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EMORY
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**OREF SOUTHEAST REGION
RESIDENT RESEARCH SYMPOSIUM**
Saturday, May 20, 2023

Emory University School of Medicine
Emory Musculoskeletal Institute
21 Ortho Lane
6th floor Conference Room
Atlanta, Georgia

Hosted by:
Scott D. Boden, MD
Professor and Chair
Department of Orthopaedic Surgery
Emory University School of Medicine

and

Co-Hosts:
Nina Suh, MD and Ajay Premkumar, MD
Associate Professors
Department of Orthopaedics
Emory University School of Medicine

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About OREF:

The Orthopaedic Research and Education Foundation (OREF) is a charitable 501(c)(3) organization committed to improving lives by supporting excellence in orthopaedic research through its grant funding and research education programs. As an independent nonprofit, OREF strives to improve clinical care and patient outcomes by advancing innovative research, developing new investigators, and uniting the orthopaedic community in promoting musculoskeletal health. Visit oref.org or follow OREF on Twitter (@OREFtoday).

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OREF SOUTHEAST REGION RESIDENT RESEARCH SYMPOSIUM

SUMMARY AGENDA

Saturday, May 20, 2023

7:00 a.m. – 8:00 a.m.	Registration and Breakfast Emory Musculoskeletal Institute 21 Ortho Lane, 6 th floor Conference Room Atlanta, Georgia
8:00 a.m. – 8:05 a.m.	Welcome and Introductions Scott D. Boden, MD Professor and Chair Department of Orthopaedic Surgery Emory University School of Medicine
8:05 a.m. – 8:10 a.m.	OREF Welcome Lee Grossman Chief Executive Officer Orthopaedic Research and Education Foundation
8:10 a.m. – 8:45 a.m.	Session I – Resident Research Presentations and Discussion
8:45 a.m. – 9:20 a.m.	Session II – Resident Research Presentations and Discussion
9:20 a.m. – 9:30 a.m.	<i>Break – please submit your scores from sessions I and II to OREF Staff</i>
9:30 a.m. – 10:05 a.m.	Session III – Resident Research Presentations and Discussion
10:05 a.m. – 10:35 a.m.	Session IV – Resident Research Presentations and Discussion
10:35 a.m. – 10:45 a.m.	<i>Break – please submit your scores from Sessions III and IV to OREF Staff</i>
10:45 a.m. – 10:48 a.m.	Introduction of Keynote Speaker
10:48 a.m. – 11:35 a.m.	Keynote Speaker <i>Planning and Executing a Research Inclusive Career in Orthopaedics</i> Scott D. Boden, MD Professor and Chair Department of Orthopaedic Surgery Emory University School of Medicine
11:35 a.m. – 11:40 a.m.	Announcement of top 6 as determined by judges' scores. <i>Thank you to all sponsors!</i> <i>Closing of program to OREF TV audience</i>
11:40 a.m. – 12:40 p.m.	Lunch

KEYNOTE SPEAKER



Scott D. Boden, MD

**Professor and Chair
Department of Orthopaedic Surgery
Emory University School of Medicine**

Dr. Scott D. Boden received his B.A. and M.D. from the University of Pennsylvania and completed an orthopaedic surgery residency at The George Washington University Medical Center, followed by a spine fellowship at Case Western Reserve University Hospitals. Dr. Boden is currently a tenured Professor of Orthopaedic Surgery at the Emory University School of Medicine and serves as the Chair of the Department of Orthopaedic Surgery, Director of the Emory Orthopaedics & Spine Center, and Vice President of Strategic Partnership Development/Business Innovation for Emory Healthcare. He was the Clinical Director of the Whitesides Orthopaedic Research Laboratory and has received many awards including the Volvo Award for Low Back Pain Research (4 times), The Marshall Urist Young Investigator Award, the North American Spine Society Outstanding Paper Award (7 times), and the prestigious AAOS/ORS Kappa Delta Research Award. He has received the Leon Wiltse Award for Outstanding Contributions to the field of spine surgery from the North American Spine Society. Dr. Boden has authored more than 200 peer-reviewed articles as well as 30 chapters and 7 textbooks.

Dr. Boden's basic research focus has centered on gaining an understanding of the biology of spine fusion healing and bone graft substitutes as well as the molecular control of bone formation and gene therapy applications for bone and intervertebral disc cartilage regeneration. His research is most recently focusing on the development of small molecules to promote bone and cartilage regeneration. He is a named inventor on over 45 issued patents and has had cumulative research funding of nearly \$30M. Dr. Boden's interests also include innovative health care delivery strategies in a managed care environment, and he is Founder and Chairmen of the National Spine Network, a collaboration of Spine Centers of Excellence around the U.S. that focused on outcomes research and quality improvement. That effort led to the largest NIH-funded multi-center prospective randomized trial studying spine surgery for patients with leg pain. Throughout his career, Dr. Boden has provided the vision and impetus for several innovative Emory Healthcare projects including a free standing multidisciplinary Musculoskeletal Outpatient Center (2004), an Orthopaedics & Spine Specialty Hospital (2008), The Emory Sports Medicine Complex in partnership with the Atlanta Hawks (2017), The Emory Sports Performance and

Research Center with the Atlanta Falcons (2021), and the Emory Musculoskeletal Institute (2021). The Emory University Orthopaedics & Spine Hospital (EUOSH) was designed using an innovative model of patient and family centered care and consistently receives some of the highest patient satisfaction ratings of any hospital in the U.S. The 180,000 square foot. Emory Musculoskeletal Institute is one of the most intelligent, healthy, safe, sustainable, and high-performance buildings in health care.

