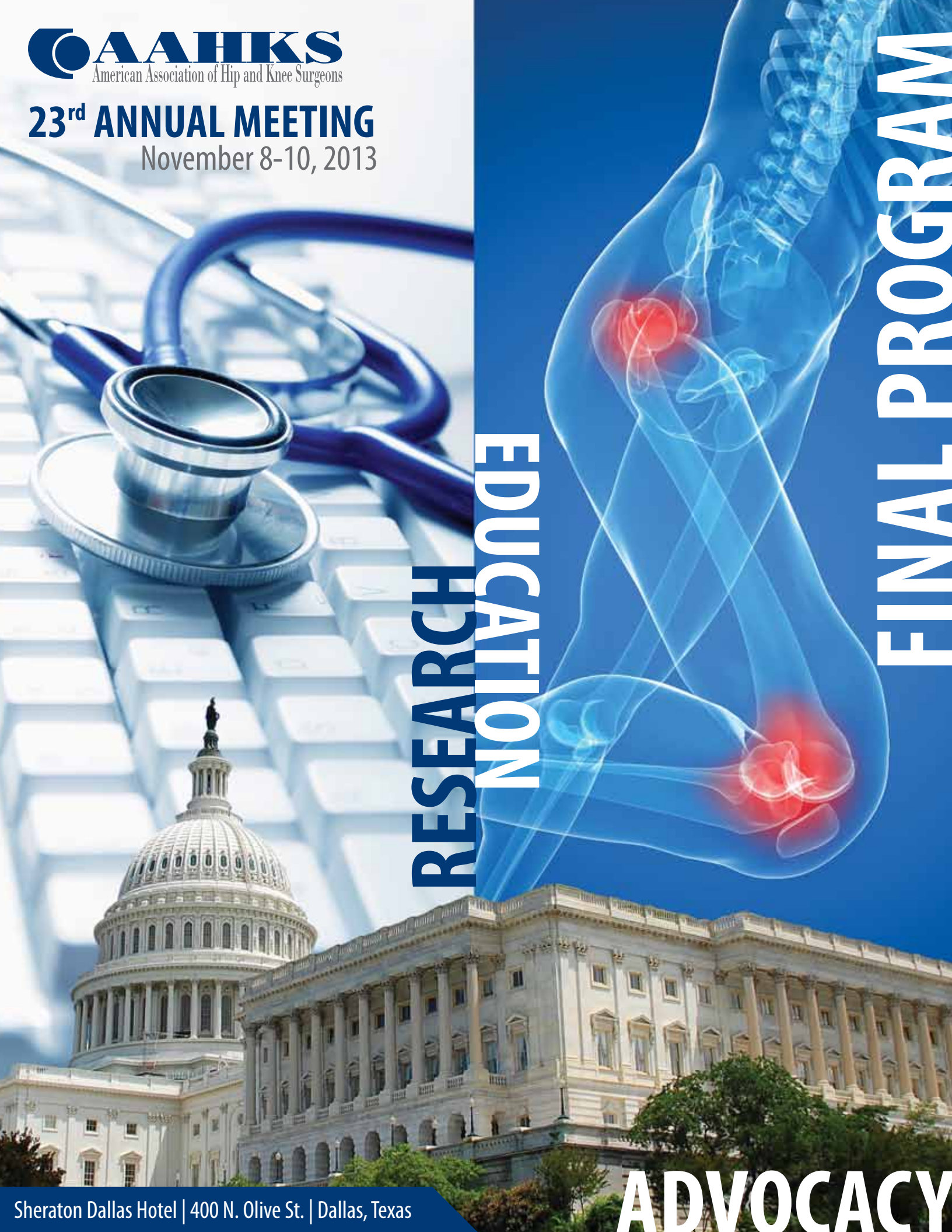
AAHKS
American Association of Hip and Knee Surgeons

23rd ANNUAL MEETING

November 8-10, 2013



RESEARCH

EDUCATION

FINAL PROGRAM

ADVOCACY

Sheraton Dallas Hotel | 400 N. Olive St. | Dallas, Texas

YOUR 2013 AAHKS LEADERSHIP

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American Association of Hip and Knee Surgeons
23rd Annual Meeting

November 8-10, 2013
Sheraton Dallas Hotel, Dallas, Texas

GOALS AND OBJECTIVES

The AAHKS 23rd Annual Meeting is designed to provide practicing orthopaedic surgeons with state-of-the-art information about the surgical applications and treatment protocols for the diagnosis and management of total hip and knee replacement, and to enhance the care of patients with arthritis and degenerative diseases. Both free paper presentations and interactive symposia will be utilized.

Upon completion of this activity, participants should be able to:

- Update clinical skills and basic knowledge through research findings and biomechanical studies.
- Discuss the various surgical and non-surgical treatments and management of conditions related to the hip and knee joints.
- Determine indications and complications in total hip and knee arthroplasty.
- Critique presentations of surgical techniques and demonstrations of treatment options.
- Evaluate the efficacy of new treatment options through evidence-based data.

The Scientific Sessions will include the most current research in joint arthroplasty. Clinical papers will focus on:

- Primary Total Knee Arthroplasty
- Primary Total Hip Arthroplasty
- Revision Total Knee Arthroplasty
- Revision Total Hip Arthroplasty
- Perioperative Factors and Arthroplasty Outcomes
- Health Policy/Non-Arthroplasty
- Infection

Symposia--- Topics include:

- Public Reporting of Complications in TJR's; AAHKS Adds Important Clinical Factors and Improves CMS Risk Methodology
- Strategies to Promote Efficiency, Cost-Containment and Outcomes in the Modern Era Revision TKA
- Management Strategies for THA Failure Secondary to Taper Corrosion, Modular Junctions and Metal-on-Metal Bearings
- Audience Response – Practice Norm/Trends
- Perioperative Arthroplasty Management 2013
- Periprosthetic Joint Infection: The Current State of Affairs
- Medicare Reimbursement Cuts-It's not Armageddon

AAHKS 23rd Annual Meeting

November 8-10, 2013 | Sheraton Dallas Hotel – Dallas, Texas

THURSDAY, NOVEMBER 7, 2013

10:00 AM–5:00 PM	Exhibit Set Up	
5:30 PM–8:00 PM	Board of Directors Meeting	

FRIDAY, NOVEMBER 8, 2013

6:00 AM–NOON	Poster Set-up	Lone Star Foyer
6:55 AM–3:30 PM	Orthopaedic Team Member Course	Dallas CD
7:00 AM–3:00 PM	5th Annual Resident Course	Dallas AB
7:00 AM–8:00 PM	Pre-Registration	Lone Star Foyer
7:00 AM–8:00 PM	Onsite Registration	Dallas Foyer
8:00 AM–11:00 AM	AAHKS Research Design Course	Seminar Room
8:00 AM–10:00 AM	Improving Patient Outcomes through Advanced Pain Management Techniques **Sponsored by Pacira Pharmaceuticals*	
10:00 AM–NOON	Resident Course Breakout 1	State Room 1
	Resident Course Breakout 2	State Room 2
	Resident Course Breakout 3	State Room 3
	Resident Course Breakout 4	State Room 4
	Resident Course Breakout 5	San Antonio A
	Resident Course Breakout 6	San Antonio B
11:00 AM–1:00 PM	Current Advancements in Total Hip Arthroplasty Bearing Technology **Sponsored by DePuy Synthes Joint Reconstruction*	
11:00 AM–1:00 PM	Surgical Site Infection in Total Hip and Knee Arthroplasty **Sponsored by Center for Healthcare Education/ConvaTec*	
NOON–1:00 PM	Resident Lunch	
NOON–1:00 PM	Orthopaedic Team Member Lunch	
NOON–5:30 PM	Speaker Ready Room	
1:00 PM–3:00 PM	Resident Course Breakout 1	State Room 1
	Resident Course Breakout 2	State Room 2
	Resident Course Breakout 3	State Room 3
	Resident Course Breakout 4	State Room 4
	Resident Course Breakout 5	San Antonio A
	Resident Course Breakout 6	San Antonio B
1:30 PM–3:30 PM	Achieving ICD-10 Implementation Success *Presented by Complete Practice Resources* *Sponsored by AAHKS*	

1:30 PM–3:30 PM ATTUNE™ Stable Motion Experience **Sponsored by DePuy Synthes Joint Reconstruction*

1:30 PM–3:30 PM Rethinking Total Knee Replacement: Is there Room for Improvement and Innovation?
**Sponsored by ConforMIS*

**Please note that the Friday optional mini-symposia are not part of the official program as planned by the AAHKS Annual Meeting Program Committee*

CONCURRENT SESSIONS ARE OFFERED ON FRIDAY ONLY

4:10 PM Welcome — Dallas Ballroom A&B
Bryan D. Springer, MD - Program Chair

SESSION ONE **Primary Total Knee Arthroplasty**
4:15–5:17 PM MODERATORS: Brian S. Parsley, MD, William L. Griffin, MD

4:15 PM
Paper #1 Economic Benefit to the Society at Large of TKA in the Young Patient: A Markov Analysis
Hany S. Bedair, MD, Boston, MA

4:21 PM
Paper #2 Younger Age is Associated with a Higher Risk of Periprosthetic Infection and Aseptic Failure after Total Knee Arthroplasty
John P. Meehan, MD, Sacramento, CA

4:27 PM
Paper #3 Perioperative Morbidity and Mortality of Same Admission Staged Bilateral Total Knee Arthroplasty
Lazaros A. Poultsides, MD, MSc, PhD, New York, NY

4:33 PM
Paper #4 Rheumatoid Arthritis does not Increase Perioperative Complications following Same-Day Bilateral Total Knee Arthroplasty
Mark P. Figgie, MD, New York, NY

4:39 PM Discussion

4:49 PM
Paper #5 Particles from Vitamin-E-Diffused HXL UHMWPE Induce Less Osteolysis Compared to Virgin HXL UHMWPE in a Murine Calvarial Bone Model
Orhun K. Muratoglu, PhD, Boston, MA

4:55 PM
Paper #6 At 5 Years Highly-Porous-Metal Tibial Components Were Durable and Reliable: A Randomized Clinical Trial of 389 Patients
Luis F. Pulido Sierra, MD, Rochester, MN

5:01 PM
Paper #7 Correlation of Patient Confidence in Attaining Treatment Goals and Outcomes after Knee Arthroplasty
Joseph F. Styron, MD, PhD, Cleveland, OH

5:07 PM Discussion

5:17–6:17 PM Ask the Experts

Primary and Revision THA	State Room 1
Primary and Revision TKA	State Room 2
Periprosthetic Joint Infection	State Room 3

SYMPOSIUM I **Public Reporting of Complications in TJR's; AAHKS Adds Important Clinical Factors and Improves CMS Risk Methodology**
5:17–6:17 PM
MODERATOR: Thomas K. Fehring, MD,
Panelists: Susan Odum, PhD, David C. Ayers, MD, Patricia D. Franklin, MD, MPH, MBA

4:10 PM Welcome Dallas Ballroom C&D
Craig J. Della Valle, MD – Education Chair

SYMPOSIUM II **Strategies to Promote Efficiency, Cost-Containment and Outcomes in the**
4:15–5:15 PM **Modern Era Revision TKA**
MODERATOR: R. Michael Meneghini, MD
Panelists: Giles R. Scuderi, MD, Douglas A. Dennis, MD, Michael J. Taunton, MD, Ryan M. Nunley, MD

SESSION TWO **Health Policy/Non-Arthroplasty**
5:15–6:17 PM MODERATORS: Mark I. Froimson, MD, William A. Jiranek, MD, FACS

5:15 PM Variations in Hospital Billing for Total Joint Arthroplasty
Paper #8 Louis S. Stryker, MD, Charlotte, NC

5:21 PM Patients' Willingness to Contribute to Cost of Novel Implants in Total Joint Arthroplasty
Paper #9 Ran Schwarzkopf, MD, MSc, Orange, CA

5:27 PM Medicare Fails to Compensate the Additional Time and Effort Associated with Revision Arthroplasty:
Paper #10 Is Patient Access to Care at Risk?
Gregory K. Deirmengian, MD, Philadelphia, PA

5:33 PM Discussion

5:43 PM Prevalence of Radiographic Abnormalities in Senior Athletes with Well-Functioning Hips
Paper #11 Lucas A. Anderson, MD, Salt Lake City, UT

5:49 PM Periacetabular Osteotomy for Acetabular Dysplasia: Are Male Patients at Higher Risk for Secondary
Paper #12 Femoroacetabular Impingement?
Stephen T. Duncan, MD, Saint Louis, MO

5:55 PM Genome-Wide Linkage Analysis and Whole Exome Sequencing in a Large Multi-Generation Family Reveal
Paper #13 Deleterious Mutations in Severely Affected Individuals with Developmental Dysplasia of the Hip
George Feldman, MD, Philadelphia, PA

6:01 PM Periacetabular Osteotomy after Failed Treatment with Hip Arthroscopy
Paper #14 John C. Clohisy, MD, Saint Louis, MO

6:07 PM Discussion

6:17–8:17 PM Welcome Reception (All Attendees Invited)

6:17–8:17 PM Posters/Exhibits Open

7:15–7:55 PM Senator John Cornyn, Political Fundraiser

8:00 PM Past President Dinner

SATURDAY, NOVEMBER 9, 2013

6:00 AM–6:00 PM Registration

6:00 AM–6:00 PM Speaker Ready Room

6:00–7:00 AM Breakfast Buffet in Exhibit Hall

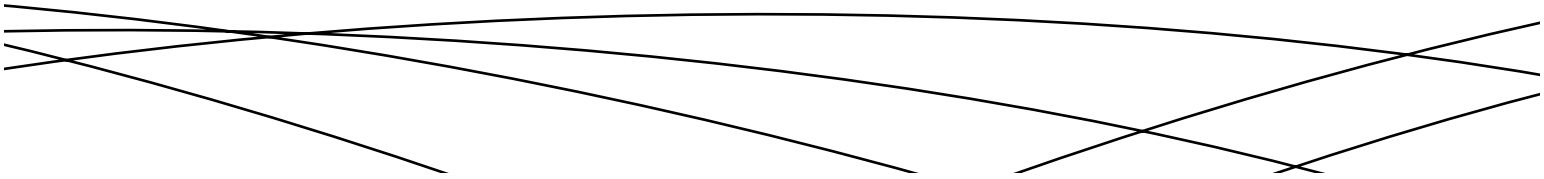
9:30 AM–7:30 PM Posters/Exhibits Open

6:50–6:55 AM Program Chair Welcome Lone Star Ballroom

SESSION THREE	**Perioperative Factors and Arthroplasty Outcomes**
6:55–7:51 AM	MODERATORS: Brian J. McGrory, MD, Christopher L. Peters, MD
6:55 AM Paper #15	Weighted versus Uniform Dose of Tranexamic Acid in Patients Undergoing Primary, Elective Knee Arthroplasty: A Prospective Randomized Controlled Trial Brett Levine, MD, MS, Chicago, IL
7:01 AM Paper #16	Prospective Randomized Trial Comparing Peripheral Nerve Blocks and Periarticular Injection for Pain Management after Total Knee Replacement Mark J. Spangehl, MD, Phoenix, AZ
7:07 AM Paper #17	A Comparison of Continuous Femoral Nerve Catheter versus Adductor Canal Block for Postoperative Pain Management Following Total Knee Arthroplasty Lalit Puri, MD, Glenview, IL
7:13 AM	Discussion
7:23 AM Paper #18	Transfer of Hip Arthroplasty Patients Leads to Increased Cost and Resource Utilization in the Receiving Hospital Atul F. Kamath, MD, Rochester, MN
7:29 AM Paper #19	Are Patient Reported Allergies a Risk Factor for Poor Outcomes in Total Hip and Knee Arthroplasty? Christopher M. Graves, MD, Iowa City, IA
7:35 AM Paper #20	Predictors and Complications of Blood Transfusion in Total Hip and Knee Arthroplasty Nicholas B. Frisch, MD, MBA, Bloomfield Hills, MI
7:41 AM	Discussion
SYMPOSIUM III	**Management Strategies for THA Failure Secondary to Taper Corrosion, Modular Junctions and Metal-on-Metal Bearings**
7:51–8:41 AM	MODERATOR: Adolph V. Lombardi, Jr. MD, FACS Panelists: William Griffin, MD, Young-Min Kwon, MD, PhD, Joshua J. Jacobs, MD, Daniel J. Berry, MD, Michael A. Mont, MD
SESSION FOUR	**Primary TKA**
8:41–9:37 AM	MODERATORS: David F. Dalury, MD, Michael P. Bolognesi, MD
8:41 AM Paper #21	Posterior Stabilized versus Cruciate-Substituting Total Knee Arthroplasty: Midterm Results David F. Scott, MD, Spokane, WA
8:47 AM Paper #22	Radiographic and Technical Factors Associated with Patellar Clunk Syndrome following Posterior Stabilized Total Knee Arthroplasty James J. Purtill, MD, Philadelphia, PA
8:53 AM Paper #23	Current Data does not Support Routine use of Patient-Specific Instrumentation in Total Knee Arthroplasty Pramod B. Voleti, MD, Philadelphia, PA
8:59 AM	Discussion
9:09 AM Paper #24	Oxford Phase III Medial Unicompartmental Knee Arthroplasty (UKA): Results of 467 Knees with a Mean 5-year Follow-Up and Analysis of Predictors of Failure Stephen Burnett, MD, FRCSC, Victoria, British Colombia
9:15 AM Paper #25	Differences in Short Term Complications between Unicompartmental and Total Knee Arthroplasty: A Propensity Score Matched Analysis John J. Callaghan, MD, Iowa City, IA

9:21 AM Paper #26	Revising an HTO or UKA to TKA: Is it More like a Primary TKA or a Revision TKA? Michael B. Cross, MD, Chicago, IL
9:27 AM	Discussion
9:37–10:01 AM	BREAK in the Exhibit Hall
SESSION FIVE **10:01–11:03 AM**	**Primary Hip** MODERATORS: Stefano A. Bini, MD, Craig J. Della Valle, MD
10:01 AM Paper #27	Trends in Total Hip Arthroplasty in the United States: The Shift to a Younger Demographic Jacob M. Drew, MD, Worcester, MA
10:07 AM Paper #28	Pain Patterns in Young, Active Patients following Hip Arthroplasty Ryan M. Nunley, MD, Saint Louis, MO
10:13 AM Paper #29	Assessment of Durability and Function at Minimum 35 Year Follow-Up of THA in Patients 50 and Under Lucian C. Warth, MD, Iowa City, IA
10:19 AM Paper #30	Performance of Highly Cross-Linked Polyethylene in Total Hip Arthroplasty in Young and Active Patients Morteza Meftah, MD, Houston, TX
10:25 AM	Discussion
10:35 AM Paper #31	Stress and Strain in the Trunnion with Big Heads: Tribocorrosion Turbocharged Carlos J. Lavernia, MD, FAAOS, Miami, FL
10:41 AM Paper #32	Direct Anterior versus Mini-Posterior Total Hip Arthroplasty with the Same Advanced Pain Management and Rapid Rehabilitation Protocol: Some Surprises in Early Outcome Kirsten Poehling Monaghan, MD, Philadelphia, PA
10:47 AM Paper #33	Direct Anterior Hip Yields Faster Voluntary Cessation of all Walking Aids in a Randomized Trial Michael J. Taunton, MD, Rochester, MN
10:53 AM	Discussion
11:03–11:10 AM	President's Welcome – Thomas K. Fehring, MD
11:10 AM–12:00 PM	KEYNOTE SPEAKER INTRODUCTION: Kevin J. Bozic, MD, MBA The Future of American Health Care Don Berwick, MD
12:00–12:43 PM	LUNCH
SESSION SIX **12:43–1:39 PM**	**Revision Total Knee Arthroplasty** MODERATORS: Rafael J. Sierra, MD, David C. Markel, MD
12:43 PM Paper #34	Mechanically Assisted Taper Corrosion in Modular TKA Christina M. Arnholt, BS, Philadelphia, PA
12:49 PM Paper #35	Stepped Porous Titanium Metaphyseal Sleeves for Tibial Defects in Revision Total Knee Arthroplasty Joseph S. Gondusky, MD, Orange, CA
12:55 PM Paper #36	Early Clinical Results of Mobile Bearing Revision TKA: A Multicenter Study Douglas A. Dennis, MD, Denver, CO

