with the values seen below.



Of those identified, four down regulated and three up regulated genes displayed disproportionately high fold changes. Five of these genes, Vitrin (VIT), Regulator of cell cycle (RGCC), F-box protein 2 (FBXO2), H1 histone family member X (H1FX), and Inter-alpha-trypsin inhibitor heavy chain 2 (ITIH2), ranked in the bottom third in terms of relatedness to the other genes.

The relatedness ranking is based on a score developed by the degree of concordance between genes reported on the list and the probability of interaction. This analysis collects published, functional interactions between genes across multiple organism platforms. The program weights the interactions based on the relatedness of the organism to humans and factors the number of these linked genes to generate a score seen below. VIT, RGCC, FBXO2, H1FX, ITIH2 are potential optimal novel targets for an OA signature since they lack influence from other genes due to their unrelated nature.

Continued on Next Page

GENE EXPRESSION OF OSTEOARTHRITIS: A META-ANALYSIS, CONTD.

Presenter: Eric Skinner, B.S.c.

Rank	Symbol	Biological Process	Score	Occurrences	# Linked Genes
1	COL1A2	Skeletal development	9.52	4	59
2	COL1A1	Skeletal development	9.37	4	56
3	RPL5	Translation	8.74	1	16
4	IGF1R	Regulation of cell cycle	8.6	1	33
5	MAPK3	Regulation of cell cycle	8.42	1	37
6	SPARC	Ossification	8.38	1	55
7	FGG	Signal transduction	8.37	1	17
8	GNB2L1	Signal transduction	8.23	1	27
9	RPL13A	Translation	8.21	2	11
10	COL3A1	Phosphate transport	8.15	5	41

These comprehensive interactions were used in conjunction with gene ontology information, to develop a visual network of OA striated by the primary cellular location that the gene functions. This network was able to identify three biological processes: skeletal development, phosphate transport, and cell adhesion, as significantly up regulated in the extracellular zone of the cell and one significantly down regulated process: transcription, in the nucleus.

CONCLUSION

Our system-based analysis supports the biologic model for osteoarthritis consisting of chondrocyte apoptosis and ineffective efforts to repair in the identification of four significant biological processes integral in these aspects. This approach has the exciting capability for identifying specific pathways and novel genes for future research into intervention strategies.

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ASSESSING THE IMPACT OF ORGANIZED YOUTH BASEBALL AND YOUTH CLIMATE DIFFERENCES IN ELITE MAJOR LEAGUE BASEBALL PITCHERS

Authors: Gregory Kolovich, M.D.; Lorena Floccari, M.D.; Mark Schickedantz, M.D.;
David Flanigan, M.D.; Grant Jones, M.D.; Michael Griesser, M.D.
Presenter: Gregory Kolovich, M.D.

Purpose:

In Major League Baseball's (MLB) 142 year history, only twenty-four pitchers have compiled 300 or more victories yet only four have reached this milestone in the past twenty years. There also has not been a 25-game winner or a pitcher who started more than 37 games in a season in over twenty years which has sparked debate whether modern pitching longevity is diminishing. Recent studies published regarding the detrimental effects on the glenohumeral joint by repetitive throwing at an early age in organized youth baseball. Moreover, pitchers born in warmer climates are more likely to throw year round, as opposed to pitchers born in colder climates, where young pitchers are likely to take a break from throwing during the winter. The purpose of this study was to investigate whether participation in organized youth baseball as well as youth climate differences affect longevity of elite MLB pitchers.

Methods:

Data were collected from all 710 MLB pitchers who compiled a minimum of 1500 career innings. Forty pitchers were excluded from the study as they were currently active on a MLB roster in 2011 bringing the total to 670 MLB pitchers. Six outcome variables were investigated: career innings, career wins, career losses, career complete games, career games started, and career years pitched.

Results:

We found that MLB players who did not participate in organized youth baseball had statistically greater career innings, career wins, and career complete games. MLB pitchers born in regions with colder average temperatures (Canada, Europe, Midwest US, and Northeast US) have greater mean career innings than pitchers born in regions with warmer average temperatures (Southeast US, Southwest US, West US, Latin America, and Asia).

Conclusions:

Organized youth baseball such as Little League or American Legion became prevalent in the United States and internationally after 1950. Participation in organized youth baseball may have detrimental affects to the pitching longevity of Major League pitchers as evidenced by diminishing career innings, wins, and complete games. In addition, MLB pitchers born in regions with colder average temperatures have greater career innings suggesting that pitching year round at an early age may also be detrimental to the longevity of Major League pitchers. These findings support the need for continued pitch count regulation in youth baseball as well suggest a need for monitored rest from throwing during the offseason.

*The Department of Orthopaedics would like to thank all
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41st Annual Mallory-Coleman Research Day*

*We would also like to thank the following for
making this research day a success:*

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Visiting Professor and Moderator

For lending his time and expertise to our research day

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Director of Orthopaedic Research

For coordinating the scientific presentations

Pfizer, Inc.

For supporting breakfast and lunch

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