Judges

Jason Bariteau, MD
Emory University School of Medicine

Adam Boissonneault, MD
Emory University School of Medicine

Michael Gottschalk, MD
Emory University School of Medicine

Ajay Premkumar, MD
Emory University School of Medicine

Nina Suh, MD
Emory University School of Medicine

Eric R. Wagner, MD
Emory University School of Medicine

OREF Southeast Region Resident Research Symposium
DETAILED AGENDA
Saturday, May 20, 2023

7:00 a.m. – 8:00 a.m. **Registration/Breakfast**
Emory Musculoskeletal Institute
21 Ortho Lane, 6th Floor Conference Room
Atlanta, GA

8:00 a.m. – 8:05 a.m. **Welcome**
Scott D. Boden, MD
Professor and Chair
Department of Orthopaedic Surgery
Emory University School of Medicine

8:05 a.m. – 8:10 a.m. **OREF Welcome**
Lee Grossman
Chief Executive Officer
Orthopaedic Research and Education Foundation

Session I – Resident Research Presentations and Discussion

8:10 a.m. – 8:15 a.m. *Anterior Shoulder Instability – An International Delphi Consensus Statement*
Eoghan T. Hurley, MD, Duke University

8:15 a.m. – 8:20 a.m. *Opioid-Free Surgery vs Traditional Perioperative Analgesia: A Randomized Control Trial of Novel Clinical Care Pathway in Elective Orthopedic Surgery*
Benjamin Averkamp, MD, Atrium Health/Carolinas Medical Center

8:20 a.m. – 8:25 a.m. *Civilian Ballistic Knee Arthrotomies: Operative versus Non-Operative Management*
John Kopriva, MD, Emory University School of Medicine

8:25 a.m. – 8:30 a.m. *Is Fixing a Fracture Below a Short Nail Really Easier? A Comparative Study of Peri-Implant Fractures*
Aleksander Mika, MD, Vanderbilt University Medical Center

8:30 a.m. – 8:35 a.m. *Does Cement Mixing Technique Affect Surgical Exposures to Contaminants and Operating Room Exposures to Volatile Organic Compounds*
Edwin Chaharbakhshi, MD, West Virginia University

8:35 a.m. – 8:45 a.m. **Question and Answer**

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OREF Southeast Region Resident Research Symposium
DETAILED AGENDA
Saturday, May 20, 2023

Session II – Resident Research Presentations and Discussion

- 8:45 a.m. – 8:50 a.m. *Autograft Versus Allograft in the Treatment of Long Bone Non-unions: A Multicenter Study*
Samuel Cohen-Tanugi, MD, Atrium Health Musculoskeletal Institute
- 8:50 a.m. – 8:55 a.m. *The Cranial-Unstable Transverse Acetabular Fracture: An Important Variant*
Lauren Luther, MD, Vanderbilt University Medical Center
- 8:55 a.m. – 9:00 a.m. *Independent Large Diameter Screw Fixation Reduces Posterior Column Acetabular Fracture Site Motion Compared to a Plate and Screw Construct: A Biomechanical Study*
Helyn Grissom Fraser, MD, Emory University School of Medicine
- 9:00 a.m. – 9:05 a.m. *Maternal and Fetal Outcomes After Pelvic Fracture in Gravid Patients*
Kirby Bonvillain II, MD Atrium Health/Carolinas Medical Center
- 9:05 a.m. – 9:10 a.m. *Early Weight Bearing After Acetabular Fracture Fixation is Not Associated with Increased Fracture Displacement or Conversion to Total Hip Arthroplasty*
Jesse Seilern und Aspang, MD – Emory University School of Medicine
- 9:10 a.m. – 9:20 a.m. **Question and Answer**
- 9:20 a.m. – 9:30 a.m. **Break - please submit your scores from Sessions I and II to OREF Staff**

Session III – Resident Research Presentations and Discussion

- 9:30 a.m. – 9:35 a.m. *Chronic Anticoagulation in Revision Total Hip Arthroplasty is Associated with Worse Outcomes*
Aidan Sweeney, MD, Emory University School of Medicine
- 9:35 a.m. – 9:40 a.m. *Early versus Late Periprosthetic Joint Infection After Total Knee Arthroplasty: Do Patient Differences Exist?*
Corey Jones, MD, Emory University School of Medicine
- 9:40 a.m. – 9:45 a.m. *Non-Invasive Active Acoustics as Biomarkers of Early Periprosthetic Joint Effusions, a Cadaveric Study*
Rahul Goel, MD, Emory University School of Medicine
- 9:45 a.m. – 9:50 a.m. *Trends in Costs and Professional Reimbursements for Revision Total Knee and Hip Arthroplasty*
Bridger Rodoni, MD, Emory University School of Medicine
- 9:50 a.m. – 9:55 a.m. *90-Day Post-Operative Complications Among Revision TKA Patients Diagnosed with COVID-19 Postoperatively*
Janice Bonsu, MD, Emory University School of Medicine
- 9:55 a.m. – 10:05 a.m. **Question and Answer**