1:01 PM	Discussion
1:11 PM Paper #37	Clinical & Radiographic Outcomes of Cemented vs Diaphyseal Engaging Cementless Stems in Aseptic Revision TKA Walter B. Beaver, MD, Charlotte, NC
1:17 PM Paper #38	Decreased Blood Transfusions Following Revision Total Knee Arthroplasty using Tranexamic Acid Christopher A. Samujh, MD, Louisville, KY
1:23 PM Paper #39	Aspirin May be Adequate for Prevention of Thromboembolic Events following Revision Total Joint Arthroplasty Javad Parvizi, MD, FRCS, Philadelphia, PA
1:29 PM	Discussion
SYMPOSIUM IV **1:39–2:09 PM**	**Audience Response – Practice Norms and Trends** Jay R. Lieberman, MD (text to: 407-376-0192 to participate in the session)
2:09–2:24 PM	Practical Advice from the Legends of AAHKS MODERATOR: Thomas K. Fehring, MD Legends: Lawrence D. Dorr, MD, James A. Rand, MD, Chitranjan S. Ranawat, MD, Merrill A. Ritter, MD
2:24–2:54 PM	AAHKS Award Papers MODERATORS: Stephen J. Incavo, MD and Adolph J. Yates, MD
2:24 PM	JAMES A. RAND AWARD Presentation of Award: James A. Rand, MD Barbed vs. Standard Sutures for Closure in Total Knee Arthroplasty: A Multicenter Prospective Randomized Trial Jeremy M. Gililland, MD, Salt Lake City, UT
2:30 PM	Discussion
2:34 PM	LAWRENCE D. DORR AWARD Presentation of Award: Lawrence D. Dorr, MD Do You Have to Remove a Corroded Femoral Stem? Nitin Goyal, MD, Arlington, VA
2:40 PM	Discussion
2:44 PM	AAHKS CLINICAL AWARD Presentation of Award: Thomas K. Fehring, MD Can the Average Total Joint Orthopaedic Surgeon Maintain an Average Income at Medicare Reimbursement Rates? Richard Iorio, MD, New York, NY
2:50 PM	Discussion
2:54 PM–3:25 PM	BREAK
SYMPOSIUM V **3:25–4:15 PM**	**Perioperative Arthroplasty Management 2013** MODERATOR: William G. Hamilton, MD Panelists: Keith R. Berend, MD, Carl A. Deirmengian, MD, Rafael J. Sierra, MD, J. Bohannon Mason, MD
SESSION SEVEN **4:15–5:17 PM**	**Infection** MODERATORS: Michael E. Berend, MD, Mathais P. G. Bostrom, MD



4:15 PM Paper #40	Positive Culture from the Liquid Medium only after Total Joint Arthroplasty: Is it Reliable? Eric B. Smith, MD, Philadelphia, PA
4:21 PM Paper #41	Diagnosing Periprosthetic Joint Infection: The Era of the Biomarker has Arrived Carl A. Deirmengian, MD, Philadelphia, PA
4:27 PM Paper #42	The Host Response: Toll Like Receptor Expression in Periprosthetic Tissues as a Biomarker for Deep Joint Infection Cara A. Cipriano, MD, Palo Alto, CA
4:33 PM	Discussion
4:43 PM Paper #43	Prospective, Randomized, Blinded Study to Evaluate the Efficacy of Two Surgical Skin Preparations in Reducing SSI after TJA Richard H. Rothman, MD, PhD, Philadelphia, PA
4:49 PM Paper #44	Public Reporting of Prosthetic Joint Infections: Do Claims Based Comorbidities Adequately Capture Case-Mix? Hilal Maradit Kremers, MD, MSc, Rochester, MN
4:55 PM Paper #45	Comparison of a Clinically-Derived Prosthetic Joint Infection (PJI) Risk Model and the NHSN Risk Model Tad M. Mabry, MD, Rochester, MN
5:01 PM Paper #46	Risk Factors for Infection after Hip Arthroplasty: Preventable vs Non-Preventable Infection James D. Slover, MD, New York, NY
5:07 PM	Discussion
5:17–6:00 PM	AAHKS Membership Business Meeting (AAHKS Members Only)
6:00–8:00 PM	Poster Session Reception (All Attendees Invited)

SUNDAY, NOVEMBER 10, 2013

6:00–10:00 AM	Registration
6:00–10:00 AM	Speaker Ready Room
6:00–7:00 AM	Continental Breakfast
SYMPOSIUM VI **7:00–8:00 AM**	**Periprosthetic Joint Infection: The Current State of Affairs** MODERATOR: Javad Parvizi, MD, FRCS Panelists: Bryan D. Springer, MD, Craig J. Della Valle, MD, Thorsten Gherke, MD
SESSION EIGHT **8:00–8:56 AM**	**Revision Total Hip Arthroplasty** MODERATORS: William P. Barrett, MD, Scott M. Sporer, MD, MS
8:00 AM Paper #47	Reproducible Fixation with a Modular, Fluted, Tapered Titanium Stem in Revision Hip Arthroplasty at 8-13 Years Follow-Up Jose A. Rodriguez, MD, New York, NY
8:06 AM Paper #48	Outcomes of Revision Total Hip Arthroplasty: Analysis of a US Based Total Joint Replacement Registry Stefano A. Bini, MD, Oakland, CA
8:12 AM Paper #49	Revision THA in Obese Patients is Associated with High Reoperation Rates at Short Term Follow Up Michael H. McGraw, MD, Philadelphia, PA
8:18 AM	Discussion
8:28 AM Paper #50	Outcomes after Revision of Metal-on-Metal Hip Resurfacing Arthroplasty Thomas P. Gross, MD, Columbia, SC

8:34 AM Paper #51	Predictive Demographic and Comorbid Factors on Functional Outcomes Following Revision Hip Arthroplasty Ivan M. Tomek, MD, FRCSC, Lebanon, NH
8:40 AM Paper #52	Construct Rigidity: Keystone for Reconstructing Pelvic Discontinuity J. Ryan Martin, MD, Rochester, MN
8:46 AM	Discussion
SYMPOSIUM VII **8:56–9:56 AM**	**Medicare Reimbursement Cuts-It's not Armageddon** MODERATOR: Thomas K. Fehring, MD AAHKS Efforts to Stop the Bleeding – Mark I. Froimson, MD, AAHKS Health Policy Chair Medicare and Private Insurers, Is there a Way Out? – Richard F. Santore, MD Keeping the Lights on While Serving – Thomas K. Fehring, MD Preparing for Payment Models of the Future – Kevin J. Bozic, MD, MBA
SESSION NINE **9:56–10:58 AM**	**Revision Total Hip Arthroplasty/Primary Total Hip Arthroplasty** MODERATORS: Gregory G. Polkowski II, MD, Thomas P. Vail, MD
9:56 AM Paper #53	How does Acetabular Component Orientation Change from Supine to Standing in Patients with Total Hip Arthroplasty? John V. Tiberi, MD, Boston, MA
10:02 AM Paper #54	Adverse Clinical Outcomes in a Primary Modular Neck/Stem System Camilo Restrepo, MD, Philadelphia, PA
10:08 AM Paper #55	10 Year Follow-Up of Highly Cross-Liked Polyethylene using Radiostereometric Analysis (RSA) Henrik Malchau, MD, PhD, Boston, MA
10:14 AM	Discussion
10:24 AM Paper #56	A Randomized Controlled Trial Comparing Wear of Oxinium and Cobalt-Chrome on Standard and Cross-Linked Polyethylene James P. Waddell, MD, Ontario, Canada
10:30 AM Paper #57	3 Year Multicenter RSA Evaluation of Vitamin E Diffused Highly Cross-Linked Polyethylene Liners and Acetabular Cup Stability Nanna H. Sillesen, MD, Boston, MA
10:36 AM Paper #58	Stratification of Total Hip Arthroplasty Survival according to BMI as a Continuous Variable Eric R. Wagner, MD, Rochester, MN
10:42 AM Paper #59	Percent Body Fat More Associated with Perioperative Outcomes after Total Joint Arthroplasty than BMI Cameron K. Ledford, MD, Durham, NC
10:48 AM	Discussion
10:58 AM	Concluding Remarks
11:03 AM	ADJOURN

AAHKS
American Association of Hip and Knee Surgeons

Economic Benefit to the Society at Large of TKA in the Young Patient: A Markov Analysis

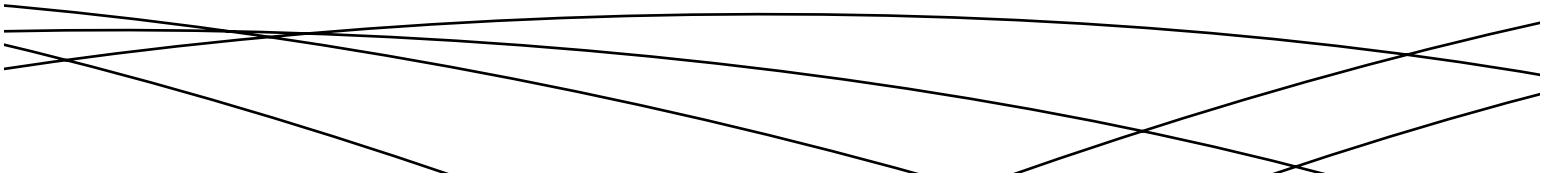
Hany S. Bedair, MD, Thomas Cha, MD, Viktor J. Hansen, MD, Henrik Malchau, MD, PhD

Introduction: The economic implications of total knee arthroplasty (TKA) to society at large have not been assessed when specifically considering the young, working population with osteoarthritis (OA) of the knee. The goal of this study is to use Markov analysis to estimate the overall average cost to society in terms of medical expenses and lost wages of delaying early TKA in favor of non-operative treatment for end-stage knee OA in a hypothetical 50-year-old patient.

Methods: A Markov state-transition decision model was constructed to compare the overall average cost of TKA to non-operative treatment in a 50-year-old patient with end-stage OA over 30 years. Earned income, lost wages, and direct medical costs related to non-operative treatment and TKA, including revisions and complications, were considered. Sensitivity analysis was performed to assess the effect that variation of key model parameters have on the overall outcome of the model.

Results: This Markov model favors early TKA compared to non-operative treatment across all plausible values for most input parameters assessed during one-way sensitivity analysis. TKA was shown to be more expensive for the first 3.5 years due to higher initial cost, but over 30 years, the cost benefit was $69,800 in favor of TKA. Only when lost wages were less than 17.7 equivalent work days per year in patients treated non-operatively, or when the rate of returning to work after TKA was less than 81% did the model favor non-operative treatment.

Conclusions: The results of this study demonstrate that the total economic cost to society for treatment of severe knee OA in a young, working patient is markedly lower with TKA compared to non-operative treatment. Increasing financial restrictions on health care providers in the United States necessitate careful consideration of the economic impact of different treatment options from the societal perspective.



Younger Age is Associated with a Higher Risk of Periprosthetic Infection and Aseptic Failure after Total Knee Arthroplasty

Richard H. White, MD, Sunny H. Kim, PhD, Amir A. Jamali, MD, **John P. Meehan, MD**

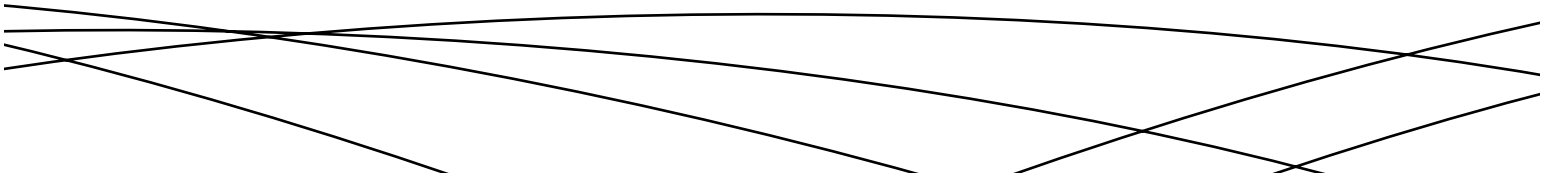
Background: Although early aseptic mechanical failure of total knee arthroplasty (TKA) has been reported in younger patients, it is unknown if early failure due to periprosthetic joint infection is more or less frequent in this subgroup of patients.

Introduction: Total hip arthroplasty (THA) has been heralded as the operation of the century for its ability to reduce pain and restore function. Thus, the purpose of this study was to examine the influence patient characteristics have on hospital charges and length of stay (LOS).

Methods: The 2009 National Inpatient Sample (HCUP-NIS) dataset was queried using ICD-9-CM codes to identify patients undergoing elective THA. We used weighted estimates of national procedure volume and patient comorbidities defined by AHRQ and identified them using standard methods described by Elixhauser. Generalized linear models, based on Poisson regression analysis, were used to estimate the influence of individual patient characteristics on hospital charges and (LOS).

Results: In 2009, an estimated 277,564 patients underwent THA. Of these, 16.6% patients had no comorbidities while 28.2% had three or more. The most common conditions included hypertension (60.8%), diabetes (14.4%), and obesity (13.3%). Mental disorders were found in 10.2%, renal failure in 3.7% and AIDs in 0.13% of patients. Mean hospital charges were $49,740 and mean hospital LOS was 3.5 days. With incremental comorbidities, both hospital charges and length of stay increased ($p < 0.01$). Both marginal charges and LOS rose with inpatient mortality (+$24,165, 1.2 days), patients with recent weight loss (+$20,487, 2.3 days), metastatic disease (+$11,245, 1.8 days), minority race (+$13,098, 0.6 days), pulmonary-circulatory disorders (+$5,048, 1.0 days), AIDs (+$7,248, 0.3 days). Patients treated in the West region had higher marginal charges but a lower LOS (+$24,164, -0.2 days).

Discussion:
Hospital charges and length of stay after THA rise dramatically with the multiply-comorbid patient. As the payments for arthroplasty continue to decline, policy makers should focus on providing fair compensation and quality metrics to hospitals and surgeons treating the comorbid; otherwise, significant restrictions in access to care may occur.



Perioperative Morbidity and Mortality of Same Admission Staged Bilateral Total Knee Arthroplasty

Stavros Memtsoudis, Huong T. Do, MA, Thomas P. Sculco, MD,
Mark P. Figgie, MD, **Lazaros Poultsides, MD, MSc, PhD**

Introduction: Controversy continues regarding the optimal timing of surgery for patients with symptomatic bilateral degenerative knee arthritis who are not considered eligible for same-day bilateral TKA (BTKA). The purpose of this study was to compare the (1) 30-day mortality, (2) rates of in-hospital complications, and (3) associated risk for complications among patients undergoing same-admission staged BTKA (separate procedures during a single hospitalization) or staged BTKA (both arthroplasties performed within one year), at a highly specialized center for total joint replacement where specific guidelines have been implemented for same-day BTKA patient selection.

Methods: We analyzed institutional data from a computerized database and medical records for 153 same-admission staged BTKA and 1557 staged-BTKA patients diagnosed with idiopathic osteoarthritis (OA) from 1998 to 2011. Patient demographics, including Deyo comorbidity index and 30-day mortality, were tabulated. Same-admission staged patients were similar in age to staged patients (70.6 $\pm$ 8.1 versus 69.5 $\pm$ 9 years; $p=0.112$), but were more likely to be male (51.6% versus 34.3%; $p<0.0001$) and had a higher overall comorbidity burden (0.8 $\pm$ 1.1 versus 0.6 $\pm$ 1.1; $p=0.002$). Outcomes of interest included procedure-related, minor or major complications, blood transfusions, and transfer to rehabilitation or higher level of care.

Results: The mean LOS was higher in the same-admission staged cohort (11.4 $\pm$ 4 versus 9.2 $\pm$ 2.9 days; $p<0.001$). There was no difference in 30-day mortality between the same-admission and staged patients (0% versus 0.06%; $p=0.754$). The same-admission group experienced more acute postoperative anemia (10.5% versus 2.7%; $p<0.0001$), blood transfusions (90.8% versus 53.6%; $p<0.0001$), and transfers to rehabilitation (82.3% versus 45.9%; $p<0.0001$). There were no differences in the overall procedure-related (3.3% versus 2.6%; $p=0.643$) and major complication (8.5% versus 6%; $p= 0.23$) rates between the same-admission and staged cohorts. However, same-admission patients had a higher rate of minor complications (38.6% versus 28.6%; $p= 0.01$) and specifically significantly higher incidence of hypotension, syncope and collapse, UTI, in-hospital infection and paralytic ileus.

Conclusion: Our results suggest that for patients who are not appropriate candidates for same-day BTKA it is preferable to undergo staged BTKA within a year and avoid same-admission staged BTKA because of higher incidence of perioperative morbidity.

Rheumatoid Arthritis Does Not Increase Perioperative Complications following Same-Day Bilateral Total Knee Arthroplasty

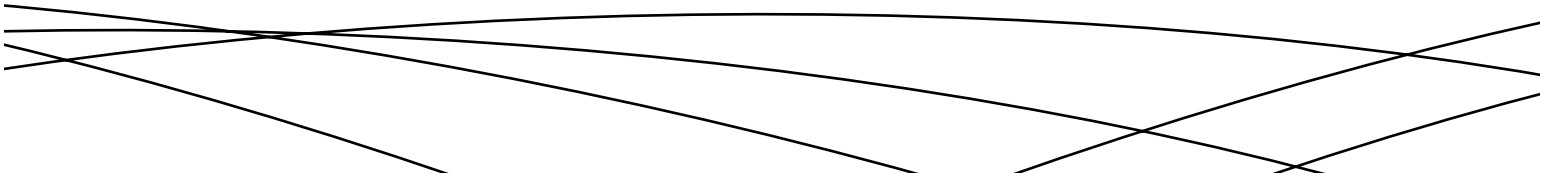
Stavros Memtsoudis, Huong T. Do, MA, Thomas P. Sculco, MD,
Mark P. Figgie, MD, Lazaros Poultsides, MD, PhD

Introduction: The severely arthritic knee secondary to rheumatoid arthritis (RA) can be a major disability for adults, impeding ambulation and limiting functional independence. Bilateral preoperative flexion contractures, multiplanar and multiple-joint deformities along with lower health status in RA compared to osteoarthritis (OA) patients may pose a surgical dilemma to the surgeon. We compared the (1) 30-day mortality, (2) rates of in-hospital complications, and (3) risk for major morbidity or mortality between RA and OA patients undergoing same-day bilateral TKA (BTKA), in a high-volume subspecialty setting where the performance of same-day BTKAs was discouraged in patients with more severe medical comorbidities.

Methods: We analyzed institutional data from 240 RA and 3680 OA patients undergoing same-day BTKAs between 1998 and 2011. Patient demographics including Deyo comorbidity index and 30-day mortality were tabulated. In general, RA patients were younger (60.9 ± 11.8 versus 65.4 ± 8.4 years; $p < 0.001$) but had higher overall comorbidity burden (0.9 ± 1.0 versus 0.3 ± 0.7; $p < 0.001$). A higher percentage of RA patients were female (82.9% versus 60.2%; $p < 0.001$). Outcomes of interest included procedure-related, minor or major complications, blood transfusions, and transfer to rehabilitation or higher level of care.

Results: The mean LOS was higher in the RA cohort (5.8 ± 2.3 versus 5.4 ± 2.0 days; $p= 0.007$). There was no difference in 30-day mortality rate between the RA and OA same-day BTKA patients (0% versus 0.03%; $p= 0.798$). The RA group was more likely to have acute postoperative anemia (17.1% versus 8.1%; $p < 0.0001$) and blood transfusions (84.2% versus 76.5%; $p=0.008$), but had similar rates of transfer to a higher level of care (ICU: 0.8% versus 0.7%, and rehabilitation: 77% versus 72%; $p=0.2$). There were no differences in the overall rates of procedure-related (2.2% versus 1.7%; $p= 0.644$), minor (23.7% versus 26.6%; $p= 0.327$) and major complication (6.2% versus 5.2%; $p= 0.463$) between the RA and OA cohorts.

Conclusion: In this retrospective study, performed in a high-volume institution, and in which same-day BTKA patients were generally much healthier and younger, we found that same-day BTKA appeared to be safe in the RA patient population.



Particles from Vitamin-E-Diffused HXL UHMWPE Induce Less Osteolysis Compared to Virgin HXL UHMWPE in a Murine Calvarial Bone Model

David Bichara, MD, Erik Malchau, MD, Nanna H. Sillesen, MD,
Selami Cakmak, **Orhun K. Muratoglu, PhD**

Introduction: Recent in vitro findings have suggested that UHMWPE wear particles containing vitamin-E (VE) may have reduced functional biologic activity and decreased potential to cause osteolysis (Bladen C.L. 2012-2013). We hypothesized that particles from VE-stabilized HXL-UHMWPE (VE-UHMWPE) would cause reduced levels of osteolysis in a murine calvarial bone model when compared to virgin HXL-UHMWPE.

Methods: Study groups: 1). VE-UHMWPE diffused after 100 kGy; 2). Virgin UHMWPE; 3). Shams. Particle generation and implantation: UHMWPE particles were generated at Bioengineering Solutions. C57BL/6 mice (n=12 for each group) received equal amounts of particulate debris overlying the calvarium and euthanized after 10d. Micro-CT scans: done using a set voltage of 70 kV and current of 70 µA. Topographical Osteolysis Scale: Each calvarial bone was blindly scored using a scale ranging from 0 (no osteolysis) to 3 (completely osteolytic bone).

Histology: H&E and TRAP staining was done on tissue to confirm micro-CT findings and quantify osteoclasts.

Statistics: Inter-rater analysis was done using Cohen's kappa analysis. An inter-rater coefficient >0.65 was considered as high inter-rater agreement. Comparison between groups was made using one-way ANOVA with post hoc Bonferroni correction for multiple comparisons. Correlations are reported as Spearman's rho. P-value<0.05 was considered significant.

Results: More than 83% of the VE-UHMWPE and more than 85% of the virgin UHMWPE particles measured less than 1 µm (mean particle size). A statistically significant greater level of osteolysis visualized on the topographical grading scale in calvaria implanted with virgin UHMWPE wear particles. Micro-CT findings were confirmed histologically (Fig. 1). Post hoc analysis revealed significant difference between VE-UHMWPE and virgin UHMWPE for the topographical osteolysis grading score (p=0.002) but no difference in osteoclast counts (p=0.293).

Conclusion: VE-UHMWPE particles have reduced osteolysis potential in vivo in a murine calvarial bone model. Arthroplasty procedures using VE-UHMWPE might be less susceptible to peri-prosthetic loosening caused by wear debris.

At 5 Years Highly-Porous-Metal Tibial Components were Durable and Reliable: A Randomized Clinical Trial of 389 Patients

Matthew P. Abdel, MD, David G. Lewallen, MD, Michael J. Stuart, MD,
Joaquin Sanchez-Sotelo, Arlen D. Hanssen, MD, Mark W. Pagnano, MD, Luis Pulido, MD

Introduction: Highly-porous-metals (HPM) have demonstrated excellent bone ingrowth properties and are an intriguing option for uncemented fixation in TKA. We performed a randomized clinical trial (RCT) to assess the durability and reliability of a highly porous metal tibia compared to a traditional cemented tibia.

Methods: From 2003 to 2006, 389 patients (age 67.8 +/- 8.7 years; 54 % female) were randomized to three groups; (1) Uncemented highly porous tibia (2) Cemented highly porous tibia (as per original FDA approval); (3) Traditional cemented tibia. Advanced computerized randomization was done dynamically based on age, sex and BMI. The same cemented posterior-stabilized femoral component was used in every case. Durability was judged by survivorship analysis at 5 years. Reliability was judged clinically: Knee Society scores, range of motion, and complications. Radiographic assessment included alignment, radiolucency, implant migration / loosening. Patients were followed until death, revision or for a minimum of 2 years (mean followup of 5.2 years (range 2 - 8.9 years). Four patients were lost prior to 2 years.

Results: Highly porous tibias (both uncemented and cemented) were as durable as a traditional cemented tibial modular tibial component, judged by survivorship at 5 years using a contemporary intention-to-treat analysis (96.8 % (1); 97.6 % (2); 96.7 % (3); NS p=0.59). Per-protocol analysis revealed that no highly porous metal tibia in this study was revised for aseptic loosening. The cumulative risk of revision at 5 years was 0.08 % for tibia aseptic loosening and 2.8 % for all causes. There was no difference in clinical or radiographic outcomes among the three groups except that non-progressive radiolucent lines were more common in the cemented groups.

Conclusion: In this large RCT, highly porous metal tibias provided durable fixation at 5 years, reliable clinical outcomes and no highly porous metal tibia was revised for aseptic loosening.

Correlation of Patient Confidence in Attaining Treatment Goals and Outcomes after Knee Arthroplasty

Joseph F. Styron, MD, PhD, Gregory J. Strnad, Joseph P. Iannotti, Carlos A. Higuera, MD

Introduction: Total knee arthroplasty (TKA) outcomes drive assessment of quality and reinvestment; therefore a risk stratified assessment is paramount for fair evaluation. Stratification can be affected by multiple factors including patient motivation. This study attempted to identify the correlation of patient's preoperative confidence in their ability to return to desired activity level after TKA and improved function and outcomes.

Methods: A continuous series of TKA procedures from 2008 to 2010 in a healthcare system was reviewed retrospectively. Patients included reported pre- and postoperative knee injury and osteoarthritis outcomes scores (KOOS), SF-12 scores, and responded a question regarding the desired activity level, including the level of confidence (0-10 scale) in attaining such goals, after surgery. Gender, age, body mass index, education level, smoking status, length of stay (LOS), 30-day readmission and reoperation, and 1-year infection rates were collected. Correlation of patient confidence in attaining treatment goals and the outcomes collected was established using multiple linear and logistic regression models adjusted for baseline mental and functional scores.

Results: A total of 1020 primary, 18 bilateral and 177 revision TKA patients completed their postoperative questionnaires and had an average follow-up of 430, 411 and 376 days, respectively. Patients were confident in achieving treatment goals with an average score of 7.7 ± 2.1, 9.3 ± 0.5 and 6.4 ± 2.6 for primary, bilateral and revision TKA, respectively. There was direct correlation of level of confidence and shorter LOS ($p=0.005$), and no correlation with readmission, reoperation and infection. Moreover, confidence was correlated with improved function and pain KOOS ($p<0.001$) and SF-12 physical scores ($p<0.001$) after primary TKA. Only physical function ($p<0.044$) was affected by patient confidence after revision TKA.

Conclusion: Patient confidence in attaining treatment goals after primary TKA has a direct correlation with shorter LOS and improved function. Patient motivation should be weighted when measuring TKA outcomes.

Variations in Hospital Billing for Total Joint Arthroplasty

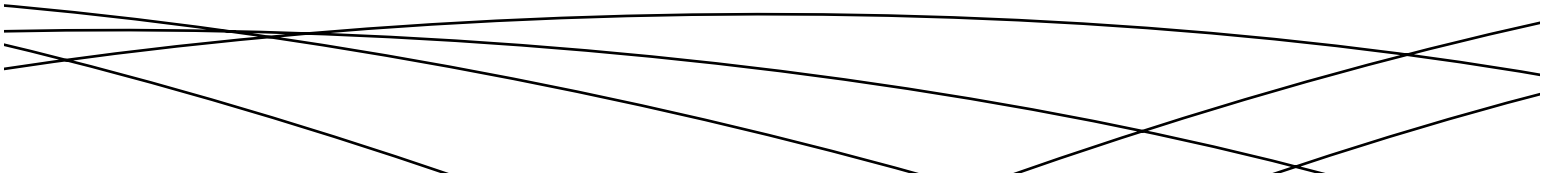
Louis S. Stryker, MD, Thomas K. Fehring, MD, Susan M. Odum, PhDc

Introduction: Regional variations in medical practice have been well described, with striking regional differences in Medicare spending also reported. It is not clear, however, if there are variations in hospital charges between regions for patients undergoing total joint arthroplasty.

Methods: Data from Centers for Medicare and Medicaid Services (CMS) on Medicare Severity-Diagnosis Related Groups (MS-DRGs) 469 (Major Joint Replacement or Reattachment of Lower Extremity with Major Complicating or Comorbid Condition) and 470 (Major Joint Replacement or Reattachment of Lower Extremity without Major Complicating or Comorbid Condition) for the fiscal year 2011 were analyzed. Institutional average hospital charges were investigated for variation by region (Northeast, Midwest, South and West) and correlation to average CMS reimbursement.

Results: Data from 932 hospitals was available for MS-DRG 469 and 2,750 hospitals for MS-DRG 470. Drastic variations in billing between institutions were apparent with a mean average hospital charge nationwide of $59,566 $\pm$ 32,307 (range, $5,304-321,918). Mean average CMS reimbursement nationwide was $16,583 $\pm$ 5,270 (range, $9,103-100,018). Statistically significant differences for hospital billing between regions were also found ($p<0.001$). In an attempt to explain these large variations, correlation between hospital charges and CMS reimbursement was calculated, as CMS reimbursement is corrected for each individual hospital by formula for wage index, cost of living, proportion of low-income care, teaching institution and outlier cases. Little to no correlation between hospital charges and reimbursement was found in some regions and only moderate correlation in others and nationwide ($p=0.0001$).

Conclusions: Extreme variations in hospital charges among individual institutions were found, as were variations in charges between regions. More importantly, these drastic disparities in billing between institutions for similar surgical procedures do not correlate with variations in wage index, cost of living, low-income care, teaching institution and outlier cases.



Patients' Willingness to Contribute to Cost of Novel Implants in Total Joint Arthroplasty

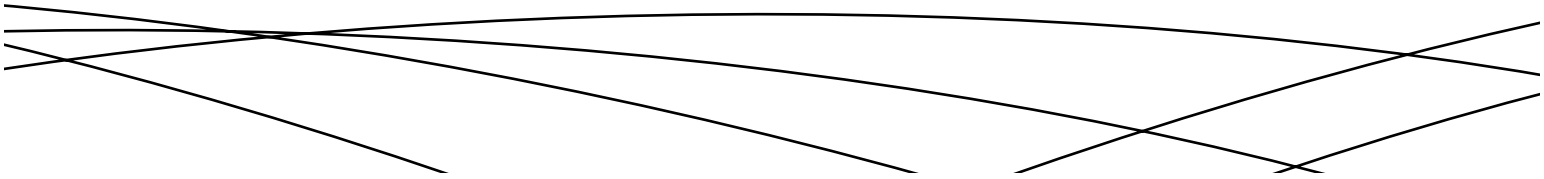
Jeffrey Katz, Stephanie P. Chen, BS, Yan Dong, PhD,
Laurel A. Donnell-Fink, MPH, Elena Losina, **Ran Schwarzkopf, MD, MSc**

Background: As health care organizations prepare to adapt more accountable financial models of care, it is increasingly important to assess how patients value new technologies, as reflected in willingness to contribute to the cost of using newer implants. This study assess whether patients' willingness to contribute to the cost of joint arthroplasty implants is associated with reported implant performance and with patient sociodemographic characteristics.

Methods: A questionnaire was administered to patients at a rheumatology practice. It captured demographics, educational level, and health insurance. We described features of a 'standard' implant including longevity of 15-years and risk of complications at 3%. We elicited whether participants would be willing to contribute to the cost of three 'novel implants: 1) longevity of 25-years with 3% risk of complications; 2) longevity of 25-years with 5% risk of complications; 3) standard longevity (15-years) with a lower 1% risk.

Results: Study included 152-patients, average age 56.3years. 43% of subjects were willing to pay added co-pay to increase longevity of an implant to 25-years with no change in complications. Willingness to pay for increased longevity decreased to 26% if longevity was accompanied by increased (5%) risk. 28% were willing to pay for an implant with standard (15-year) longevity and a decreased (1%) risk. Men were more willing to pay for novel implants, and older patients were less willing, especially for added longevity. Patients with higher education were willing to add co-pay for increased longevity and for decreased risk. Patients with private insurance compared to Medicare and Medicaid were willing to add co-pay for increased longevity.

Conclusion: This study demonstrated that 26%-43% of patients are willing to share costs of a novel prosthesis. Willingness to pay was associated with the proposed implant benefits (increased longevity, decreased complications) and with patient characteristics. These findings help clarify the extent that patients are willing to bridge gaps between the cost of novel implants and the reimbursement offered by payers.



Medicare Fails to Compensate the Additional Time and Effort Associated with Revision Arthroplasty: Is Patient Access to Care at Risk?

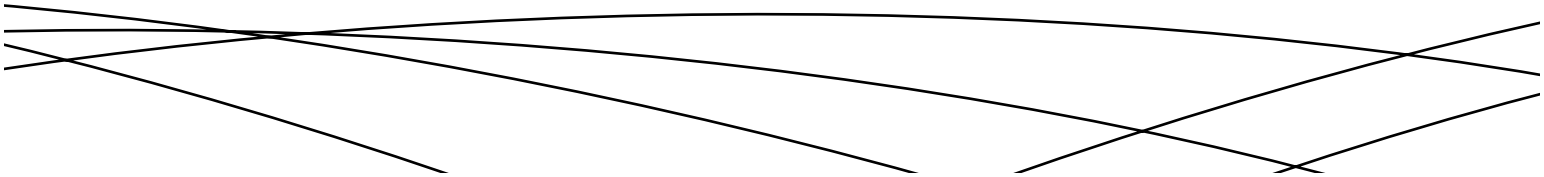
Gregory K. Deirmengian, MD, Anthony T. Tokarski, Paul M. Lichstein, MD, MS, Carl A. Deirmengian, MD, Matthew S. Austin, MD, Javad Parvizi, MD, FRCS

Introduction: The future demand for primary and revision arthroplasty procedures will likely exceed the supply of fellowship-trained surgeons. The purpose of this study was to assess the relative time and effort employed for primary and revision hip and knee arthroplasty procedures and to determine if current Medicare reimbursement rates compensate the additional time and effort associated with revision arthroplasty.

Methods: Using our institutional database, we analyzed all hip and knee arthroplasty procedures performed by a single fellowship-trained surgeon over a 2-year period. Data collected included procedure performed, surgical time, length of stay, and repeat procedures within 90 days of the index procedure.

Results: When comparing 246 primary and 113 revision knee arthroplasty procedures, the surgical time was 1.8 fold greater for all revisions and 2.4 fold greater for complex revisions. These revisions were also associated with 1.2 days greater length of stay and an 8.5% higher rate of repeat surgery within 90 days. When comparing 216 primary and 124 revision hip arthroplasty procedures, the surgical time was 1.8 fold greater for all revisions and 2.3 fold greater for complex revisions. These revisions were also associated with 1.1 days greater length of stay and a 3.4% higher rate of repeat surgery within 90 days. Assuming current Medicare rates and a fixed number of operating hours, each 10% increase in a surgeon's revision practice results in a commensurate 7% decline in reimbursement for knees and 5% decline in reimbursement for hips.

Discussion and Conclusions: Currently, Medicare reimbursement rates do not reward the additional time and effort spent by surgeons willing to perform revision hip and knee arthroplasty procedures. Given the elective nature of revision and primary arthroplasty, and the expected excess future supply of primary arthroplasties, patient access to physicians willing to perform revision arthroplasty may soon be at risk.



Prevalence of Radiographic Abnormalities in Senior Athletes with Well-Functioning Hips

Ashley Kapron, Stephen K. Aoki, Michael B. Anderson, MD, Ray A, Grijalva, MD,
Jill A. Erickson, PA-C, Christopher L. Peters, MD, **Lucas A. Anderson, MD**

Introduction: It is not known whether morphological abnormalities of the hip are compatible with life-long hip function and avoidance of osteoarthritis (OA). Our purpose was to investigate the prevalence of dysplasia and femoroacetabular impingement (FAI) in senior athletes with well-functioning hips.

Methods: 517 senior athletes (57% male), average 67-years-old (range 50-91; SD:8) participated in this IRB approved study. 1024 native hips were evaluated for radiographic signs of FAI and dysplasia and OA on anteroposterior and frog lateral radiographs.

Cam FAI was noted if alpha-angle (AA) was >50°, pincer FAI if center-edge-angle (CEA) was > 39° or acetabular index (AI) was <0°, or a cross-over sign was detected. Dysplasia was noted if CEA was < 20° or AI was >10°.

Results: 29% of hips (n=302) had radiographic evidence for dysplasia; 4% had a CEA that was < 20° and 29% had an AI that was >10°.

76% of hips had radiographic evidence of FAI (n=775) and was more prevalent in males (OR=16.4, 95% CI 7.99 – 33.72, p<0.001). 68% had at least one sign of cam and 21% had at least one sign of pincer impingement. 14% of hips (n=146) had both cam and pincer.

Radiographic OA (Tönnis grade 2-3) was present in 263 hips (26%); 84% of 263 hips with OA had evidence of FAI (n=220) and 19% had evidence of dysplasia (n=50). OA was not associated with dysplasia (p=0.38). Hips with FAI were more likely to have OA (OR=2.79, 95% CI 1.45 – 5.37, p=0.002), though 72% of FAI hips (n=555) showed little to no evidence of OA (Tönnis grade 0-1) despite the athletes' age and lifelong activity levels.

Conclusions: Morphologic abnormalities associated with dysplasia and FAI were more prevalent than anticipated in these senior athletes though osteoarthritis rates were relatively low. This study suggests that factors other than morphology, possibly genetics or cartilotype, may play a joint preserving role in this series of high functioning senior athletes.

Periacetabular Osteotomy for Acetabular Dysplasia: Are Male Patients at Higher Risk for Secondary Femoroacetabular Impingement?

Stephen T. Duncan, MD, Jeff Nepple, MD, Ljiljana Bogunovic, MD, Geneva Baca, BA, Perry L. Schoenecker, MD, John C. Clohisy, MD, Meghan Gottlieb, MSW

Introduction: Favorable outcomes following periacetabular osteotomy (PAO) occurs in most patients, but a cohort exists that is complicated by secondary femoroacetabular impingement (FAI). We hypothesize that males presenting with acetabular dysplasia have a higher incidence of FAI and are at risk for secondary FAI. The purpose of this study was to investigate the association of patient sex with clinical, radiographic, and intraoperative findings that increase the risk of secondary FAI after PAO surgery.

Methods: Retrospective review of patients with a primary diagnosis of acetabular dysplasia treated with PAO was performed. Clinical data including patient demographics, physical exam and radiographic measurements, intraoperative findings and patient-rated outcome scores were collected.

Results: There were 156 females and 50 males. Mean age was similar among sexes; however, BMI was higher in males compared to females (25.7 vs. 23.7 kg/m², $p<0.01$). Males had higher preoperative UCLA (7.3 vs. 6.3, $p<0.05$) and Harris Hip score (63.2 vs. 58.0, $p<0.05$). Males had less hip range of motion including internal rotation at 90° of flexion (14.0° vs. 24.6°, $p<0.001$), external rotation at 90° of flexion (31.1° vs. 37.7°, $p = 0.05$). A crossover sign (76.6% vs. 47.1%, $p < 0.001$) and posterior wall sign (85.1% vs. 61.1%, $p<0.001$) were more common in males. Males had higher alpha angles on both the frog lateral (62.8° vs. 54.8°, $p<0.01$) and Dunn views (63.6° vs. 56.3°, $p<0.05$). The incidence of an impingement trough was higher in males (40.0% vs. 19.2%, $p<0.05$).

Conclusion: Males patients have a higher prevalence of clinical and radiographic signs consistent with FAI on both the femoral and acetabular side. Preoperative evaluation of acetabular dysplasia in males should include careful attention to factors associated with FAI and be treated if indicated at the time of surgery to minimize the risk of secondary FAI after PAO correction.

Genome-Wide Linkage Analysis and Whole Exome Sequencing in a Large Multi-Generation Family Reveal Deleterious Mutations in Severely Affected Individuals with Developmental Dysplasia of the Hip

George Feldman, MD, Hind Sawan, BS, Javad Parvizi, MD, FRCS

Introduction: Developmental Dysplasia of the Hip (DDH) is characterized by incomplete formation of the acetabulum, suboptimal joint function, and accelerated wear of the articular cartilage resulting in arthritis. DDH affects 1 in 1000 newborns in the United States with well defined "pockets" of high prevalence in Japan, Italy and other Mediterranean countries. Although reasonably accurate for detecting gross forms of hip dysplasia, existing techniques fail to find milder forms of dysplasia. Undetected hip dysplasia is the leading cause of osteoarthritis of the hip in young individuals causing over 40% of cases in this age group.