**OREF Southeast Region Resident Research Symposium
DETAILED AGENDA (continued)
Saturday, May 20, 2023**

Session IV – Resident Research Presentations and Discussion

- 10:05 a.m. – 10:10 a.m. *Determining the Effect of Intraoperative TXA on Postoperative Blood Loss in ACDF*
Ayub Karwandyar, MD, Vanderbilt University Medical Center
- 10:10 a.m. – 10:15 a.m. *Are Routine Postoperative Laboratory Tests Necessary After Primary 1 or 2 Level Lateral Interbody Fusions?*
Virgenal Owens, MD, Carolinas Medical Center
- 10:15 a.m. – 10:20 a.m. *Lower Perioperative Complication Rate and Shorter Length of Hospital Stay in Technology Assisted Total Knee Arthroplasty vs Conventional Instrumentation in 2,174,685 Primary Total Knee Arthroplasties: Nationwide Inpatient Sample 2016-2019*
David Constantinescu, MD, University of Miami
- 10:20 a.m. – 10:25 a.m. *Fracture Related Infections after Low-velocity Ballistic Tibia Fractures: What do Cultures Show?*
Nainisha Chintalapudi, MD, Atrium Health/Carolinas Medical Center
- 10:25 a.m. – 10:35 a.m. **Question and Answer**
- 10:35 a.m. – 10:45 a.m. **Break – please submit your scores from Sessions III and IV to OREF Staff**
- 10:45 a.m. – 10:48 a.m. **Introduction of Keynote Speaker**
- 10:48 a.m. – 11:35 a.m. **Keynote Speaker**
Planning and Executing a Research Inclusive Career in Orthopaedics
Scott D. Boden, MD
Professor and Chair
Department of Orthopaedic Surgery
Emory University School of Medicine
- 11:35 a.m. – 11:40 a.m. **Announcement of top 6 winners as determined by Judges scores**
Thank you to the sponsors.
Closing of program to OREF TV audience
- 11:40 a.m. – 12:40 p.m. **Lunch Reception**

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Anterior Shoulder Instability—An International Delphi Consensus Statement

Eoghan T. Hurley, MD
Duke University

Purpose: The purpose of this study was to establish consensus statements via the Delphi process on the management anterior shoulder instability.

Significance: There are often regional philosophical differences in how anterior shoulder instability is approached that result in a dichotomous treatment algorithm between surgeons.

Methods: A consensus process on the treatment of anterior shoulder instability utilizing the Delphi technique was conducted. Sixty-five shoulder surgeons from 14 countries across 5 continents participated in these consensus statements based on their level of expertise in the field. Nine working groups were established 1) Diagnosis, 2) Non-operative Management, 3) Bankart Repair, 4) Latarjet Procedure, 5) Remplissage, 6) Glenoid Bone-Grafting, 7) Revision Surgery, 8) Rehabilitation and Return to Play, and 9) Follow-up. Consensus was defined as achieving 80-89% agreement, whereas strong consensus was defined as 90-99% agreement, and unanimous consensus was indicated by 100% agreement with a proposed statement.

Results: Of the 84 total questions and consensus statements on anterior shoulder instability, 14 achieved unanimous consensus, 60 achieved strong consensus, 9 achieved consensus and 1 did not achieve consensus.

Conclusion: The majority of statements reached unanimous or strong consensus, and ultimately these statements may provide surgeons with guidelines for treating patients with anterior shoulder instability.

Opioid-Free Surgery vs Traditional Perioperative Analgesia: A Randomized Control Trial of Novel Clinical Care Pathway in Elective Orthopedic Surgery

Benjamin Averkamp, MD
Atrium Health/Carolinas Medical Center

Purpose: The purpose was to compare the efficacy of a novel opioid-free pain management pathway compared to an opioid-containing pathway across five orthopedic subspecialty procedures.

Significance: Recently, orthopedic surgeons have attempted to decrease opioid consumption post-operatively through multimodal pain management. Limited effort however has been made in eliminating opioids entirely in the peri- and post-operative period.

Methods: This is a noninferior randomized controlled trial of 315 patients undergoing orthopedic surgery. In a 1:1 unblinded fashion, patients were randomized to either an opioid-free (OF, n=157) or opioid-containing (OC, n=158) pain management pathway for five, common orthopedic subspecialty procedures. Pain was measured with a numeric pain rating scale (NPRS) of 0 to 10 at 6-, 12-, 24-hour (primary outcome assessing noninferiority), 2-,6-week, and 1-year.

Results: At 24-hours, median NPRS among the OF group was significantly ($p<.0001$) noninferior to the OC group. Secondly, pain levels were significantly lower among OF patients than OC group at 12-hours and 2-weeks ($P=.0003$, $.0173$). Patients in the OF group reported greater comfort at 24-hours ($p=.0392$) and higher pain satisfaction at 6-weeks ($p=.0355$).

Conclusion: Across multiple orthopedic subspecialty procedures, an opioid-free pain management pathway is effective and provided noninferior pain control at 24-hours compared to the opioid-containing pathway.

Civilian Ballistic Knee Arthrotomies: Operative versus Non-Operative Management

John Kopriva, MD
Emory University School of Medicine

Purpose: We hypothesize that non-operative management of ballistic knee arthrotomies carries no increased risk of infection.

Significance: Surgeons debate the necessity of operative management for ballistic arthrotomies. For numbers, current studies include multiple joints and varying injury patterns.

Methods: A retrospective review of patients between 2018-2022 who sustained a ballistic knee arthrotomy. To create comparable groups, we included only patients that met our proposed non-operative criteria (regardless of management)—wounds <1cm, no foreign body or debris, and no fracture requiring fixation. To improve follow-up, patients were contacted via phone survey.

Results: 115 patients sustained ballistic knee arthrotomies. 46 met non-operative criteria. Of the 46, 24 underwent operative irrigation and debridement and 22 received non-operative management (bedside irrigation and antibiotics). 17/24 operative and 7/22 non-operative patients returned for follow-up. Phone surveys successfully contacted 13 patients and chart review of emergency room visits for the knee added 2 more (9 operative, 6 non-operative), creating 8-month to 3-year follow-ups. No patient was found to develop an infection.