Methods: A 72 member, four generation affected family has been recruited, DNA from its members retrieved. Genome-wide linkage analysis and whole exome sequencing were performed.

Results: Linkage analysis revealed a 2.61 Mb candidate region (38.7-41.31 Mb from the p term of chromosome 3) co-inherited by all affected members with a maximum LOD score of 3.31. Whole exome sequencing and analysis of this candidate region in four severely affected family members revealed one shared variant, rs3732378, which causes a threonine (polar) to methionine (non-polar) alteration at position 280 in the trans-membrane domain of CX3CR1. This variant was validated in all affected members of the family and obligate heterozygotes. Other possibly deleterious mutations shared by 4 severely affected members were found.

Discussion and Conclusion: This CX3CR1 variant is predicted to have a deleterious effect on its encoded protein which functions as a receptor for the ligand fractalkine. CX3CR1 mediates cellular adhesive and migratory functions and is known to be expressed in mesenchymal stem cells destined to become chondrocytes. A genetic risk factor that is very likely to be among the etiologic factors for the family in this study has been identified, laying the foundation for a predictive genetic test for newborns.

Periacetabular Osteotomy after Failed Treatment with Hip Arthroscopy

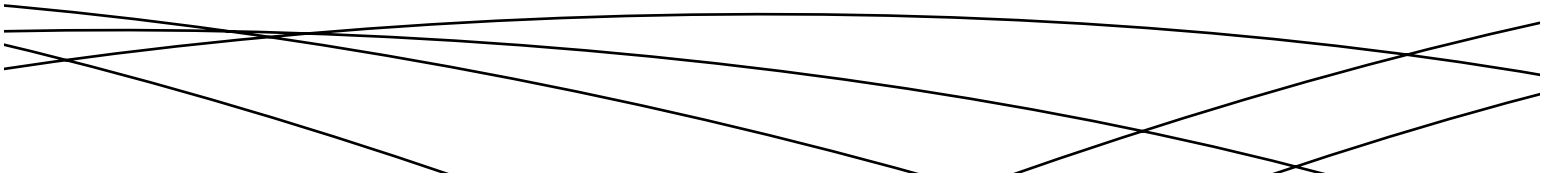
Geneva Baca, BA, Paul F. Beaule, MD, FRCSC, **John C. Clohisy, MD,**
Meghan Gottlieb, MSW, Michael B. Millis, MD, David A. Podeszwa,
Rafael J. Sierra, MD, Ernest Sink, MD, Gail E. Pashos, BS

Introduction: Treatment of symptomatic hip dysplasia has focused on corrective osteotomy surgery, while hip arthroscopy remains controversial. Improved understanding of the patient population that fails to improve with hip arthroscopy alone is important to guide future treatment of hip dysplasia. The purpose of this study was to define the patient population and clinical presentation of patients that fail hip arthroscopy, present with persistent symptoms, and are treated with periacetabular osteotomy (PAO).

Methods: A prospective, multi-center database of over 2250 hip preservation procedures was searched to identify patients who underwent a PAO, following a failed hip arthroscopy. Patients were analyzed by preoperative radiographs, clinical outcome scores, and intra-operative disease patterns.

Results: 30 patients (30 hips) diagnosed with acetabular dysplasia underwent PAO after failing hip arthroscopy. 87% of the patients were female, the average age at surgery was 27.3 years, and the average BMI was 24.1. The previous hip arthroscopies were performed on average 22 months prior to the PAO. 23% of the patients underwent 2 arthroscopies prior to PAO. The average lateral center edge angle was 14.7°, acetabular inclination 16.3°, and anterior center edge angle 16.8°. The average alpha angles were 51.1° and 54.6° on the frog lateral and Dunn view, respectively. Labral abnormalities and acetabular chondral disease were noted in 72% and 56% respectively of patients who had either an arthrotomy or arthroscopy performed at the time of PAO (N=22). The average modified Harris Hip Score was 53.5, WOMAC 56.9, SF-12 physical component 36.4, and UCLA 5.4 prior to PAO.

Conclusion: Failed hip arthroscopy and the need for PAO is most commonly observed in young female patients with mild to moderate acetabular dysplasia. These patients usually present approximately 2 years after arthroscopy with persistent/recurrent hip symptoms and major functional limitations. At revision surgery, labral and articular cartilage abnormalities are common.



Weighted versus Uniform Dose of Tranexamic Acid in Patients Undergoing Primary, Elective Knee Arthroplasty: A Prospective Randomized Controlled Trial

Mark N. Belkin, MD, **Brett R. Levine, MD, MS,** Zachary H. Goldstein, BA

Introduction: The goal of this study was to evaluate the effectiveness of a uniform versus weighted dose of tranexamic acid (TA) in reducing intraoperative and postoperative blood loss during primary Total Knee Arthroplasty (TKA).

Methods: In a prospective, randomized, double-blinded, controlled study, TA was injected before tourniquet release during primary TKA in two study groups (50 patients). Group 1 (n=25) received a uniform 1g dose, and group 2 (n=25) received a weighted 20mg/kg single dose. All surgeries were performed by the senior author via a midvastus approach using a tourniquet for the duration of the procedure. Postoperative protocols and anticoagulation were standardized following institutional TKA pathways.

Results: For the uniform dose group, intraoperative blood loss was 100.00 ± 31.69mL (25-300mL), postoperative blood loss was 193.75 ± 55.72mL (35-495mL), and total blood loss was 293.75 ± 77.96mL (135-795mL). For the weighted dose group, intraoperative blood loss was 65.00 ± 8.50mL (25-100mL), postoperative blood loss was 291.50 ± 83.31mL (0-960mL), and total blood loss was 356.50 ± 77.61mL (range 100-985mL). There was no significant difference between groups with intraoperative, postoperative, and total blood loss ($p = 0.256$, 0.370, and 0.581, respectively).

For the uniform dose group, postoperative hemoglobin (Hb) decreased by 2.56 ± 0.38 g/dL(1.6-4.4 g/dL), and in the weighted dose group, Hb decreased by 2.23 ± 0.425 g/dL(1.1-5.1 g/dL). There was no significant difference between the two groups in Hb change ($p = 0.591$). There has been 1 adverse event in each group, and 2 blood transfusions were given to one patient in the weighted dose group while none in the uniform dose group.

Discussion: The lack of significant statistical difference between groups with the numbers available for study, suggests that a single 1-gram dose can be used with the same efficacy as a weighted 20mg/kg single dose.

Prospective Randomized Trial Comparing Peripheral Nerve Blocks and Periarticular Injection for Pain Management after Total Knee Replacement

Henry D. Clarke, MD, Jospeh Hentz, MS, Lopa Misra,
Joshua L. Blocher, PA-C, MPAS, David Seamans, MD, **Mark J. Spangehl, MD**

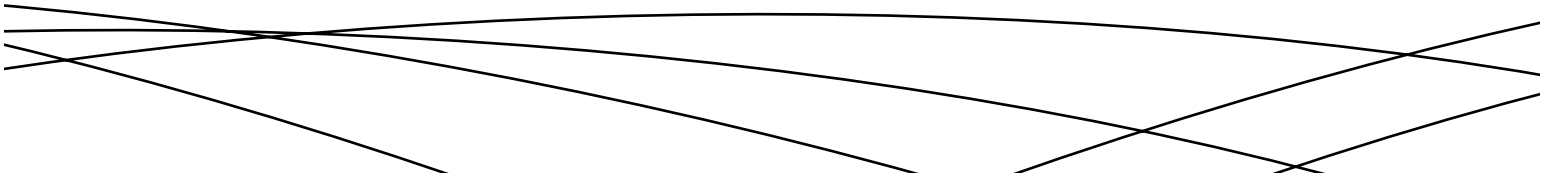
Introduction: Multimodal pain management, apart from narcotic medications alone, is becoming the standard of care for pain management after knee replacement. This study was undertaken to compare the outcome of two adjuvant modalities, peripheral nerve blocks versus periarticular injections, as part of a multimodal pain protocol after total knee replacement.

Methods: 160 patients completed randomization into two treatment arms: 1) peripheral nerve blocks (n=79) with an indwelling femoral nerve catheter and a single shot sciatic block (peripheral nerve block group - PNBG); or 2) periarticular injection (n=81) using ropivacaine, epinephrine, ketorolac and morphine (periarticular injection group - PAIG). All patients received standardized general anesthesia and oral medications.

The primary outcome was post-operative pain, on a 0 – 10 scale, the afternoon of post-operative day 1 (POD 1). Secondary outcomes were patient satisfaction, narcotic use, length of stay, hemoglobin changes, blood transfusions, and peripheral nerve complications.

Results: Mean pain scores on the afternoon of POD 1 were similar between groups (PNBG: 2.9 (SD 2.4); PAIG 3.0 (SD 2.2) 95% CI: -0.8 – 0.6. p = 0.76). Mean pain scores taken at three times points on POD 1 and patient satisfaction were also similar between groups. Hospital length of stay was significantly shorter for the PAIG (2.44 days (SD 0.65) vs. 2.84 days (SD 1.34) for PNBG (p = 0.02). Narcotic consumption was significantly higher the day of surgery for the PAIG, but thereafter no difference. Mean drop in hemoglobin and transfusion did not differ. Significantly more patients in the PNBG had sequelae of peripheral nerve injury (mainly dysesthesia) at 6 week follow-up (9(12%) vs 1(1%); p=0.009).

Conclusion: Patients receiving periarticular injections had similar pain scores and satisfaction with pain management, shorter lengths of stay, but greater narcotic use on the day of surgery compared to patients receiving peripheral nerve blocks.



A Comparison of Continuous Femoral Nerve Catheter versus Adductor Canal Block for Postoperative Pain Management following Total Knee Arthroplasty

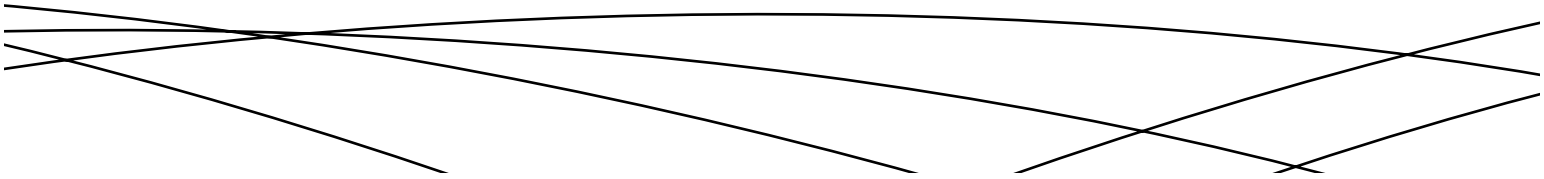
Lalit Puri, MD, Justin Gettings, MD

Introduction: Pain following total knee arthroplasty (TKA) can be a significant barrier to recovery following surgery. Historically, femoral nerve catheters have been used effectively to control pain following TKA, however, concern regarding muscle weakness and falls have led to increased utilization of sensory blocks, such as the adductor canal block and it effects on the saphenous and infrapatellar sensory nerves. The goal of this study was to assess whether differences exist between patients receiving femoral nerve catheters versus adductor canal blocks following TKA.

Methods: Fifty consecutive patients who had received an adductor canal block were compared to fifty consecutive patients who had received a femoral nerve catheter. Both groups received spinal epidural anesthesia intra-op, and were given the same combination of opioid medications post-op. Inclusion criteria: patients aged 35-85, unilateral TKA, surgery for degenerative osteoarthritis. Exclusion criteria: allergies to study medications, bilateral TKA, ICU admission post-op. Outcomes measures were collected on post-op days 1-3 during therapy. Measures included VAS pain scores, range of motion, ambulation distance, length of stay, and peri-op complications. Groups were statistically similar with respect to demographic information.

Results: Length of stay was reduced in patients receiving adductor canal blocks compared to those receiving femoral nerve catheters. The mean length of stay in the adductor canal block and femoral nerve catheter groups were 2.69 and 3.04 respectively. A two-sample t-test was performed to evaluate differences in mean length of stay and found a significant effect ($t=2.47$, $df=96$, $p=0.0152$). All other outcomes were equal with the exception of range of motion in the femoral catheter group, which was found to be significantly greater on postoperative day one ($t = 4.62$, $df = 88$, <0.0001), but not upon discharge.

Conclusions: Our study highlights that adductor canal blocks are equivalent to continuous femoral nerve catheters with respect to pain, mobilization and post-op complications, while functioning to decrease length of stay following TKA.



Transfer of Hip Arthroplasty Patients Leads to Increased Cost and Resource Utilization in the Receiving Hospital

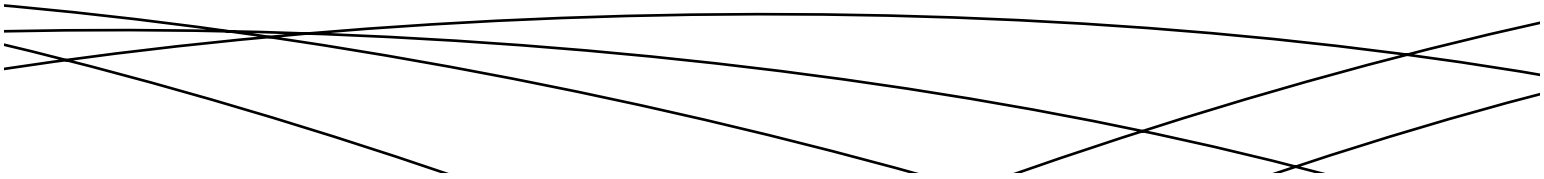
Atul F. Kamath, MD, Daniel C. Austin, BA, Peter B. Derman, MD, MBA, Craig L. Israelite, MD

Introduction: Factors other than complexity of care drive the transfer of orthopedic patients to tertiary centers. We sought to analyze the demographics, insurance data, peri-operative outcomes and institutional costs of hip arthroplasty patients transferred from outside facilities compared to patients derived from our arthroplasty clinics. We hypothesized that transferred patients would have less desirable insurance profiles and would be associated with longer hospital courses and higher costs than those who presenting from within the system. This transfer of arthroplasty patients has not been previously studied, and the financial implications are unknown.

Methods: From a cohort of 419 consecutive hip arthroplasty patients, we compared 41 patients who were transferred to our institution to 373 patients derived from our clinic system. Five patients were excluded due to incomplete clinical data from the transferring institution. This retrospective cohort study examined the characteristics of these groups using the mann-whitney test to compare quantitative data and chi-squared analysis to compare qualitative metrics.

Results: Transferred patients were older ($p=0.01$) and less likely to have private insurance ($p<0.0001$). These patients were more likely to be admitted on weekends ($p=0.04$), and both dislocation and fracture were more prevalent in transferred patients ($p=0.04$; $p=0.003$). Post-operative complications including intensive care unit requirements ($p=0.001$) and blood transfusions (p0.01) were significantly higher in transferred patients. Transferred patients had a 75% longer median length of stay (<0.0001) and a 28% greater median total cost ($p<0.0001$) in comparison to directly admitted patients.

Conclusion: Across all key metrics – including length of stay, peri-operative outcomes, and total costs – transferred patients more significantly strained the resources of our arthroplasty center. This report prompts further study into reasons for orthopedic transfer of care, as well as the need to optimize the pre-operative medical status and to minimize the institutional costs associated with this subset of patients.



Are Patient Reported Allergies a Risk Factor for Poor Outcomes in Total Hip and Knee Arthroplasty?

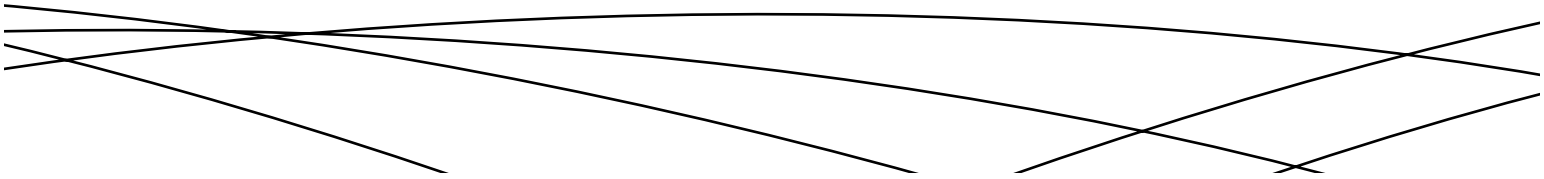
Christopher M. Graves, MD, Jesse E. Otero, MD, PhD, Melissa Willenborg, MD, Yubo Gao, PhD, Steve Liu, MD, Devon Goetz, MD, Richard C. Johnston, MD, MS, John J. Callaghan, MD

Introduction: Patient reported dissatisfaction rates following elective TKA and THA range from 14 to 28%. Government organizations and insurers are considering payments to hospitals and surgeons based on patient reported satisfaction. Numerous investigators are researching the factors associated with dissatisfaction following joint replacement. The authors have hypothesized that patients with multiple reported allergies report higher rates of dissatisfaction following TKR and THR. The purpose of this study is to compare patient reported outcomes in patients with and without multiple reported allergies.

Methods: At the authors institution patient reported SF36 and WOMAC scores are reported preoperatively and at follow-up of THR and TKR procedures. As a study group, we evaluated 459 patients undergoing THR or TKR who completed preoperative and postoperative WOMAC and/or SF36 surveys. Medical comorbidities and reported allergies were also recorded. Evaluation of surveys was compared for patients with or without 4 or more reported allergies using ANOVA and regression analysis.

Results: Patients with 4 or more reported allergies had less improvement on SF36 Physical Component Score (ΔPCS avg +4.2) than those with 0-3 allergies (ΔPCS avg +10.0, p = 00002). Regression analysis showed that this change was independent of self-reported comorbidities. Patients reporting 4 or more allergies also had less improvement in WOMAC function (ΔF avg 21.4) than those with 0-3 allergies (ΔF = 27.2 p = 0.036). Similar non significant trends occurred in SF36 mental and WOMAC pain and stiffness scores.

Conclusion: Patients with multiple reported allergies who undergo THR and TKR report less improvement in SF36 physical components scores and WOMAC functional scores following the procedure. Surgeons and patients should be aware of these findings and the patient subgroup with multiple allergies should be counseled as to the potential for less satisfactory outcomes than the patients without multiple allergies.



Predictors and Complications of Blood Transfusion in Total Hip and Knee Arthroplasty

Nolan M. Wessell, MD, Michael A. Charters, MD, MSE, Jakub A. Sikora-Klak, Stephen Yu, Christopher R. Dobson, James J. Jeffries, Craig D. Silverton, DO, Michael W. Laker, MD, **Nicholas B. Frisch, MD, MBA**

Introduction: Increased attention has been paid toward perioperative optimization to minimize the need for post-operative blood transfusions in patients undergoing total hip arthroplasty (THA) and total knee arthroplasty (TKA). The purpose of this study was to determine pre-operative, operative and post-operative predictors of transfusion and identify complications associated with transfusions.

Methods: A retrospective chart review of clinical records from 1795 patients who underwent total hip arthroplasty (THA) or total knee arthroplasty (TKA) at our institution between January 1, 2011 and December 31, 2012. After excluding patients if they had a bilateral procedure, partial arthroplasty or revision surgery, a total of 1573 patients were ultimately included. Logistic regression evaluated variables predictive of transfusion and a stepwise logistic model determined the best fit multivariate model. A Wilcoxon two-sample test, a Spearman's correlation and a linear regression to analyze the number of units transfused.

Results: Of the 1573 patients included in the study 949 patients underwent TKA and 624 patients THA. 88 (9.27%) TKA patients received a blood transfusion compared to 166 (26.6%) THA patients. Significant predictors for transfusion are: hemoglobin OR 0.62 [95%CI, 0.53, 0.76, p=0.001], age 1.45 [1.19,1.77, p=0.001], female gender 2.60 [1.55,4.43, p=0.001], body mass index 0.84 [0.72,0.98, p=0.027], creatinine 1.35 [1.05,1.74, p=0.020], TKA 0.39 [0.25,0.63, p=0.001], operating room time 1.25 [1.05,1.74, p=0.029], estimated blood loss 1.14 [1.06,1.24, p=0.001], intra-operative fluids 1.04 [1.01,1.07,p=0.012]. DVT rate was 1.9% and not statistically significant, but infection rate amongst transfused patients was 13.3% higher than non-transfused patients (p=0.001).

Conclusion: The rates of blood transfusion at our institution were 9.27% in TKA and 26.6% in THA. Increased age, female gender and BMI were predictive of transfusions. Rates of transfusion increased with longer OR time, EBL and IVF. DVT rates were similar regardless of transfusion, but infection rates were statistically higher in the transfused patients.

Posterior Stabilized versus Cruciate-Substituting Total Knee Arthroplasty: Midterm Results

David F. Scott, MD

Introduction: There is no consensus whether a traditional post and cam-style posterior stabilized (PS) total knee device is superior to a deep-dish, more congruent cruciate-substituting (CS) device. This study compared the clinical and radiographic outcomes of two such devices. The primary hypothesis was that the clinical outcomes would be equivalent and the secondary hypothesis was that there would be measurable differences in the tourniquet time and intraoperative blood loss.

Methods: This prospective randomized study compared the outcomes of 56 patients who received a Triathlon® PS tibial insert and 55 patients who received a Triathlon® CS lipped tibial insert (Stryker®, Mahwah, NJ, USA). All patients undergoing elective primary total knee arthroplasty were eligible for participation. Institutional Review Board approval and informed consent from participants were obtained. Regular clinical and radiographic assessments were performed preoperatively, 6 weeks, 6 months, and annually. Data were compared using chi-square test and T-test with a significance level of .05.

Results: The mean follow-up period is 45 months (range, 30 - 57 months). There were no statistically significant differences in demographic characteristics, intraoperative blood loss, and the pre- postoperative hemoglobin. There was a significantly greater amount of blood transfused for the male PS subgroup ($P < .039$) and tourniquet time was 9.87% longer for the PS group ($P < .015$). There were no significant differences between groups for the Knee Society scores, the Lower Extremity Activity Scale, ROM, and alignment (preoperative versus 1-year postoperative).

Conclusion: As hypothesized, the clinical outcomes of the two groups were equivalent statistically. There was a statistically longer tourniquet time for the PS group and more blood transfused in the male PS subgroup. At the 2-year follow-up point in this 5-year study, the results cannot clearly demonstrate superiority of either device.

Radiographic and Technical Factors Associated with Patellar Clunk Syndrome following Posterior Stabilized Total Knee Arthroplasty

John D. Peters, MD, Daniel M. Kopolovich, Michael Aynardi, MD,
James J. Purtill, MD, James A. Costanzo, MD

Introduction: The patellar clunk syndrome is a well-known complication of total knee arthroplasty (TKA). Although patellar clunk syndrome was described over twenty years ago, technical factors associated with the development of this syndrome have not been well established. To our knowledge, this is the largest single surgeon, single institution study to report on the radiographic and technical factors associated with patellar clunk syndrome in posterior stabilized TKA.

Methods: From 2001 until 2012, all patients undergoing primary TKA by a single surgeon, at a single institution using only posterior stabilized components were identified. Revision TKA and infection cases were excluded. All patients who were diagnosed and treated arthroscopically for patellar clunk were identified. Patients were matched with controls by sex, surgeon, and date of surgery. Operative notes and immediate pre- and post-operative radiographs were reviewed to determine radiographic and technical factors associated with patellar clunk.

Results: 2271 patients underwent primary posterior stabilized TKA. A total of 75 knees in 68 patients were diagnosed and treated arthroscopically for patellar clunk for an incidence of 2.67%. Preoperatively patients in the clunk cohort had a significantly more valgus alignment than matched controls (mean 2.6 degrees valgus vs 3 degrees varus, p=.042). Postoperatively, the clunk cohort had a significantly greater increase in posterior femoral offset (2.8mm vs 0.65mm, p=.0001). Patellar component size less than 38mm was significantly associated with patellar clunk (p=.001). Tibial and femoral component size, tibial offset, and patellar length were not statistically significant.

Conclusion: Patellar clunk syndrome is a significant complication of TKA. Both radiographic and technical factors are associated with development of patellar clunk. This highlights the importance of technical precision and component selection in primary TKA, especially in patients with predisposing factors for patellar clunk syndrome.

Current Data does not Support Routine use of Patient-Specific Instrumentation in Total Knee Arthroplasty

Mathew Hamula, BA, BS, Gwo-Chin Lee, MD, **Pramod B. Voleti, MD**

Introduction: Proposed advantages of patient-specific instrumentation in TKA include enhanced accuracy in component positioning, decreased operative time, and reduced cost. The purpose of this study is to compare patient-specific versus standard TKA instrumentation with regard to: (1) coronal alignment, (2) sagittal alignment, (3) operative time, (4) blood loss, (5) transfusion requirement, and (6) perioperative cost.

Methods: A systematic review of the peer-reviewed literature indexed on Medline and/or Embase was performed in search of Level I, II, or III studies comparing the results of patient-specific versus standard TKA instrumentation. The data published in these studies were aggregated for the purpose of comparing the two treatment groups.

Results: The nine included studies described 957 TKAs (529 performed with patient-specific instrumentation and 428 with standard instrumentation). While patient-specific instrumentation demonstrated improved accuracy in coronal alignment as measured by femorotibial angle (FTA) ($p = 0.0003$), standard instrumentation demonstrated improved accuracy in coronal alignment as measured by hip-knee-ankle angle (HKA) ($p = 0.02$). Importantly, there were no significant differences in the ability of either technique to avoid outliers (> 3 degrees from target alignment) in either FTA ($p = 0.7$) or HKA ($p = 0.7$). Measures of sagittal alignment accuracy were equivalent between the two groups for both the femoral component ($p = 0.5$) and the tibial component ($p = 0.9$). Operative time (93 minutes vs. 104 minutes, $p = 0.1$), blood loss (371 mL vs. 384 mL, $p = 0.2$), transfusion requirement (10.1% vs. 14.1%, $p = 0.1$), and perioperative cost were also similar between treatment groups.

Conclusion: Patient-specific instrumentation does not demonstrate superiority over standard instrumentation with regard to coronal or sagittal alignment accuracy, operative time, blood loss, or perioperative cost. Therefore, current data does not support routine use of patient-specific instrumentation in TKA.

Oxford Phase III Medial Unicompartmental Knee Arthroplasty (UKA): Results of 467 Knees with a Mean 5-year follow-up and Analysis of Predictors of Failure

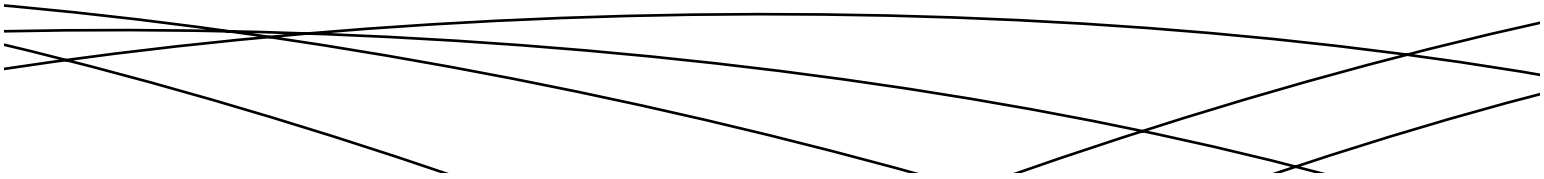
Duncan Jacks, MD, FRCSC, Christine Hall, MD, FRPCP,
Stephen Burnett, MD, FRCSC, Rajesh Nair, MD, BSc

Introduction: Previous studies from Oxford have reported a revision rate of 3%. Other independent centers and registries have demonstrated inferior results (3-15% revision rates). Our purpose is to report revision, bearing dislocation, and assess independent predictors of failure from a single large independent center.

Methods: A retrospective clinical and radiographic review of 467 consecutive UKA for isolated medial OA was performed. Oxford Knee Score, KSCRS, WOMAC, SF-12 and analysis of multiple independent predictors of revision (gender, BMI, age, number of previous surgeries, implant sizes, polyethylene thickness, surgeon experience, cement type & technique, MIS vs standard incision) using univariate odds ratio was performed. Radiographic analysis included long-leg alignment films. No industry bias or implant company funding was received for this study. The mean follow-up was 5.2 years (range, 2-10yrs).

Results: Thirty-four knees (7.3%) were revised or pending revision to TKA (at a mean 47mos) most commonly for lateral compartment OA. Six knees (19%) required revision augments (5 tibial, 1 femoral). Seven short cemented tibial stems were utilized. Twelve CR(39%) knees, 14 PS(45%), 4 cruciate substituting/dished(13%), and 1(3%) constrained polyethylene were used. The dislocation rate was 0.86% (4 knees). Over correction into valgus on immediate postoperative radiographs was a predictor of revision. Surgeon experience and volume, non-MIS exposure, Simplex cement, and separate cement mixing for tibia and femur trended towards more favorable outcomes.

Conclusions: This is a large independent review with revision results not as favorable as from Oxford. Lateral compartment OA was the most common reason for revision. Trends for surgeon experience and surgical technique were clinically significant. A valgus alignment on immediate postoperative radiograph was predictive of failure. Revisions were not 'simple', and failure rates may be higher as time progresses to 10 years and this is of concern considering the lower revision rates associated with TKA surgery.



Differences in Short Term Complications Between Unicompartmental and Total Knee Arthroplasty: A Propensity Score Matched Analysis

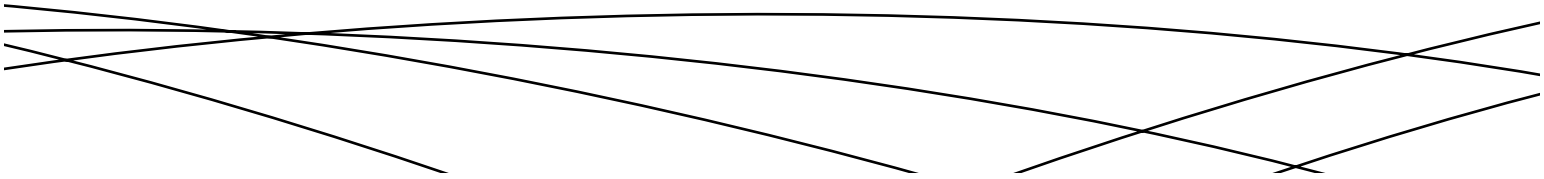
Kyle R. Duchman, MD, Yubo Gao, PhD, Andrew J. Pugely, MD,
Christopher T. Martin, MD, **John J. Callaghan, MD**

Introduction: Total knee arthroplasty (TKA) and unicompartmental knee arthroplasty (UKA) have emerged as effective treatments for end-stage disease in the appropriately indicated patient. Differences in short-term complications after TKA and UKA have not been well described. We sought to identify differences in 30-day complication rates between TKA and UKA using a large, heterogeneous national database provided by the ACS NSQIP.

Methods: Patients undergoing TKA and UKA between 2005 and 2011 were identified from the ACS NSQIP database. CPT codes were used to select cases of elective primary knee arthroplasty. Short-term 30-day incidences of morbidity and mortality were calculated in the two cohorts. Statistical models employing univariate and multivariate logistic regression identified risk factors for complication after TKA and UKA. Propensity matching addressed demographic differences between TKA and UKA cohorts.

Results: In total, 29,333 patients were identified; 27,745 (94.6%) had TKA, and 1588 (5.41%) had UKA. Females comprised 63.7 and 55.3% of the TKA and UKA cohorts, respectively. The average BMI in the TKA and UKA cohorts was 32.7 ± 7.3 and 31.5 ± 6.5 kg/m2, respectively ($p < 0.0001$). A well-developed propensity score matching algorithm was used to address significant demographic differences in the two cohorts. Following matching, composite complications (16.6% vs 5.2%; $p < 0.0001$), DVT (1.5% vs 0.50%; $p < 0.02$), blood transfusions (11.7% vs 1.1%; $p < 0.001$), operative time (91.4 vs 89.0 mins; $p = 0.019$), and length of hospital stay (LOS) (3.4 vs 2.2 days; $p < 0.0001$) were all significantly higher in the TKA cohort.

Conclusion: Although TKA and UKA are performed in different patient populations, addressing these differences with propensity matching in a heterogeneous cohort provided by the ACS NSQIP database revealed lower short-term morbidity and mortality following UKA.



Revising an HTO or UKA to TKA: Is It More Like a Primary TKA or a Revision TKA?

Paul H. Yi, BA, Mario Moric, Craig J. Della Valle, MD, **Michael B. Cross, MD**

Introduction: The ease and success of revising a unicompartmental knee arthroplasty (UKA) or a high tibial osteotomy (HTO) to a total knee arthroplasty (TKA) is controversial. Our purpose was to compare a cohort of patients who underwent revision of a UKA to a TKA or a HTO to a TKA to matched cohorts of patients who underwent (1) a primary TKA and (2) an aseptic both component revision TKA.

Methods: 49 consecutive patients revised from a UKA and 43 revised from an HTO to a TKA were matched by age and BMI to 43 aseptic both component revision TKAs and 97 primary TKAs. The outcomes studied included Knee Society Scores (KSS), range of motion (ROM), Knee Function Scores (KFS), operative time, postoperative complications, revision rates and reasons for revision surgery, need for stems/augments/constrained implants, and length of stay. ANOVA was used to compare the differences in means ($p<0.05$).

Results: The mean improvement in KSS and KFS in the UKA to TKA, HTO to TKA and primary TKA cohorts were similar with the numbers available for study ($p>0.05$). Primary TKA and HTO to TKA had significantly better outcomes than the revision cohort in KFS score improvement ($p<0.05$). Length of stay was significantly shorter in the primary TKA cohort than the other 3 cohorts ($p<0.05$, all). Primary TKA had the highest postoperative motion, but was only significantly better than aseptic revision TKA ($p<0.05$). Revision implants were required in 29% of UKA to TKA procedures compared to 2% of primary TKAs.

	UKA to TKA (n= 49)	HTO to TKA (n = 42)	Primary TKA (n = 97)	Revision TKA (n= 43)
Preop KSS	50.2	47.9	49.4	42.4
Postop KSS	84.5	90.3	85.7	70.6
Δ KSS	34.2	42.4	36.1	28.6
Preop KFS	48.0	48.0	48.9	44.9
Postop KFS	79.3	85.4	84.9	61.4
Δ KFS	31.1	37.4	34.5	20.6
Length-of-stay	3.2	4.3	1.84	4.2
Preop ROM	117.7	112.5	101.0	85.0
Posto ROM	115.3°	115.5°	117.0°	108.5°
Δ ROM	0.4	5.0	13.2	23.0

Conclusions: In our cohort of patients, revising an HTO to TKA and a UKA to a TKA both had outcomes that were more similar to a primary than a both component revision TKA although revision implants were required more commonly and length of stay was longer than a primary TKA.

Trends in Total Hip Arthroplasty in the United States: The Shift to a Younger Demographic

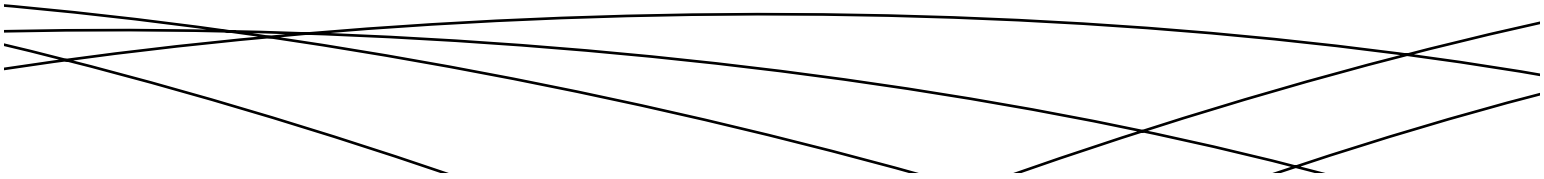
Jeffrey Lange, MD, Virginia G. Briggs, PhD, Patricia D. Franklin, MD,
David C. Ayers, MD, **Jacob M. Drew, MD**

Introduction: The trend of increasing incidence of THA, particularly among younger patients, must be better understood in order to guide consensus strategy and maximize resource efficiency. We address the relative contributions of population size versus rate of utilization to this trend, and assess its impact on primary payer and the revision burden.

Methods: This retrospective review uses hospital discharge data from the Nationwide Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), 2000-09. All THA and revision THA (RTHA) were identified. Using standard statistical analyses, we report procedural rates, age, payer, length of stay (LOS), discharge disposition, and revision burden for each year, stratified by age.

Results: The total number of THA increased by 73% overall, by 123% for those 45-64, and by 54% for those 65-84. The rate/100K population of THA increased by 59% overall, by 73% for those 45-64, and by 36% for those 65-84. The number of RTHA increased by 27% overall; the rate increased by 3%. Medicare paid for 58.2% of all THAs in 2000, and 52.8% in 2009. Revision burden decreased from 17.72% to 13.69% overall, and from 15.2% to 11.6% for 45-64.

Conclusion: Annual incidences of THA in the US continue to increase through 2009. The shift from the 65-84 age group into the 45-64 age group was more dramatic compared to the previous decade. These trends are driven primarily by the disproportionate growth in the rate of utilization among younger patients, and secondarily by overall population growth. The shift to a younger demographic is reflected by a similar shift from Medicare to private insurers. The overall incidence of RTHA increased moderately, and rates of RTHA remained stable. Despite spanning the peak of the metal-on-metal era, the decade saw the overall revision burden decrease by 23%, and by 24% in the 45-64 age group.



Pain Patterns in Young, Active Patients following Hip Arthroplasty

Ryan M. Nunley, MD, Peter Brooks, MD, FRCS(C), John C. Clohisy, MD,
Robert L. Barrack, MD, Humaa Nyazee, MPH

Introduction: The purpose of this study is to determine the incidence, severity, and location of pain experienced by young active patients after hip arthroplasty utilizing pain drawings.

Methods: This multicenter study identified a cohort of young, active patients who were at least one year post SRA or THA. Young active patients were defined as males age 18-60, females age 18-55 with a pre-symptomatic UCLA score >= 6. Potential participants were mailed a letter explaining the study and asking them to complete a questionnaire. Participants were asked to indicate whether or not they experienced pain and to what level in 8 anatomical areas of interest. Participants used a 0 – 5 pain scale, with 0 being 'No Pain' and 5 being 'Constant Pain'. Completed questionnaires were returned to their respective centers and de-identified data was sent to the coordinating center. For data analysis purposes, pain was considered to be 'mild' if scored with a 0 or 1 (no pain or pain only with extreme activity). Pain was considered to be 'moderate/severe' if scored between 2 and 5.

Results: Four hundred and thirty-three questionnaires were returned (224 SRA/209 THA) from two centers. Forty percent of patients reported pain in at least one area. There was no difference in groin pain as reported by both SRA and THA patients (SRA=70/224, 31%; THA=61/209, 29%; p=0.63). THA patients reported more anterior thigh pain (SRA=18/224, 8%; THA=53/209, 25%; p<0.001). In addition, anterior thigh pain was more severe for THA patients (Pain >1: SRA=7/224, 3%; THA=31/209, 15%; p< 0.001).

Conclusion: Many young, active patients experience some degree of pain after hip replacement when assessed with pain drawings. Patients with SRA and THA are equally likely to experience groin pain. THA patients experience significantly more anterior thigh pain with a surprising number having moderate or worse anterior thigh pain.

Assessment of Durability and Function at Minimum 35 Year follow-up of THA in Patients 50 and Under

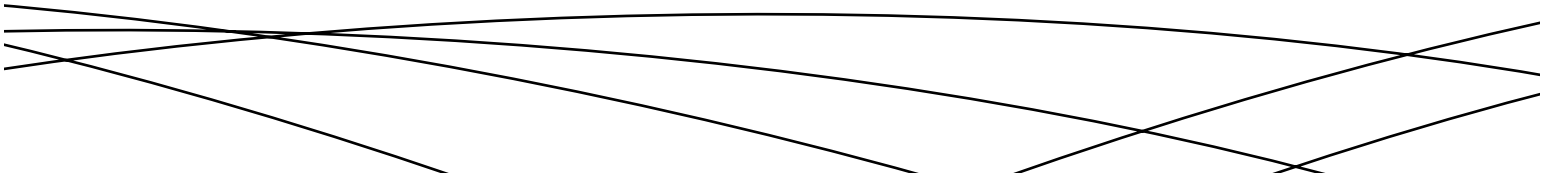
Lucian C. Warth, MD, Steve Liu, MD, Alison Klaassen, MA,
Devon D. Goetz, MD, Richard C. Johnston, MD, MS, John J. Callaghan, MD

Introduction: The purpose of the present study was to evaluate the clinical, radiographic and functional outcomes of Charnley THA in patients age 50 & under (a group that continues to actively function) at minimum 35 years of follow-up.