Conclusion: There was no difference in infection rates (zero) between operative and non-operative groups. Follow-up remains a limitation, but phone surveys created improvement. Ballistic knee arthrotomies meeting our proposed criteria may be eligible for non-operative management.

Is Fixing a Fracture Below a Short Nail Really Easier? A Comparative Study of Peri-Implant Fractures

Aleksander Mika, MD
Vanderbilt University Medical Center

Purpose: To compare injury patterns and outcomes following peri-implant fractures below short or long cephalomedullary nails.

Significance: Many different devices are commonly used for the treatment of intertrochanteric fractures with no consensus on ideal nail length. Determining the clinical sequelae of fixing peri-implant fractures around short versus long nails may provide valuable information for this fracture pattern.

Methods We identified 37 patients with peri-implant fractures around cephalomedullary nails and compared fracture pattern, treatment strategy, operative details, and outcomes between groups.

Results: Treatment groups differed on fracture location (diaphyseal vs metaphyseal) and fixation method (revision nail vs ORIF), but when comparing operative details, there was no differences in operative time or x-ray use. The short nail group experienced less blood loss ($p=0.027$) but had equivocal transfusion requirement.

There was no difference in hardware failure or implant complication. We found no difference in discharge destination, weightbearing status, or length of stay when comparing the two groups. When controlling for other variables including nail length, transfusion requirement was the only factor significantly associated with length of stay ($p=0.006$).

Conclusion: Despite several small statistical differences, we found no clinically significant differences in revision surgery for fracture below a short or long cephalomedullary nail.

Does Cement Mixing Technique Affect Surgical Exposures to Contaminants and Operating Room Exposures to Volatile Organic Compounds?

Edwin Chaharbakhshi, MD
West Virginia University

Purpose: Poly(methyl methacrylate) (PMMA) cement may be a source of contamination while also releasing harmful volatile organic compounds (VOCs) during preparation. We hypothesized that different cement mixing techniques have variability in terms of contamination and VOC exposure.

Significance: Prosthetic joint infections have been hypothesized to be related to bacterial adherence to cement particle plumes during preparation. VOCs from PMMA have been shown to be harmful in *in vivo* models suggesting occupational exposure should be limited in operating rooms (ORs). Comparing mixing techniques may yield an optimal method.

Methods: Open bowl, vacuum, and all-in-one mixing techniques were compared in an OR. Five tests with each technique were performed. Cements were pre-mixed with 1 gram of powder that illuminates under blacklight. Particle and VOC counters were positioned throughout the OR. Contamination events, distance to contamination, particle counts in air, and VOC concentrations were compared.

Results: All-in-one mixing systems had significantly shorter ranges of contamination from the mixing site ($p=0.03$), significantly less contamination sites ($p=0.04$), and significantly lower VOC concentrations ($p<0.05$) compared to open bowl and closed bowl vacuum mixing systems.

Conclusion: All-in-one mixing systems may be safer for patients and OR staff in regard to particle contamination and harmful VOC exposure.

Autograft versus Allograft in the Treatment of Long Bone Non-unions: A Multicenter study

Samuel Cohen-Tanugi, MD
Atrium Health Musculoskeletal Institute

Introduction: Nonunion of long bone fractures remains a challenge for orthopedic surgeons with a prevalence of up to 20%. Current dogma on bone grafting for non-union postulates that autograft is superior to allograft. Concerns of morbidity, blood loss, and pain have led to an interest in allograft. The purpose of this study is to compare clinical outcomes in patients who received autograft, allograft, or both during long bone non-union surgery.

Materials and Methods: This was a multi-center retrospective review of long bone non-unions that were treated with either autograft, allograft, or both. Autograft included iliac crest, RIA, and local graft. Inclusion criteria included patients >18 years old with follow-up > 180 days. Demographic data, injury and surgical characteristics, complications, and outcomes were collected. The primary outcome was the rate of union, and secondary outcomes were rates of overall complication, reoperations, length of stay (LOS).

Results: 811 patients met our inclusion criteria. 88 patients received allograft alone, 597 received autograft alone, and 126 patients received both. Injury characteristics showed that the allograft group had fewer segmental gap defects (3.4% vs 17.3% vs 16.7%; $p = 0.0007$). There was no difference in union rate between groups ($p = 0.16$). The allograft group had lower LOS ($p = 0.0001$) and a lower readmission rate (9.1% vs 23.2% vs 20.1%; $p = 0.064$).

Conclusion: In this large retrospective review of long bone non-union surgery, patients receiving allograft did not experience lower rates of union. These preliminary findings suggest that allograft may be a good option in non-union surgery.

The Cranial-Unstable Transverse Acetabular Fracture: An Important Variant

Lauren Luther, MD
Vanderbilt University School of Medicine

Purpose: We sought to characterize outcomes of transverse acetabular fractures with an associated ipsilateral sacroiliac joint injury ("cranial unstable"). We hypothesized that operative sequence (pelvis-first vs. acetabulum-first) would impact important operative and post-operative outcomes.

Significance: Operative details (operative time, blood loss) and postoperative reduction quality are important predictors of outcome in acetabular fractures.

Methods: We identified all patients with a transverse or transverse-posterior wall (T-PW) fracture in combination with ipsilateral sacroiliac joint injury over a 12-year period. Demographics, associated injuries, mechanism, operative details including sequence of fixation, reduction quality, and clinical outcomes were collected. Malreduction was defined as >2mm of intra-articular step-off or gap.