Methods: 93 consecutive non-selected hips in 69 patients age 50 & under at index Charnley THA has been prospectively followed for 35 years. This cohort has been previously evaluated at 25 years, allowing for a longitudinal comparison. 30 of 32 living patients were available for evaluation. Radiographic and clinical follow-up with quality of life and hip scores (SF-36, WOMAC, HHS) in addition to functional evaluation with activity scores (UCLA and Tegner), and activity measurements (6minute walk and pedometers) were performed.

Results: At latest follow-up, 44% of the cohort was alive and 34 (36.5%), of 93 THAs had been revised or removed. 21 acetabular (22.6%) and 7 femoral (7.5%) components were revised for aseptic loosening. Since the last follow-up, the average 6-minute walk distance decreased from 395m to 171m, and this decrease correlated with increasing comorbidity. WOMAC and Harris Hip ratings have also significantly declined ($p<0.05$).

Conclusion: This study demonstrates the durability of cemented THA in a young patient population. Although 63.5% of the original hip replacements were functioning at the latest follow-up or at the time of death, a significant decrease in activity level was seen over time. This is the first long-term follow-up of THA to quantitate the decrease in function over time. Age and health related factors as opposed to implant failure serve to limit activity in this cohort at long-term follow-up. Also 44% of the original patient cohort was alive for assessment, which is much higher than the 4.5% alive at 35 years in a cohort of THAs performed in older patients.



Performance of Highly Cross-Linked Polyethylene in Total Hip Arthroplasty in Young and Active Patients

Danyal H. Nawabi, MD, FRCS, Amar S. Ranawat, MD,
Chitranjan S. Ranawat, MD, **Morteza Meftah, MD**

Introduction: Hard-on-hard bearings and surface replacement (SR) have been used in young and active patients due to the reduced wear and lower rates of osteolysis. However, neither of these options resulted in survivorship higher than 90%-95% in this group of patients. The purpose of this prospective study was to compare minimum 10-year survivorship of non-cemented total hip arthroplasty (THA) using 28mm metal head against highly-cross linked polyethylene (HXLPE) in our cohort as compared to published reports of other bearings, including surface replacements, in young-active patients.

Methods: From 1999 to 2003, 91 consecutive patients (112 hips; 57 males and 34 females) with average UCLA score of 8 and mean age 53 years (range 24-65 years), who received metal on HXLP (Crossfire), were included. At minimum 10-years follow-up, patients' clinical data was assessed. All level I, II studies, registry data, and prospective cohorts published in the literature with minimum 10 years of surface replacement (SR) and ceramic on ceramic (CoC) in young patients were included.

Results: There were no revisions for fracture, osteolysis or loosening. There were 2 revisions: one periprosthetic infection and one chronic dislocation. Kaplan-Meier survivorship was 97% for all cause failures and 100% for wear-related failures. In review of the literature, the 10-year results of metal on HCLPE in young patients as well as the registry data were similar or better than SR and CoC.

Discussion and Conclusion: This study demonstrates that 28mm metal head on HXLPE has lower revision rates as compared to other bearings and surface replacement in the published literature at a minimum 10-year follow-up in young-active patients, without the limitations of heard-on-heard bearings. This bearing should be considered as the gold standard for young and middle age patients. Oxidation of Crossfire is an overly stated limitation.

Stress and Strain in the Trunnion with Big Heads: Tribocorrosion Turbocharged

Kinzy Jones Jr., MD, Hari Kishore Adluru, Jose L. Gonzalez, Jesus M. Villa, MD,
William Kinzy Jones, PhD, **Carlos J. Lavernia, MD, FAAOS**

Introduction: The use of large heads has increased 10 fold since the introduction of highly cross-linked polyethylene and metal-on-metal bearing surfaces. Cobalt-chromium (Co-Cr) has approximately twice the modulus of elasticity of titanium (Ti) alloys. Most stems used in the USA today are made out of Ti alloys. Our objective was to investigate the effect of large Co-Cr heads on the resulting stresses and strains in the trunnion.

Methods: A 3D model was constructed of a standard 12/14 trunnion using Simulia's ABAQUS 6.12-3.5 head sizes were modeled. The model had 130.6k nodes and 93.2k elements. To better capture the surface stress, first order membrane elements were overlaid on tetrahedron elements. The trunnion was assigned the material properties of Ti alloys and the heads of Co-Cr. A pressure load of 2.1 MPa was applied to simulate a 2.6 body-weight force at the hip.

Results: The area underneath the head had a significant increase in stresses and strains as the heads increased from 28mm to 40mm. For a 28mm diameter ball the maximum principal stress was 20.3 MPa, for a 32mm ball it was 36.0 MPa, and for a 40mm ball it was 43.8 MPa. Our data shows a 2X increase across the ball diameters studied.

Discussion and Conclusions: Our model suggests that increase in head size significantly augments the stresses and strains at the trunnion-head junction. This increase in motion and stresses at the trunnion head junction can significantly contribute to tribocorrosion and metal ion release. This effect can be magnified if an additional interface exists as in a double modular trunnion.

Direct Anterior versus Mini-Posterior Total Hip Arthroplasty with the Same Advanced Pain Management and Rapid Rehabilitation Protocol: Some Surprises in Early Outcome

Atul F. Kamath, MD, Michael J. Taunton, MD,
Mark W. Pagnano, MD, **Kirsten Poehling Monaghan, MD**

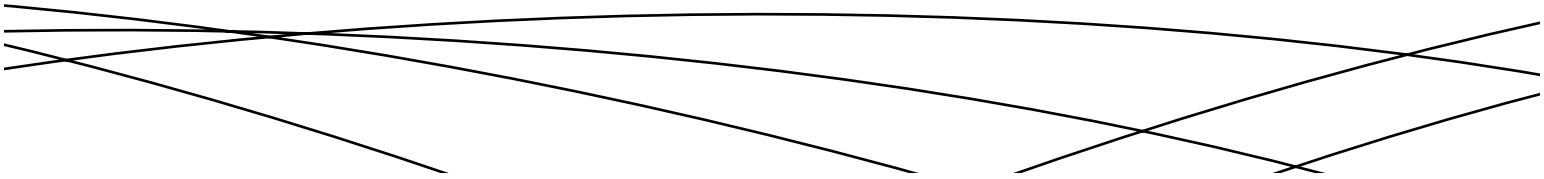
Purpose: Determining the effect of surgical technique on early outcome is confounded when advances in pain management, rapid rehabilitation, or patient education are introduced or applied asynchronously. We sought to determine the influence of surgical technique alone in contemporary cohorts of total hip arthroplasties done by 2 fellowship trained surgeons each performing their technique of choice with the same advanced pain and rapid rehabilitation protocol.

Methods: 126 consecutive direct anterior (DA) procedures were compared with 96 consecutive mini-posterior (MP) procedures done from July 2011 - February 2012. Groups did not differ ($p>0.2$ for all) in age (64+/-12 years), sex (50% female), body mass index (30 +/-5.7), or preoperative Harris Hip Score (HHS) (55+/-12). Operative details, in-hospital complications, visual analog scale (VAS) pain scores, and functional milestones at two- and eight-weeks were reviewed.

Results: No differences in length of stay (2.2 days), operative or in-hospital complications, intravenous breakthrough analgesia, stairs, maximum feet walked in-hospital, or discharge disposition (80% home) all $p>0.2$. The DA group had a higher VAS max pain (5.3 DA; +/- 2, vs 3.8 MP; +/-2 $p=<0.0001$). At two weeks, more DA patients required gait aids (92% vs 68% of MP; $p=<0.0001$). At eight weeks, DA had higher HHS (95 versus 89) but a lower return to work and driving; no difference: gait aids, narcotics, ADLs, or walking 0.5 mile. More wound problems occurred in the mini-posterior ($p=<0.01$).

Conclusion: With the same advanced pain and rehabilitation protocol it was somewhat surprising to find that the direct anterior had more early pain and more often used gait aids at 2 weeks. The DA group had fewer early wound problems contrasting with the belief that anteriorly based incisions would be more problematic.

Significance: Advanced pain and rehabilitation protocols may trump surgical approach in determining most early outcomes after contemporary hip arthroplasty done by surgeons experienced in using direct anterior or mini-posterior techniques.



Direct Anterior Hip Yields Faster Voluntary Cessation of All Walking Aids in a Randomized Trial

J. Bohannon Mason, MD, **Michael J. Taunton, MD,** Bryan D. Springer, MD, Susan M. Odum, PhDc

Introduction: Direct anterior total hip arthroplasty (DA-THA) has been touted as providing more rapid functional recovery, yet few randomized trials have queried this supposition. We sought to examine clinical and radiographic differences between DA-THA and tissue sparing mini-incision posterior approach THA (MPA-THA).

Methods: Fifty-four patients were randomized to two treatments; MPA-THA or DA-THA. A single surgeon familiar with both approaches, utilizing identical implants, performed all surgeries. Physical therapy protocols were standardized and patients were encouraged to progress at their own pace. Patient recorded diaries were collected at 3 and 6 weeks, and at 1 year. Two independent reviewers reviewed radiographs. SF-12 v1, WOMAC® and HHS scores were tabulated and all statistical analysis was performed with SAS.

Results: Time to ambulation without any assistive device strongly favored DA-THA (22.8 days vs 35.1 days, $p = 0.04$). Three week WOMAC® function, 6 week HHS ROM and 1 year HHS function scores all trended toward significance favoring DA-THA ($p = 0.08$; $p = 0.07$; $p = 0.07$, respectively). Three week SF mental scores favored MPA-THA (59.8 vs 55.7, $p = 0.03$). No statistical difference was noted for leg length (3.3 mm, SD 4.8 anterior; 3.5 mm, SD 4.2 posterior, $p = 0.88$) or acetabular component abduction angle (38.7° SD 4.1° anterior; 39.1°, SD 4.1°posterior). Acetabular component anteversion was higher with MPA-THA (28.9°, SD 4.6° vs. 25.6°, SD 3.2, $p = 0.004$). Inter-rater reliability was high ($p < 0.004$). No differences were seen with time to narcotic cessation, WOMAC® or HHS pain or stiffness sub-scores or with total scores at any time interval.

Conclusions: In a randomized trial, patients undergoing THA via direct anterior approach voluntarily quit use of all walking aids on average 12 days earlier than patients with a mini-incision posterior approach. Little additional clinical or radiographic benefit was seen between the cohorts.

Mechanically Assisted Taper Corrosion in Modular TKA

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Introduction: Little is known about mechanically assisted crevice corrosion of modular tapers in TKA. Recently a case of adverse local tissue reaction (ALTR) has been reported at a TKA taper (McMaster 2013). The purpose of this study was to characterize the prevalence of taper damage in modular components for TKA.

Methods and Materials: 1873 retrieved TKA components were collected from 2002-2013 as part of a multi-center, IRB-approved retrieval program. 218 modular components from 159 revised knees were implanted for 3.7±4.0y (range: 0.0-17.5y). TKAs were predominantly revised for loosening, infection, and instability. Medical records were reviewed for sightings of ALTRs. Modular components were disassembled and evaluated for fretting corrosion using a semi-quantitative 4-point scoring system (1 being little-to-no fretting corrosion and 4 being extensive fretting corrosion) (Higgs 2013). Flexural rigidity, stem diameter, alloy coupling, patient weight, age and implantation time were assessed as predictors of fretting corrosion damage.

Results: Mild to severe fretting corrosion (score ≥ 2) of at least one component was observed in 106/111 (95.5%) of the tapers on the modular femoral components and 98/107 (91.6%) of the modular tibial components. Damage was more prevalent in mixed alloy pairs (Ti Alloy and CoCr) as compared to same alloy pairs. Clinical factors (e.g., Age, Weight, Implantation time) didn't correlate with fretting damage ($p>0.05$). Threaded tapers had a lower damage score compared with conical tapers ($p<0.0001$). Femoral components exhibited significantly greater fretting and corrosion damage as compared with tibial components ($p<0.02$).

Discussion: The clinical implications of fretting and corrosion for TKA remain unclear, because modularity in TKA is typically reserved for unstable or revised knees, and we based our analysis of metallosis and ALTR on a retrospective review of clinical records. The majority of TKAs were cemented, which may also limit the diffusion of corrosion products.

Stepped Porous Titanium Metaphyseal Sleeves for Tibial Defects in Revision Total Knee Arthroplasty

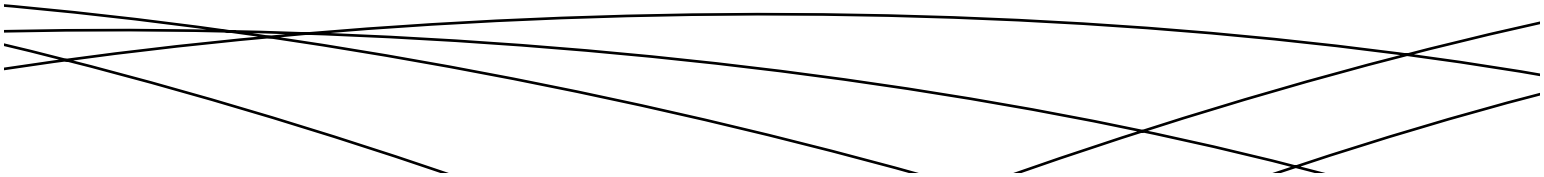
Leera Choi, Ryan Mayer, Jay Patel, MD,
Steven L. Barnett, MD, Robert S. Gorab, MD, **Joseph S. Gondusky, MD**

Introduction: The treatment of tibial defects during revision total knee arthroplasty (TKA) can be challenging. Stepped titanium metaphyseal sleeves with in-growth potential allow for diffuse force distribution and bony support, and may provide a good construct option.

Material and Methods: We retrospectively reviewed data on 51 patients who underwent revision TKA utilizing a metaphyseal sleeve for Anderson Orthopaedic Research Institute (AORI) Type II and III tibial defects between June 2007 and July 2011. Fifty-eight percent of patients were male, with average age of 66, body mass index of 30.74, and American Society of Anesthesiology class of 2.31. The majority of the TKA revisions were for instability (27.8%), infection (25.0%) and aseptic loosening (16.7%). Preoperative and postoperative knee range of motion (ROM) and Knee Society scores were analyzed. We report survivorship data and investigated all failed cases in detail for mode of failure.

Results: Final clinical follow-up averaged 38 months (SD: 11.64; range: 24-62 months). We observed improvements in knee range of motion ($p<0.001$) and Knee Society Functional and Knee scores ($p<0.001$). Radiographic review at final follow-up revealed stable, osteointegrated components without component migration or clinically significant osteolysis. Four component revisions were required by the time of final follow-up. Etiology included femoral adaptor fracture after trauma, aseptic loosening of the femoral component, infection, and recalcitrant end-of-stem pain on the tibial side. No case of aseptic failure of the tibial metaphyseal sleeve was observed.

Conclusion: Use of stepped porous titanium metaphyseal sleeves led to good short-term outcomes in our study and may provide a good option for the management of challenging tibial defects in revision TKA.



Early Clinical Results of Mobile Bearing Revision TKA: A Multicenter Study

Raymond H. Kim, MD, Charlie C. Yang, MD, Brian D. Haas, MD,
Gwo-Chin Lee, MD, **Douglas A. Dennis, MD**

Introduction: Mechanisms for failed revision total knee arthroplasty (TKA) include aseptic loosening and post damage. Although mobile bearing (MB) revision TKA components can theoretically decrease stress to the tibial baseplate and post, bearing complications are concerning. The purpose of this study is to evaluate the clinical outcomes and bearing complications of MB revisions.

Material and Methods: We retrospectively reviewed 316 consecutive MB revision TKAs performed at 2 centers between 2006 and 2010. There were 183 females and 133 males with an average age of 68 years (41- 94 years). Preoperative diagnosis for revision TKA included aseptic loosening (95), instability (92), infection (52), failed UKA (25), arthrofibrosis (24), fracture (6), malposition (6), osteolysis (6), poly wear (6), mal-alignment (3), and arthrotomy dehiscence (1). Patients were clinically evaluated using the KSS scores for pain and function, bearing complications were recorded, and radiographs were reviewed for signs of loosening and osteolysis.

Results: Average follow-up was 32 months (24 – 72 months). Six patients were lost to follow-up. Prior to surgery, the KSS pain and function scores averaged 45.3 points (12-71) and 50 points (5-80). Following surgery, the mean KSS scores for pain and function was 83 points (34-100) ($p<0.001$) and 62 points (10-100) ($p<0.01$) respectively. There were no cases of bearing spin out or instability. 8 knees had subsequent procedures following revision including arthroscopic debridement for patellar crepitus (3), I+D with polyethylene exchange (2), arthroscopic lysis of adhesions (1), revision for instability (1), and resection arthroplasty (1). Radiographic review showed no evidence of loosening or osteolysis.

Conclusion: At short-term follow-up, mobile bearings can be used safely and reliably in revision TKA. Long-term studies are needed to evaluate the theoretical benefits of reduced post wear and prosthetic loosening. As demographic trends reveal younger patients requiring revision TKA, MB revisions may be a reasonable option to potentially improve long-term survivorship.

Clinical & Radiographic Outcomes of Cemented vs. Diaphyseal Engaging Cementless Stems in Aseptic Revision TKA

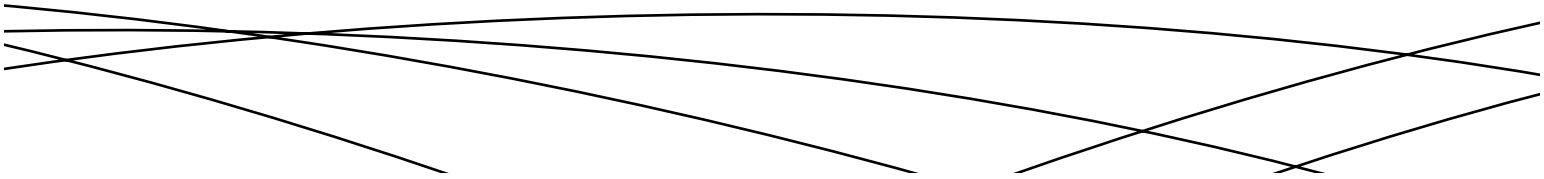
Jeremy M. Gililland, MD, Christian J. Gaffney, MD, MSc,
Christopher L. Peters, MD, **Walter B. Beaver, MD,** Susan M. Odum, PhDc

Introduction: The rate of revision TKA in the US has risen over 250% and is likely to increase. Although modular revision systems have become standard, the type of stem fixation remains controversial. The purpose of this study is to compare the incidence of failure between cemented and diaphyseal engaging cementless stems in aseptic revision TKAs.

Methods: We performed a multicenter retrospective review of 87 revision TKAs with minimum 2-year follow-up utilizing 86 femoral and 83 tibial stems. All revisions were performed for aseptic failures of primary TKAs. 53 revisions utilized cemented and 34 utilized diaphyseal engaging cementless stems. Medical records and radiographs were reviewed for failure as defined by aseptic revision of the stemmed components or radiographic evidence of loosening. Clinical outcomes were evaluated using the Knee Society Score (KSS). There was no difference in demographics between groups. Follow-up averaged 70 months (range 25-245) and 72 months (range 25-201) for the cemented and cementless groups.

Results: With the numbers available for study, revision rates and radiographic failure rates for both femoral and tibial stems were similar between groups. Two cemented tibial stems were revised (both for instability), while no cementless tibial stems were revised ($p=0.53$). Two cemented femoral stems were revised (1 for instability, 1 for aseptic loosening), while two cementless femoral stems were revised (1 for periprosthetic fracture, 1 for malrotation) ($p=0.64$). The rates of radiographic loosening were 1.9% and 6.7% ($p=0.30$) for cemented and cementless tibial stems, and 3.8% and 3% ($p=0.99$) for cemented and cementless femoral stems. Additionally, we found similar improvements in KSS, and similar rates of infection between groups.