Results: From a cohort of 992 acetabular fractures, we identified 28 (2.8%) transverse fractures with unstable cranial segments. Patients were predominantly young (average age=37) males (71%) involved in higher energy mechanisms. When considering fixation strategy, an "acetabulum-first" approach was associated with a higher rate of malreduction (33% vs 6%, $p<0.05$), higher average blood loss (1700 vs 520mL, $p<0.05$), and increased operative time (406 vs 293 min $p=0.06$) when compared to a "ring-first" approach.

Conclusion: In this series, a "ring-first" approach to fixing cranial unstable transverse acetabular fractures was associated with improved operative and post-operative outcomes.

Independent Large Diameter Screw Fixation Reduces Posterior Column Acetabular Fracture Site Motion Compared to a Plate and Screw Construct: A Biomechanical Study

Helyn Grissom Fraser, MD
Emory University School of Medicine

Purpose: Determine whether a suprapectineal posterior column pelvic reconstruction plate and screw (P&S) construct or a single 6.5 mm cannulated posterior column screw (PCS) construct is superior for fixation of acetabular fractures involving the posterior column.

Significance: To our knowledge, this is the first biomechanical model testing these specific fixation strategies in posterior column acetabulum fractures.

Methods: 12 composite hemipelvi were utilized, 6 per construct. The models were cyclically loaded at 0.5 cycles/second for 100 cycles at 400N and 800N, in a sit-to-stand position and subsequently in a squat-to-stand position.

Results: Under sit-to-stand loading, the PCS construct exhibited less relative movement at both 400N (0.06 ± 0.02 vs 0.1 ± 0.02 , $p=0.02$) and 800N (0.13 ± 0.03 vs 0.19 ± 0.04 , $p=0.03$). Under squat-to-stand loading, the PCS construct again outperformed the P&S construct at 400 N (0.22 ± 0.13 vs 1.9 ± 0.5 , $p = < 0.001$) and 800N (1.48 ± 0.44 , vs 4.77 ± 0.3 , $p = < 0.001$). 2 of 6 PCS and 4 of 6 P&S underwent catastrophic failure during squat-to-stand loading at 800N.

Conclusion: Fixation of a posterior column acetabulum fracture with a 6.5 mm cannulated screw is biomechanically superior to fixation with a P&S construct.

Maternal and Fetal Outcomes After Pelvic Fracture in Gravid Patients

Kirby Bonvillain II, MD
Atrium Health/Carolinas Medical Center

Purpose: This study examines injury features, interventions, and maternal-fetal consequences in pregnant patients with pelvic ring fractures.

Significance: Pelvic fractures during pregnancy are uncommon, severe injuries with insufficient existing research.

Methods: Medical records of pregnant patients with pelvic ring or combined pelvic-acetabular fractures at a Level I trauma center were reviewed. Patient demographics, co-existing injuries, treatments, and maternal-fetal outcomes were analyzed.

Results: Of 18 identified patients, 14 had pelvic ring fractures and four had combined fractures. Median Injury Severity Score (ISS) was 29. Gravid status distribution was similar. Nine patients presented with intrauterine fetal demise (IUFD) and ISS >15. Eight underwent open reduction and internal fixation (ORIF). Maternal complications occurred in eight patients: three infections, three pulmonary embolisms, and pain/neurological deficits in five. One deep infection correlated with pelvic ORIF. Among IUFD patients, five complications arose. One maternal death resulted from pulmonary embolism and sepsis. At final follow-up, seven of 18 patients experienced at least one additional live birth, with two having prior IUFDs and four prior ORIFs.

Conclusions: IUFD is common in patients with ISS >15. No association was observed between ORIF and fetal demise sequelae. Previous IUFD and/or fracture fixation does not impede future conception.

Early Weight Bearing After Acetabular Fracture Fixation is Not Associated with Increased Fracture Displacement or Conversion to Total Hip Arthroplasty

Jesse Seilern und Aspang, MD
Emory University School of Medicine

Purpose: Determine the association between weight bearing restriction (WBR) compliance and postoperative acetabular fracture displacement.

Significance: WBR protocols after acetabular surgery are currently ill defined.

Methods: 347 consecutive patients requiring acetabular surgery with ≥ 3 months follow-up were included. Postoperative fracture gap- and articular step-off displacement (difference between immediate postoperative and final radiographs) was measured on AP and Judet radiographs. A difference of ≥ 5 mm (fracture gap) and ≥ 2 mm (articular step-off) was considered significant displacement. WBR compliance was determined from medical record review. Outcomes between compliant and non-compliant patients were evaluated with Chi-squared analysis and Fisher's exact test.

Results: Seventy-two (20.5%) patients were non-compliant. Time to weight bearing as tolerated (WBAT) was 10 ± 2 weeks for compliant, and 5 ± 3 weeks for non-compliant patients ($p < 0.001$). No non-compliant patient had fracture gap displacement ($n=0/72$) compared to two compliant patients ($n=2/280$), ($p=0.472$). There was no difference in step-off displacement between compliant (6.8%) and non-compliant (4.2%) patients ($p=0.587$). Non-compliant patients did not have significantly higher rates of conversion to THA (2.8%) compared to compliant patients (4.3%), ($p=0.743$).

Conclusion: Non-compliance with WBR and early WBAT was not associated with fracture displacement or need for THA, suggesting that early weight bearing protocols may be safe for patients after surgical treatment of acetabular fractures.

Chronic Anticoagulation in Revision Total Hip Arthroplasty is Associated with Worse Outcomes

Aidan Sweeney, MD
Emory University School of Medicine

Purpose: To evaluate the effects of chronic anticoagulation (CA) on complications following revision total hip arthroplasty (rTHA). We believe that patients on CA will have higher complication rates after rTHA compared to those not on CA.