Conclusions: At midterm follow-up, we found no difference in failure rates of cemented and diaphyseal engaging cementless stems. While both types of stem appear to provide reliable fixation, cementless stems may provide some benefit via bone preservation for future revisions.



Decreased Blood Transfusions following Revision Total Knee Arthroplasty using Tranexamic Acid

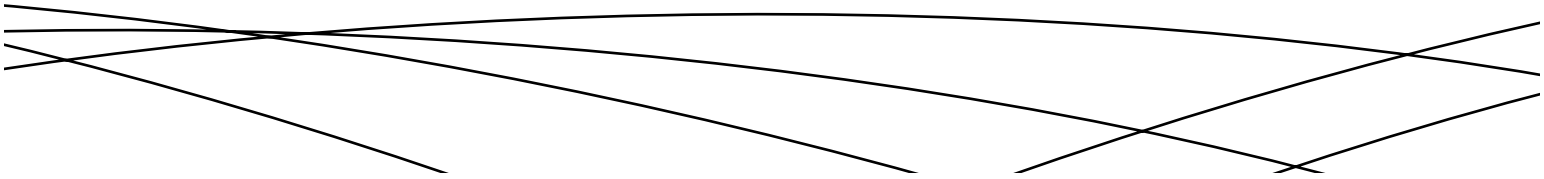
Thomas D. Falls, MD, Langan Smith, BS, Robert P. Wessel, BS,
Arthur L. Malkani, MD, **Christopher A. Samujh, MD**

Introduction: Revision Total Knee Arthroplasty (TKA) can lead to significant blood loss due to extensive soft tissue and bone trauma. Tranexamic Acid (TXA) has been used successfully in primary TKA. The purpose of this study is to determine its efficacy in revision TKA.

Methods: This is a retrospective review of 113 patients undergoing revision TKA. There were 68 patients in the control group that did not receive TXA and 45 patients in the treatment group that received one intravenous 10mg/kg dose of TXA 10 minutes prior to tourniquet release. Groups were stratified into patients receiving a femoral and tibial revision, single component revision, or an isolated liner exchange. Hemoglobin levels were evaluated pre and post operatively. The incidences of blood transfusion, number of units transfused, length of hospital stay, and the presence of thromboembolic events were assessed.

Results: There were no differences between groups with respect to age, preoperative hemoglobin, intraoperative blood loss, and length of hospital stay. In the control group, 13 out of 68 (19.1%) patients required a transfusion versus 2 out of 45 (4.4%) patients in the treatment group ($p=0.012$). The control group used 25 units of blood compared to 3 units used by the treatment group ($P=0.008$). When stratified by type of revision, there were more patients transfused in the control group when both the femur and tibia were revised ($p=0.013$). Each group had 1 patient with a post operative DVT. The control group had 1 patient with a PE.

Conclusion: Patients receiving TXA during revision TKA experienced a significant reduction transfusion and blood units utilized compared to the control group. Given the drawbacks of allogenic blood transfusion, we strongly recommend the use of TXA in revision TKA especially when two or more components are being revised.



Aspirin May be Adequate for Prevention of Thromboembolic Events following Revision Total Joint Arthroplasty

Paul M. Lichstein, MD, MS, Jenny Cai, BS, Rachael Wynne, RN, Eric B. Smith, MD, Gregory K. Deirmengian, MD, **Javad Parvizi, MD, FRCS**

Introduction: The increased risks of venous thromboembolic disease (VTE) and wound complications associated with revision TJA may influence the choice of VTE prophylaxis. The goal of our study was to determine whether large differences in complication rates existed in patients receiving aspirin or warfarin for VTE prophylaxis after revision TJA.

Materials and Methods: We retrospectively reviewed a consecutive cohort of 223 revision TJAs. 137 patients received aspirin and 86 received warfarin for VTE prophylaxis with a goal INR 1.5-2.0. Univariate analysis was used to assess whether the VTE prophylaxis agent influenced risks of symptomatic VTE, bleeding, wound healing complications, and infection.

Results: The incidence of symptomatic VTE was 0.7% in patients receiving ASA, compared to 5.8% for patients receiving warfarin. The incidence of major bleeding was lower (3.6%) in the ASA group than the warfarin group (5.8%). The rate of wound complications at 10.2% and infection at 3.6% was lower in the ASA cohort, compared to 14.0% and 4.7%, respectively, in the warfarin group. Due to the small sample size, none of these difference reached statistical significance. With the observed effect size and power analysis, a minimum of 338 patients would be needed to avoid type II error for risk of VTE and 2436 patients for major bleeding.

Conclusions: The findings of this study reveal that aspirin may be an acceptable prophylaxis following revision TJA as the incidence of symptomatic VTE events does not seem to be substantially higher in the cohort that received aspirin compared to those who received more aggressive prophylaxis. Revision TJA patients are at increased risk of bleeding, and agents that are effective against VTE without causing increased bleeding would be a desirable choice in this patient cohort. The findings of this study are compelling enough to warrant further investigations.

James A. Rand Award Paper

Barbed vs. Standard Sutures for Closure in Total Knee Arthroplasty: A Multicenter Prospective Randomized Trial

Lucas A. Anderson, MD, Jacob Barney, BS, Hunter L. Ross, BS, Christopher Jones, MD, Clint D. Barnett, MD, Keith R. Berend, MD, Christopher E. Pelt, MD, Christopher L. Peters, MD, **Jeremy M. Gililland, MD**

Introduction: In total joint arthroplasty, running knotless barbed suture, compared to standard interrupted knotted suture, has been associated with improved closure efficiency and similar safety in prior retrospective and small prospective studies. In this multicenter randomized controlled trial, we hypothesized that barbed suture would be associated with similar closure related complications, similar clinical outcomes, similar patient satisfaction, shorter closure times, and lower cost as compared to standard suture.

Methods: We performed a patient blinded multicenter randomized control trial of 411 patients undergoing primary TKA. One group received running barbed suture and the other interrupted standard suture for the fascial and deep dermal layers. Demographics, as well as pre-operative, 2-week, and 6-week Knee Society Scores were compared. Closure time was measured and a cost analysis was performed based on suture and operating room time costs. Intra-operative and post-operative complications were recorded. Patient satisfaction and wound cosmesis scores were obtained at 6-weeks.

Results: Seventeen patients were withdrawn due to incorrect suture use, leaving 191 TKAs randomized to barbed suture and 203 randomized to standard suture. Mean closure time was shorter with barbed suture (9.8 vs. 14.5 min, $p<0.001$), and total closure cost was less with barbed suture ($327 vs. $426, $p<0.001$). Intra-operatively, there were more broken sutures in the barbed group (12 vs. 0, $p<0.001$), though we noted a trend toward more needle sticks in the knotted group (5 vs. 1, $p=0.22$). Wound complications, post-operative complications, clinical scores, patient satisfaction, and wound cosmesis scores were similar between the groups.

Conclusion: The use of barbed suture is associated with shorter closure time, lower cost, and no difference in wound complications, postoperative complications, clinical outcomes, or patient satisfaction in primary TKA. Additionally, we noted a trend toward fewer needle sticks with the use of barbed suture. Barbed suture appears to be a reasonable option for closure in TKA.

Do You Have to Remove a Corroded Femoral Stem?

Nitin Goyal, MD, Kevin B. Fricka, MD, Charles A. Engh Jr. MD, Henry Ho

Introduction: Corrosion at head-neck taper has been identified as a cause of clinical symptoms, elevated metal ion levels, and adverse local tissue reaction. There are no guidelines concerning removal of stable femoral components when corrosion is present. The objective of this study is to report the survivorship when a new metal ball is placed on a corroded stem.

Methods: Eighty-six retrieved femoral heads that were in-situ for a minimum of 10 years were retrieved at revision for polyethylene wear or osteolysis. Taper corrosion was graded by three reviewers using a 5-point scale. All balls were mated with a CoCr extensively porous coated stem from a single manufacturer. Taper sizes included fifty-eight 14/16 tapers (67%) and twenty-eight 12/14 tapers (33%). There were forty-nine 28mm (57%), and thirty-seven 32mm (43%) heads.

Results: Head corrosion was scored as high-grade (3-5) on 32 balls and as low-grade (1-2) on 54 balls. The time in-situ prior to revision (14.7 $\pm$ 3.1, 10.1 to 23.1 years) in this group did not correlate with the corrosion score ($p= 0.44$). Taper size and head-diameter also showed no relationship with corrosion ($p=0.752$ and $p=0.071$).

The mean follow-up after revision was 3.3$\pm$3.4 (0 to 12.7) years. There were 7 rerevisions (8.1%) but none were for corrosion-related diagnoses. The mean time to rerevision was 1.4$\pm$0.9 (0.31-2.61) years. There was no difference in the survivorship between cases with a high-grade corrosion and those with lower scores (90.9% vs 84.1% at 3-years, $p=0.36$).

Discussion: Corrosion of a ball is correlated to corrosion on the stem taper. We determined that the amount of corrosion did not influence the rate of rerevision or survivorship at a mean follow-up 3.3 years. Although the follow-up is short, at this time we do not recommend removal of a well-fixed femoral stem with corrosion at the taper.

Can the Average Total Joint Orthopaedic Surgeon Maintain an Average Income at Medicare Reimbursement Rates?

Joseph D. Zuckerman, MD, Emmanuel N. Koli, MD, **Richard Iorio, MD**

Purpose: Health care reform is causing a change in employment models and reimbursement mechanisms for adult reconstruction (AR) orthopaedic surgeons who perform total joint replacement (TJR). As more patients move out of private insurance plans and more become covered by government insurance plans, we asked if the average AR surgeon could generate an average AR income at Medicare reimbursement rates.

Materials and Methods: Using the 2009 MGMA Cost Survey, 2011 MGMA Academic and Private practice Compensation Survey (Specialty Hip and Joint), 2010 Sullivan Cotter Physician Compensation and Productivity Survey, CMS locality reimbursement data, as well as internal billing and collection data, a model was generated to calculate the collections which could be realized by an AR surgeon performing 300 TJR per year (66% Knees, 33% Hips, 15% Revision surgery), seeing 2500 outpatient visits per year, and being compensated at current Medicare reimbursement rates. This projected data was compared with actual data of an average AR surgeon in a mixed payer reimbursement model.

Results: Using average Medicare reimbursement data for an AR orthopaedic surgeon, the surgical collections total was $493,563, and the average outpatient collections total was $183,480. Total possible Medicare collections were $677,043. Given a 33% contribution to overhead and benefits, this would justify a salary of $453,618 in a Medicare only environment, using a 50% contribution would result in a salary of $338,521. The Sullivan and Cotter median compensation for an AR surgeon in a mixed reimbursement model was $530,635 and the mean was $606,439. The MGMA regional average for AR was $563,339 with a 33% fringe contribution.

Conclusion/Discussion: Using Medicare compensation as a basis for modeling the projected salary realized by an AR orthopaedic surgeon, the projected total is well below the average compensation in a mixed reimbursement model. As reimbursement levels decrease under health care reform, the trend calls into question the viability of pure private practice AR surgeon models going forward. Alternate reimbursement initiatives may create opportunity for the preservation of private practice AR orthopaedic surgery.

Positive Culture from the Liquid Medium Only after Total Joint Arthroplasty: Is it Reliable?

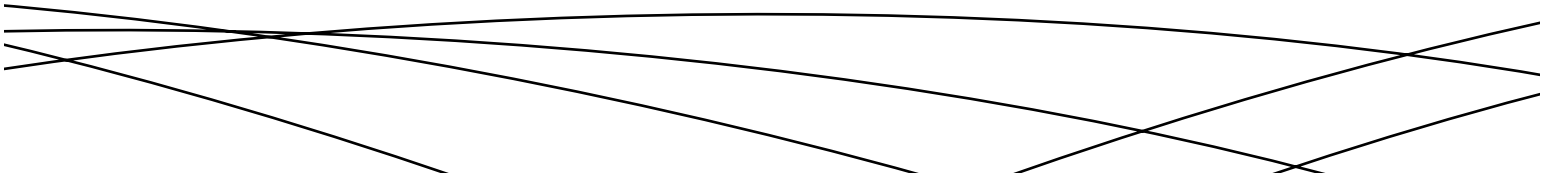
Rachael Wynne, RN, Jenny Cai, BS, Mitchell Maltenfort, PhD,
Robert P. Good, MD, **Eric B. Smith, MD**

Background: During revision total joint arthroplasty (TJA), infection may be the root cause for implant failure or pain. Therefore, routine intraoperative cultures are obtained. Culture results may not be finalized for several days after surgery and have a significant impact on the postoperative care for these patients. Typically, if a positive culture is obtained, long-term intravenous antibiotics are started. However, when cultures are analyzed, a portion of the specimen is treated in a liquid medium (broth) prior to being applied to the agar medium. This technique may subject the specimen to contamination. We sought to determine the reliability of cultures that were reported as positive from only the liquid medium after revision TJA.

Methods: A single-institution retrospective chart review was performed on 257 consecutive revision TJA cases from 2009 through 2010. 190 (74%) of cases had cultures for review. All culture results, as well as treatment, if any, were recorded and patients were followed for a minimum of one year for evidence of periprosthetic joint infection. Cultures were measured as positive, positive broth-only, or negative.

Results: Positive broth-only cultures occurred in 22 cases (11.6%). None of these cases would be considered positive based on the Musculoskeletal Infection Society criteria. The most common organism identified was coagulase-negative staphylococcus (CNS) in 14 (64%) of these cases. Only 2 of the 22 cases (9.1%) developed a clinical infection requiring additional surgery. Interestingly, one of these two cases grew a different organism (E. coli) at the time of irrigation and debridement than what was identified from the positive broth-only specimen at the index procedure (CNS). The sensitivity, specificity, positive predictive value, and negative predictive value were 20%, 87%, 9%, and 94%, respectively.

Conclusions: A positive culture from only the broth (liquid medium) obtained during revision TJA is a poor indicator of actual periprosthetic infection. Thus, it may not be necessary to subject these patients to prolonged antibiotic therapy.



◊ Diagnosing Periprosthetic Joint Infection: The Era of the Biomarker has Arrived

Keith W. Kardos, Patrick Kilmartin, Alexander C. Cameron, BS,
Kevin J. Schiller, BSc, Javad Parvizi, MD, FRCS, **Carl A. Deirmengian, MD**

Introduction: The diagnosis of periprosthetic joint infection remains a serious clinical challenge and currently requires an algorithmic approach utilizing a multitude of clinical and laboratory considerations. There is a need for improved diagnostics. We report on completion of our 8 year biomarker program, evaluating the diagnostic profile of the 16 most promising synovial fluid biomarkers.

Methods: Synovial fluid was prospectively collected from 95 patients being evaluated for infection in the setting of revision hip or knee arthroplasty. All synovial fluid samples were tested by immunoassay for 16 putative biomarkers that were developed and optimized specifically for use in synovial fluid. The MSIS criteria, including cultures, CRP, ESR, fluid WBC, PMN %, and histology, was used to classify 29 PJIs and 66 cases of aseptic failure. Sensitivity, specificity and ROC curve analysis were performed for all biomarkers.

Results: Five synovial fluid biomarkers (alpha-defensin, neutrophil elastase 2, bactericidal/permeability increasing protein, neutrophil gelatinase-associated lipocalin, and lactoferrin) correctly predicted the MSIS classification of all patients in this study, exhibiting an AUC of 1.0 with >98% sensitivity and specificity for the diagnosis of PJI. Eight other biomarkers exhibited an AUC of >0.9. Pearson correlations comparing the biomarkers to each other and to the synovial fluid WBC revealed only weak correlations.

Conclusions: A comprehensive biomarker research program has led to the identification of several synovial fluid biomarkers that appear to be diagnostic for PJI. These host biomarkers are triggered by pathogen recognition, and concentrate in the synovial fluid to protect the host. Diagnostically, they outperform historically-reported results of other tests for periprosthetic infection. Given the ability of these assays to match the results of the more complex MSIS definition of PJI, we believe that synovial fluid biomarkers can elevate the diagnostic abilities of entire health care systems to the level of expert surgeons in the field.

◊The FDA has not cleared the following pharmaceutical and/or medical device (Leukocyte Esterase Test Strip; CD Diagnostics) for use described in this presentation.

The Host Response: Toll Like Receptor Expression in Periprosthetic Tissues as a Biomarker for Deep Joint Infection

Cara A. Cipriano, MD, Aparna Maiti, PhD, Gregory Hale, MD, William A. Jiranek, MD, FACS

Introduction: Accurately defining periprosthetic joint infection (PJI) is critical to patient care and outcomes; however, no gold standard for the diagnosis exists. Toll like receptors (TLRs) 1 and 6 are critical molecular elements of the host inflammatory response against bacterial infection. Our purpose was to determine whether TLR elevation in periprosthetic tissues can be detected as a biomarker specific for bacterial PJI.

Methods: Under an IRB approved protocol, 57 patients undergoing revision total hip and knee arthroplasty were prospectively evaluated for PJI according to currently recommended diagnostic criteria. 8 patients were excluded for insufficient workup and 7 for conflicting findings; of the 42 remaining, 17 were designated infected, 21 noninfected, and 4 persistently infected following antibiotic treatment. Periprosthetic tissues were collected intraoperatively and analyzed for expression of TLR1 and 6, as well as TLR 10 (as a tissue control) using real time polymerase chain reaction (PCR). Mean TLR expressions in infected and noninfected patients were compared using a student t test. Receiver operating characteristic curves, area under the curves (AUC), sensitivity, and specificity were calculated to determine the accuracy of each TLR for predicting PJI.

Results: TLR1 and 6 expression was significantly elevated in infected compared to noninfected samples ($p=0.0004$, $p=0.0049$), while TLR 10 was not ($p=0.8163$). AUCs were 0.995 for TLR1 (94.4% sensitivity, 95.5% specificity), 0.917 for TLR6 (83.3% sensitivity, 81.8% specificity), and 0.505 for TLR 10. Mean levels of TLR1 and 6 in the persistently infected group (0.118, 0.200) were lower than in the infected group (0.699, 0.249) but higher than in the noninfected group (0.00643, 0.192).

Conclusion: In our pilot study, TLR1 expression in periprosthetic tissues most accurately predicted PJI, with 94.4% sensitivity and 95.5% specificity. This measure of the host response may be particularly helpful in detecting culture-negative infections and avoiding false positives resulting from contamination.

Prospective, Randomized, Blinded Study to Evaluate the Efficacy of Two Surgical Skin Preparations in Reducing SSI after TJA

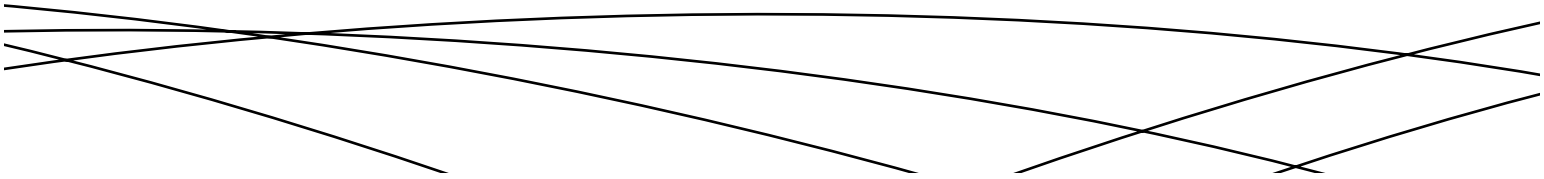
Tiffany Morrison, MS, CCRP, Mayank Taneja, MBBS, MBA, James J. Purtill, MD, Matthew S. Austin, MD, Javad Parvizi, MD, FRCS, **Richard H. Rothman, MD, PhD**

Background: Surgical site infection (SSI) following total joint arthroplasty (TJA) is a devastating complication with on patients and healthcare. Due to the presence of foreign material, prevention of SSI in this patient population is challenging. We hypothesized that a majority of contaminants of the surgical site are introduced during surgical draping and that repeat skin antisepsis prior to application of the incise drape is likely to reduce the incidence of SSI.