Significance: Patient's undergoing rTHA have worse outcomes when compared to their primary counterparts. Several risk factors have been identified that contribute to the increased complication rates. However, the role of CA and its effects on complications following rTHA have yet to be studied.

Methodology: The IBM MarketScan database was utilized to retrospectively identify patients undergoing rTHA. Patients were divided into cohorts based on their CA status. 90-day and 2-year complication rates were evaluated with univariate and multivariate analysis controlling for demographic and comorbidity data.

Results: A total of 10,157 patients were included, including 2,100 patients on CA. At 90 days, CA patients had higher odds of PJI, sepsis, surgical site infection, and prosthesis complication. At 2 years, CA patients had higher odds of PJI, prosthesis complication, and revision.

Conclusion: Patients on CA have increased odds of developing acute and chronic complications when undergoing rTHA when compared to those that are not on chronic anticoagulation.

Early versus Late Periprosthetic Joint Infection After Total Knee Arthroplasty: Do Patient Differences Exist?

Corey Jones, MD
Emory University School of Medicine

Purpose: The objective of the study was to determine demographic and comorbidity profile differences between those with early versus late PJI.

Significance: PJI following TKA is a severe complication with psychosocial implications for patients and a financial burden on the healthcare system. However, there is limited evidence comparing patients with early versus late PJI.

Methodology: Subjects diagnosed with PJI were classified as either 'early' (within 90 days of index procedure) or 'late' (>2 years after index arthroplasty) using the IBM MarketScan database. Demographics and comorbidities between groups were compared, including univariate and multivariable logistic regression analyses.

Results: Compared to the early infection group, the late infection group was younger (58.1 vs. 62.4 years, $P = <0.001$) and had a higher likelihood of chronic kidney disease (13.3% vs. 4.1%; OR 5.17, $P = 0.002$), malignancy (20.4% vs. 10.5%; OR 2.53, $P = 0.009$), uncomplicated diabetes (40.8% vs. 30.6%; OR 2.00, $P = 0.01$), or rheumatoid arthritis (9.2% vs. 3.3%; OR 5.17, $P = 0.046$).

Conclusions: Younger age, chronic kidney disease, malignancy, uncomplicated diabetes, and rheumatoid arthritis were found to be independent risk factors for the development of late PJI. Preoperative optimization interventions may be necessary for these patients.

Non-invasive Active Acoustics as Biomarkers of Early Periprosthetic Joint Effusions, A Cadaveric Study

Rahul Goel, MD

Emory University School of Medicine

Introduction: Knee joint effusions in the setting of total knee arthroplasty (TKA) may be associated with several different clinical entities, including prosthetic joint infection (PJI) and aseptic loosening, the two most common indications for TKA revision. There is a lack of available simple and operator independent non-invasive tools to detect small (<60 cc) effusions within the knee joint and characterize these effusions. This work presents a novel application of non-invasive active acoustics (AA) to identify, characterize, and potentially monitor periprosthetic joint effusions.

Methods: Seven fresh frozen hip-to-toe cadavers (80.6 ± 10.2 years, BMI 26.0 ± 4.9 kg/m²) with knee replacements were included in this study. These included three cruciate retaining, three posterior stabilized TKA and one unicompartmental knee arthroplasty. Effusions were simulated by injecting 20mL increments (80mL max) of saline and bacteria (methicillin sensitive staphylococcus aureus) solutions into the joint space. AA were recorded after each injection by broad band exciting the tibia with a miniature shaker. Transducers attached to the skin measured the input force and output acceleration 2.2cm proximal to the input. The normalized spectral band power (BP) of the input / output frequency response functions was calculated.

Results: The BP at 1255 ± 228 Hz was highly correlated (Pearson's $r = 0.83$) with the injected volumes over all specimens ($n = 33$). Within specimen correlations varied between 0.80 and 1.00. The 20 cc volume BP was higher than the baseline (0 cc) ($p = 0.03$). The BP was on average lower for bacteria solution compared to saline solution, however not significantly ($p > 0.05$).

Discussion and Conclusion: This cadaveric study demonstrates the potential utility of AA to quantify extremely small (20 cc) effusions in patients with total knee arthroplasties. The use of AA to discriminate between bacteria and saline effusions demonstrates promise but requires mores data to be confirmed.

Figure 1:

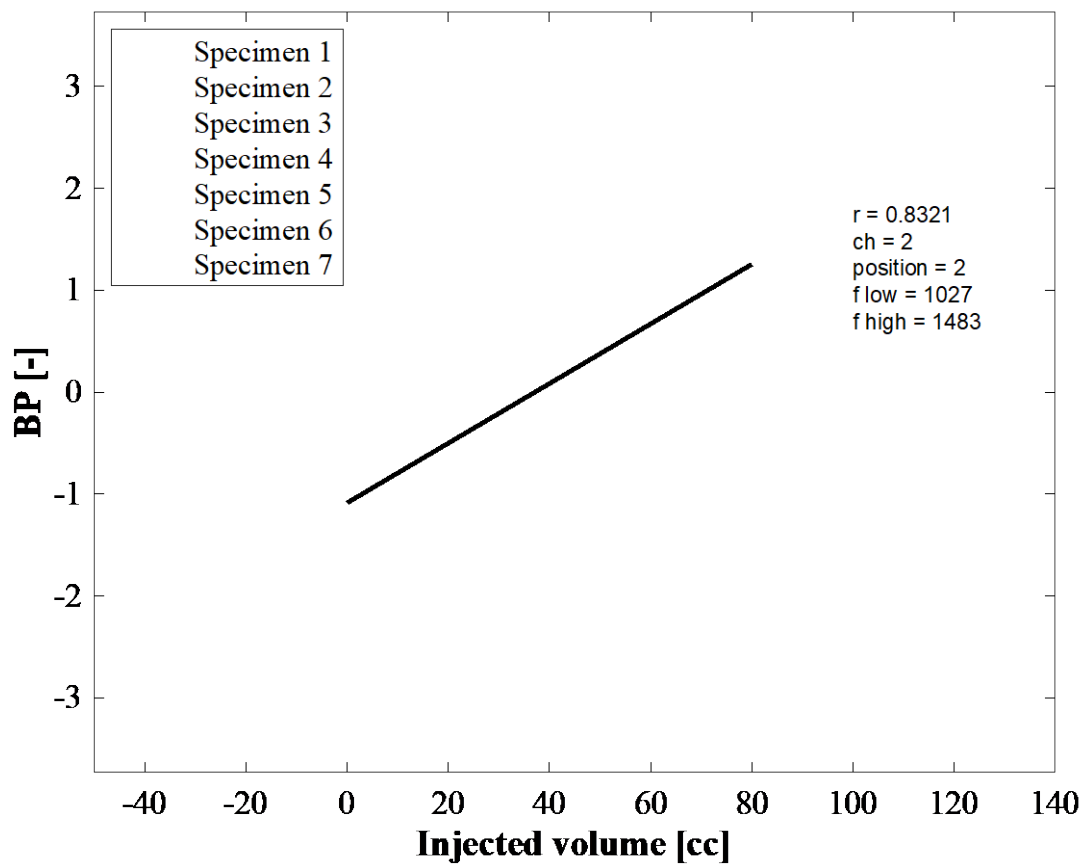


Figure 1 Correlation plot between the normalized BP and the injected fluid volume. The BP correlates with the injected volume with a Pearson's r of 0.83 at a population level (33 data points). (Ch 2 means described output location, position 2 means 45° flexion.)

Trends in Costs and Professional Reimbursements for Revision Total Knee and Hip Arthroplasty

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Introduction: With increasing numbers of revision hip and knee arthroplasties (rTHA and rTKA), understanding trends in related out-of-pocket (OOP) costs, overall costs, and provider reimbursements is critical to improve patient access to care.

Methods: This study utilized the IBM MarketScan healthcare database to identify patients who underwent rTHA or rTKA in the inpatient setting between 2009 and 2018. Patient OOP costs associated with surgery and related inpatient care were calculated as the sum of copayment, coinsurance, and deductible payments. Professional reimbursement was calculated as total payments to the principal physician. All monetary data were adjusted to 2018 dollars. Multivariate regressions evaluated the associations between costs and procedure type, insurance type, and region of service.

Results: 89,724 total patients were evaluated. From 2009 to 2018, overall costs for rTHA significantly increased by 42.7%, and overall costs for rTKA significantly increased by 39.6%. During this period, professional reimbursements did not increase, but when measured as a proportion of total costs significantly decreased by 36.4%. OOP costs for rTHA had no significant difference, while OOP costs for rTKA had a significant increase of 27.4%. Patients with commercial insurance and fee-for-service (FFS), high-deductible health plans were associated with having the highest OOP costs for both procedures. Patients with Medicare FFS plans had a decrease of \$411.8 and \$558.5 in OOP costs for rTHA and rTKA, respectively, compared to patients with private FFS plans.

Conclusion: From 2009 to 2018, total costs related to rTHA and rTKA significantly increased. OOP costs significantly increased for rTKA, and professional reimbursements significantly decreased relative to total costs during this period. Overall, these trends may combine to create greater financial burden to patients and the healthcare system, as well as further limit patients' access to revision arthroplasty care.

90-Day Post-Operative Complications Among Revision TKA Patients Diagnosed with COVID-19 Postoperatively

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Purpose: The objective of this study is to characterize the postoperative effects of postoperative COVID-19 infection among revision TKA (rTKA) patients.

Significance: The COVID-19 pandemic has introduced new challenges for the medical community, including the management of patients who are diagnosed with postoperative COVID, and its potential impact on recovery.

Methodology: We reviewed data from the IBM MarketScan database for patients who underwent rTKA and received a postoperative diagnosis of COVID within 90 days. Using propensity-score matching and multivariate logistic regression, we compared postoperative complications in this cohort to rTKA patients without a COVID diagnosis, as well as to COVID+ patients who did not undergo rTKA.

Results: Compared to 600 matched rTKA/COVID- patients, 60 rTKA/COVID+ patients had higher rates of pneumonia (OR 6.07, $p<0.001$), PE (OR 32.4, $p<0.001$), DVT (OR 32.4, $p<0.001$), and readmissions (OR 2.19, $p=0.02$). Among rTKA/COVID+ patients, the time to diagnosis of thromboembolic event after a COVID diagnosis was 14.7 days (SE 6.13) versus 7.6 days (SE 3.6) for COVID+ patients without rTKA ($p=0.34$).

Conclusion: Among rTKA/COVID+ patients, there was a significant increase in thromboembolic events, pneumonia, and subsequent readmission. There was no significant difference in the time to thromboembolic event compared to COVID+ patients alone.

Determining the Effect of Intraoperative TXA on Postoperative Blood Loss in ACDF

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Purpose/Hypothesis: Intraoperative tranexamic acid (TXA) could be an effective agent in improving hemostasis following anterior cervical discectomy and fusion (ACDF) surgery.

Significance: TXA is often administered to reduce blood loss without increasing the risk of complications or thrombotic events. Currently, there are limited studies looking at TXA use specifically for ACDF. Our goal was to examine the effect of intraoperative TXA in ACDF on postoperative bleeding.

Methods : 286 patients underwent ACDF; 190 patients did not receive TXA while 96 patients did receive intraoperative TXA (a 30 mg/kg bolus followed by continuous 3 mg/kg per hour infusions of TXA beginning 1 hour prior to surgery and finishing upon surgical site closure). The primary outcome was postoperative blood loss, measured by 24-hour drain output. Univariate, bivariate and multivariate analysis were used to compare results.

Results: Intraoperative TXA was associated with shorter drain duration ($\beta=-5.74$, 95% CI: -10.9 to -0.53, $p=0.031$), lower 24-hour drain output ($\beta=-9.65$, 95% CI: -17.5 to -1.79, $p=0.016$), and smaller decreases between preoperative and postoperative hemoglobin ($\beta=-0.49$, 95% CI: -0.86 to -0.12, $p=0.011$) and hematocrit ($\beta=-1.76$, 95% CI: -2.95 to -0.58, $p=0.004$). TXA use had no impact on rates of transfusions, thrombotic events, and hematomas.

Conclusion: Intraoperative TXA use for ACDF procedures leads to a decrease in postoperative blood loss and faster drain removal, while not increasing the risk of thromboembolic complications.

Are Routine Postoperative Laboratory Tests Necessary After Primary 1 or 2 Level Lateral Interbody Fusions?

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Purpose: The purpose of this study is to determine if routine postoperative labs are necessary after primary 1 or 2 level lateral interbody fusion procedures.

Significance: Evaluate the cost-effectiveness, safety, and efficacy of obtaining limited routine labs for primary lateral interbody fusion.

Methods: A retrospective review of patients undergoing a primary lateral interbody fusion performed at a single center from 2012 to 2021. Included were patients who received routine pre- and post-op laboratory results. We excluded any patients with missing pre-operative or post-operative data. Charts were reviewed for any inpatient interventions for abnormal lab values (blood transfusion, electrolyte repletion, IV bolus for AKI). Secondary outcome variables included 90-day emergency room visits or readmissions.

Results: Out of 110 patients, 4 had actionable lab values (3.6%) that required electrolyte repletion for hypokalemia. The 4 patients had statistically significantly lower creatinine and potassium in postop lab values compared to the rest of the cohort. One patient required blood transfusion for symptomatic anemia. One patient returned to the ED within 90 days from discharge for reasons unrelated to abnormal lab values.

Conclusion: 96% of routine labs did not warrant intervention in patients undergoing one and two level lateral interbody fusions with percutaneous posterior instrumentation.

Lower Perioperative Complication Rate and Shorter Length of Hospital Stay in Technology Assisted Total Knee Arthroplasty vs Conventional Instrumentation in 2,174,685 Primary Total Knee Arthroplasties: Nationwide Inpatient Sample 2016-2019

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Purpose: To compare (1) perioperative complications and (2) resource utilization between robotic assisted (RA) and computer navigated (CN) versus conventional TKA.

Significance: Technology allows surgeons increased precision in component positioning in total knee arthroplasty (TKA). Whether the value and outcomes differ over conventional instrumentation remains to be settled.

Methods: A retrospective cohort study was performed using the Nationwide Inpatient Sample database to identify patients undergoing primary elective TKA from 2016 to 2019 using RA, CA or conventional instrumentation.

Results: A total of 2,174,685 patients were identified and included RA (69,445), CN (112,225), or conventional instrumented (1,993,015) TKA. RA TKA leads to lower intraoperative fracture (0.05% vs 0.07%, $p<0.05$), respiratory complications (0.6% vs 1.1%, $p<0.05$), renal failure (1.3% vs 1.7%, $p<0.05$), delirium (0.1% vs 0.2%, $p<0.05$), GI complications (0.04% vs 0.09%, $p<0.05$), postop anemia (8.9% vs 13.9%, $p<0.05$), blood transfusion (0.4% vs 0.9%, $p<0.05$), pulmonary embolism (PE) and deep vein thrombosis (DVT) (0.1% vs 0.2%, $p<0.05$) and mortality (0.01% vs 0.02%, $p<0.05$) compared to conventional TKA. Length of hospital stay is decreased in both RA (1.8 days vs 2.2 days, $p<0.05$) and CN (2.1 days vs 2.2 days, $p<0.05$).

Conclusion: Technology assisted TKA results in lower perioperative complication rates and faster recovery.

Fracture Related Infections after Low-velocity Ballistic Tibia Fractures: What do Cultures show?

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Purpose: Identify risk factors for developing a culture positive infection in operative ballistic tibia fractures and to report on the microbiology of intraoperative culture results obtained during debridement.

Significance: Ballistic tibia fractures have deep infection rates ranging from 2-14%, however there is limited information regarding their microbiology.

Methods: A retrospective review was performed of 128 adults with operative low-velocity ballistic tibia fractures, from 2011-2020. We excluded injuries with large tissue defects or concomitant vascular injuries. All patients received Cefazolin prophylaxis. Demographics, injury and surgical characteristics, wound management, and cultures were abstracted.

Results: The culture positive infection rate was 12.8% (12/94) with 55% of organisms not susceptible to first generation cephalosporins. The most common isolate was *Streptococci* (50%) then gram negative rods (33.3%), and anaerobes (25%). There were no identifiable risks for FRI. 41.6% of patients required a second debridement where 40% of cultures were positive for *Enterococcus*.

Conclusions: We found a high infection rate with 55% of organisms not susceptible to standard of care prophylaxis and no difference in baseline or surgical characteristics between FRI cohort and patients without infections. Consideration should be given to broader prophylaxis or local antibiotic treatment in the management of low-velocity ballistic tibia fractures.

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