Methods: This randomized, single-blind, prospective study recruited 600 patients undergoing TJA between March 2010 and Nov 2011 at a single center. In the control group standard skin preparation with chlorhexidine (pre-op shower), alcohol and betadine (intra-op skin preparation) was performed, followed by surgical draping. The incise drape was applied once the skin was dry. In the experimental group identical prep of the skin was performed, but prior to application of the incise drape, additional skin preparation with iodine povacrylex (iodophor)/alcohol combination (DuraprepTM) was applied. There were no differences shown in any confounding variables.

Results: 581 patients were eligible for randomization. The repeat antisepsis prior to incise draping significantly reduced the incidence of SSI in patients undergoing TJA; there were no patients diagnosed with SSI in the experimental group (0/284) compared to a 2.06% incidence of SSI in the control group (6/297) ($p<0.0307$). Skin blistering within 6 weeks after surgery was also lower in the experimental group at 3.52% (10/284) versus 6.23% (18/289) in the control group ($p=0.1745$).

Conclusion: Repeat skin antisepsis after surgical draping and prior to incise draping does lead to a significant reduction in SSI; we believe this benefit is a result of removing contaminating organisms that gain access to the surgical site during surgical draping. Reduction in skin blistering may also be attributed to this effect. While the use of any skin prep which contains alcohol requires caution due to its flammable nature, we believe that with proper precautions; repeat skin antisepsis is a valuable addition to surgical preparation.



Public Reporting of Prosthetic Joint Infections: Do Claims Based Comorbidities Adequately Capture Case-Mix?

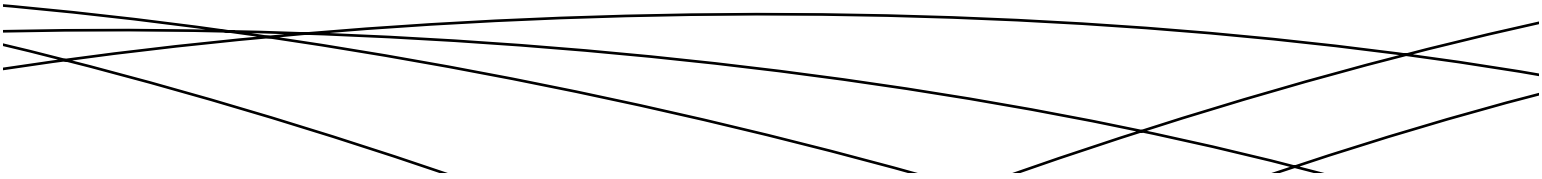
Hilal Maradit-Kremers, MD, MSc, Brian Lahr, Tad M. Mabry, MD, James Steckelberg, Daniel J. Berry, MD, Arlen D. Hanssen, MD, Elie F. Berbari, Douglas R. Osmon, MD, Laura Lewallen, MD

Introduction: Surgical site infections, including prosthetic joint infections (PJI), are hospital quality measures and will soon be subject to public reporting and part of CMS value-based purchasing criteria. The predictive value of the comorbidity-based models ascertained from claims data has never been tested against clinically-derived PJI risk models. The purpose of this study is to assess the prognostic value of comorbid conditions (based on ICD-9 codes) relative to clinically-derived PJI risk factor data.

Methods: The study included 21941 THA and TKA procedures performed at a large US tertiary care hospital between 1/1/2002 and 12/31/2009. Revision procedures for infections were excluded. Data elements were ascertained through the institutional joint registry, electronic medical records and administrative records. Comorbidity data reflecting all documented clinical diagnoses were retrieved. Clinical PJI risk factors included body mass index, surgery type, indications for surgery, prior surgeries on the index joint, ASA score, anesthesia type, procedure duration, and selected labs and medications. Significant obesity was defined as BMI >40kg/m2. All cases of PJI were reviewed manually to validate PJI diagnosis, and PJI outcome was limited to definite cases.

Results: Selected comorbidities were individually associated with a higher risk of PJI, including heart failure (HR 2.1, 95% CI 1.5, 2.9), pulmonary disease (HR 1.5, 95% CI 1.1, 2.0), diabetes (HR 1.8, 95% CI 1.3, 2.3), renal disease (HR 2.4, 95% CI 1.8, 3.3) and rheumatological diseases (HR 1.9, 95% CI 1.3, 2.7). Based on a multivariable model that included a total of 7 comorbidities along with age, sex, obesity and a history of prior TJA, resulted in a c-statistic of 0.682, and was comparable to a clinically derived risk model (0.695).

Conclusions: Our findings support the value of using comorbidity-based risk stratification measures in capturing case-mix across hospitals when evaluating PJI. If used in the clinical setting, the model performance might be improved further with the inclusion of additional clinical data elements.



Comparison of a Clinically-Derived Prosthetic Joint Infection (PJI) Risk Model and the NHSN Risk Model

Hilal Maradit-Kremers, MD, MSc, Brian Lahr, **Tad M. Mabry, MD,**
James Steckelberg, Daniel J. Berry, MD, Arlen D. Hanssen, MD,
Elie F. Berbari, Douglas R. Osmon, MD, Laura Lewallen, MD

Introduction: Several PJI risk models have been proposed for both clinical use and for risk-stratification in hospital ratings. One is the National Healthcare Safety Network (NHSN) risk model. The purpose of this study is to compare the prediction of PJI with the THA and TKA specific NHSN risk models and a clinically-derived risk model that includes patient- and surgery-specific risk factors.

Methods: The study population comprised 21941 THA and TKA procedures performed at a large US tertiary care hospital between 1/1/2002 and 12/31/2009. Revision procedures for infections were excluded. Data elements for each of the risk models were ascertained through the institutional joint registry, electronic medical records and administrative records. Medical records of all cases of PJI were reviewed manually. Significant obesity was defined as BMI >40kg/m2. Cox proportional hazard regression was used to estimate hazard ratios (HR) for individual risk factors; a robust sandwich covariance estimator was used to correct for within-subject correlation for those with multiple surgeries. Comparison of the NHSN risk models and the clinically-derived PJI risk model focused on discriminative ability as measured by the concordance (c) statistic.

Results: During the 1-year window following surgery, 230 PJI occurred. Of the 7 risk factors included in the NHSN risk model, 5 were significantly associated with the risk of deep PJI infections in univariate analyses. These were history of prior TJA (HR 2.1, 95% CI 1.6, 2.7), ASA score of 4 (HR 6.3, 95% CI 1.9, 20.3), operation time (per hour, HR 1.2, 95% CI 1.1, 1.3), general anesthesia (HR 1.8, 95% CI 1.3, 2.4) and trauma (HR 2.9, 95% CI 2.2, 3.9). Discrimination of the NHSN risk model was good (c-statistic=0.697) and very comparable to that of the clinically-derived risk model. Adding 2 specific risk factors to the NHSN risk model: diabetes (HR 1.8, 95% CI 1.3, 2.3) and significant obesity (HR 2.2, 95% CI 1.6, 3.1), improved the c-statistic from 0.697 to 0.706.

Conclusion: NHSN-identified risk factors perform well in predicting the risk of deep PJI within 1-year of THA or TKA. The model prediction might be improved further with the inclusion of additional factors such as body mass index and diabetes status.

Risk Factors for Infection after Hip Arthroplasty: Preventable vs. Non-Preventable Infection

Michael Phillips, MD, Guy Maoz, **James D. Slover, MD,**
Joseph Bosco, MD, Richard Iorio, MD

Background: The purpose of this study was to identify the potentially modifiable risk factors for deep surgical site infections (SSI) after primary hip arthroplasties.

Methods: Data was obtained from a consecutive series of 3,132 primary hip arthroplasties performed at a single specialty hospital over a three year time period (Janurary 1, 2009 – Dec 31, 2011). All deep SSI were identified using CDC case definitions. Univariate analysis was performed to determine the association of patient and surgical risk factors on SSI.

Results: 24 deep SSI were identified after 3,132 hip arthroplasty surgeries (0.77 SSI per 100 procedures). Univariate analysis revealed the following significant risk factors associated with SSI: Female (OR 3.32, 95% CI: 1.24, 8.91, $p = .01$), non-same day admission (OR 4.31, 95% CI: 1.69, 10.97, $p = 0.006$), not receive pre-operative topical antiseptic wipes (OR 3.88, 95% CI 1.67, 8.33, $p=0.003$), ASA score > 2 (OR 4.47, 95% CI 1.82, 11.00, $p <0.001$), BMI > 40 (OR 4.56, 95% CI 1.49, 13.92, $p = 0.02$), attending case load < 80/year (OR 4.81, 95% CI 1.79, 12.91, $p = <0.001$), hemi-arthroplasty procedure (OR 3.87, 95% CI 1.30, 11.46, $p=0.03$), received blood product (OR 3.79, 95% CI 1.01, 14.23, $p = .049$). 18 deep SSI occurred after the 2,901 hip arthroplasties performed within 1 day of admission (same day) compared to 6 deep SSI which occurred after the 230 hip arthroplasties performed greater than one day after admission (non-same day), OR 0.23 (95% CI 0.08, 0.66), $p=0.006$).

Conclusion: Non-same day hip arthroplasties have a significantly higher infection rate than same day hip arthroplasties. The potentially modifiable risk factors in our patient population include use of pre-operative topical antiseptic wipes, elevated BMI, and use of blood products. A preoperative program including Shared decision Making and behavior modification designed to educate patients about risks and assist them in addressing risk factors may potentially decrease SSI rates and allow patients to make better informed decisions regarding their surgery. When reporting deep SSI rates, stratification into same day vs non-same day hip arthroplasty and preventable infections (when the modifiable risk factors are not addressed) vs non-preventable infections (these risk factors are adequately addressed) may provide a more accurate assessment of performance on an institutional and individual level.

Reproducible Fixation with a Modular, Fluted, Tapered Titanium Stem in Revision Hip Arthroplasty At 8-13 Years Follow-up

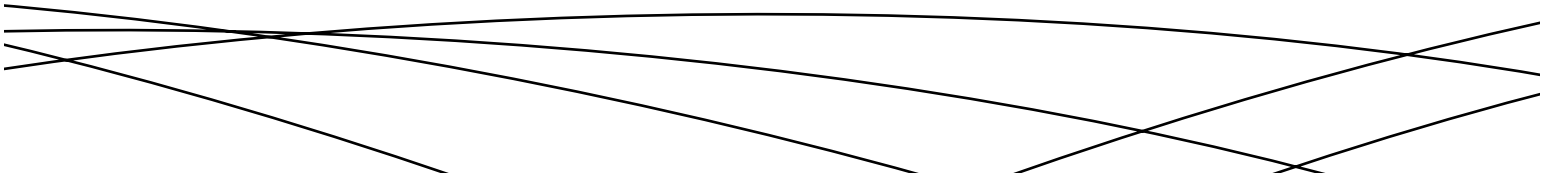
Jose A. Rodriguez, MD, Charles N. Cornell, Vijay J. Rasquinha, MD,
Amar S. Ranawat, MD, Chitranjan S. Ranawat, MD, Ajit Deshmukh, MD

Introduction: Severe bone loss creates a challenge for fixation in femoral revision. The goal of the study was to assess reproducibility of fixation and clinical outcomes of femoral revision with bone loss using a modular, fluted, tapered distally fixing stem.

Methods: 92 consecutive patients (96 hips) underwent hip revision surgery using the same design of a modular, fluted, tapered titanium stem between 1998 and 2005. Fourteen patients with 16 hips died before a 2-year follow-up. Eighty hips were followed for an average of 11.3 years (range of 8 to 13.5 years). Bone loss was classified as per Paprosky's classification, osseointegration assessed according to a modified system of Engh et al, and Harris Hip Score was used to document pain and function. Serial radiographs were reviewed by an independent observer to assess subsidence, osseointegration and bony reconstitution.

Results: The average patient age was 68 years at the time of surgery (range 40 to 91). 80% hips had at least Paprosky type 3A proximal bone loss and 41% had an associated proximal femoral ostoetomy. Pre-operative Harris Hip scores (HHS) averaged 50.368 (range 22 to 72.775) and improved to an average HHS of 87.432 (range 63.450 to 99.825) at last follow-up. The HHS improved an average of 37.103 points (range 13.750 to 58.950). Radiographically, osseointegration was evident in all hips. No hips had measurable migration beyond 5 mm. 61%) hips had evidence of bone reconstitution and 27% demonstrated diaphyseal stress shielding. One well-fixed distal stem was revised for stem fracture, and two proximal segments were revised for recurrent dislocation.

Conclusion: Reproducible fixation and clinical improvement were consistently achieved with this stem design in the setting of femoral bone loss.



Outcomes of Revision Total Hip Arthroplasty: Analysis of a US based Total Joint Replacement Registry

Monti Khatod, MD, Guy Cafri, PhD, Maria C. Inacio,
Alan L. Schepps, MS, Elizabeth Paxton, **Stefano A. Bini, MD**

Background: The incidence of total hip arthroplasty (THA) and revision THA (rTHA) are increasing. However, the survivorship of rTHA and the factors associated with re-revision has not been thoroughly evaluated.

Methods: A US Total Joint Replacement Registry was used to identify patients who had aseptic rTHA. The endpoint of this study is all cause re-revision THA. Factors evaluated for re-revision THA include: patient (age, gender, body mass index (BMI), race, general health status), implant (fixation, bearing surface, femoral head size, component revised), surgeon (fellowship training, volume, experience), and hospital (volume). A multivariable Cox proportional hazards model was used.

Results: 629 rTHAs were included with a median follow up of 2.2 years. The number of re-revisions was 63 (10%). The cohort mean age was 57.0 (standard deviation (SD)=12.4). At the time of the initial revision most implants were uncemented (97.3%), involved replacement of only the femoral component (54.2%), were metal on HXLPE (60.6%), with head sizes < 36 (51.3%). Most procedures were performed by surgeons doing <10 revision surgeries per year (79.8%). For every 10 year increase in age the hazard ratio (HR) for re-revision decreases by a factor of 0.72 (95%CI: 0.58-0.90). For every 5 revision surgeries performed by a surgeon, the hazard decreases by a factor of 0.93 (95%CI: 0.86-0.99). Having a hybrid or cemented hip relative to uncemented at time of rTHA increases the hazard by a factor of 3.19 (95%CI: 1.22-8.38). Ceramic on HXLPE decreases the hazard relative to metal on HXLPE by a factor of 0.32 (95%CI: 0.11-0.95). Metal on constrained bearing increases the hazard relative to metal on HXLPE by a factor of 3.32 (95%CI: 1.16 -9.48).

Discussion/Conclusion: When evaluating patient, implant, surgical and hospital factors at time of rTHA: age, surgeon experience, implant fixation, and bearing surfaces had significant impact on risk of re-revision.

Revision THA in Obese Patients Is Associated with High Reoperation Rates at Short Term follow Up

Michael H. McGraw, MD, Gwo-Chin Lee, MD, Nicholas Pulos

Introduction: Prior studies have shown obese patients to be at increased risk of complications following joint replacement surgery. However, there is little information on the outcomes of revision THA in this patient population. The purpose of this study is to evaluate the intraoperative and postoperative outcomes in obese patients undergoing revision THA.

Method: We retrospectively reviewed 259 consecutive revision THAs performed at our institution. The reason for revision was loosening in 158, infection in 37, instability in 31 and periprosthetic fractures in 19. We identified a subgroup of patients with BMI >35 (N=52) (Group I) and compared perioperative factors including operative time; complications defined as intraoperative fracture, excessive blood loss > 2000 ml, and immediate postoperative thromboembolic event; transfusions requirements; 90 day-readmissions; and reoperations to patients undergoing revision THA with BMI < 35 (Group II).

Results: The average follow up was 29 months (range 24-69). The average BMI was 41.5 and 26.4 in groups I and II respectively. There were no significant differences in operative time, post operative length of stay, ICU admission rates, and transfusion requirements between the 2 groups. 10 patients (19%) in group I was readmitted to the hospital within 90 days following revision THA compared to 29 patients (15%, p=0.452) in group II. Finally, there was a significantly higher rate of reoperation in the obese group compared to controls. 23 (44.2%) patients in group I required reoperation compared to 53 (26.8 %) in the obese group (p=0.025). The most common reasons for reoperation in the obesity group were dislocation and infection.

Conclusion: Revision THA in obese patients was associated with significantly higher reoperation rates at a mean of 29 months follow up. Increased BMI does not only impact the outcomes of primary THA but has significant impact on the success of revision THA.

◊Outcomes after Revision of Metal-on-Metal Hip Resurfacing Arthroplasty

Fei Liu, **Thomas P. Gross, MD**

We report the results of 58 hip resurfacing arthroplasties (HRA) revised by a single surgeon with an average of 5.2±2.6 years follow-up. The four most common causes for revision were acetabular component loosening, femoral neck fracture, femoral component loosening, and adverse wear related failure (AWRF). In 95% of cases (55/58), the revision bearing was a large metal-on-metal type including in all seven AWRF cases; three cases were revised to ceramic-on-polyethylene. There were two repeat revisions due to acetabular component loosening. Revision of AWRF had an excellent outcome using limited debridement and a stable large metal bearing placed in the correct position. The only problematic group was the one revised for acetabular loosening in which 2/16 (6%) required repeat revision for failure of acetabular fixation.

◊The FDA has not cleared the following pharmaceutical and/or medical device (Biomet hip resurfacing implants) for use described in this presentation.

Predictive Demographic and Comorbid Factors on Functional Outcomes following Revision Hip Arthroplasty

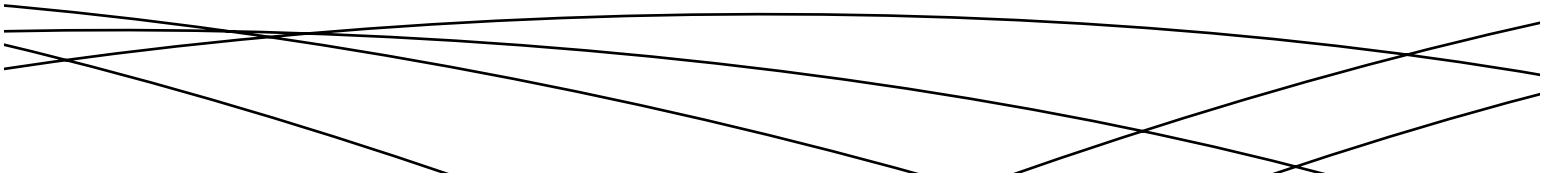
Ivan M. Tomek, MD, FRCSC, Manoshi Bhowmik-Stoker, PhD, Geoffrey H. Westrich, MD, Arthur L. Malkani, MD, Robert M. Molloy, MD, Michael A. Masini, MD, Kristin Robinson, MS

Introduction: As reimbursement models become aligned with quality metrics and patient functional outcomes, the importance of patient-reported measures (PRMs) is increasing. The purpose of this study was to examine patient-reported outcomes in the 5 years after revision total hip arthroplasty (THA), and to describe patient-specific variables that are associated with improved self-reported physical function at 2 years.

Methods: As part of a prospective, multicenter study (15 centers, 19 surgeons) PRMs were obtained pre-operatively and followed longitudinally for 5 years after revision THA in 128 patients. Short Form 36 (SF-36) questionnaires at 2-year follow-up were available in 93% (n=119) of baseline patients (60 males, 59 females), allowing calculation of physical (PCS) and mental (MCS) composite summary scores, as well as bodily pain score (BPS). To determine associations between baseline variables such as self-reported medical co-morbidity burden, PRMs and physical assessment information to the patients' 2-year PCS score, multivariate stepwise regression analysis was performed.

Results: Mean preoperative SF-36 PCS was 33.7 and improved to 43.7 at 2 years, while BPS improved from 36.0 to 46.9. In cases where both the stem and cup were revised, the 2-year PCS was higher than for cases where only the acetabular component was revised ($p=0.02$). Predictors of low PCS at 2 years were a history of cancer ($p=0.018$), and endocrine or metabolic disorders ($p=0.018$). The absence of concurrent medical conditions ($p=0.01$) was a predictor of higher 2-year PCS, as was higher baseline PCS or MCS.

Discussion: In this prospective study, significant improvement in SF-36 physical and mental domains as well as bodily pain was noted in the first 2 years after surgery, after which scores plateaued but did not diminish markedly. Quantitative assessment of patients' pre-operative medical comorbidities and self-reported health state predicted functional outcomes at 2-year follow-up, which may aid in managing patient expectations.



Construct Rigidity: Keystone for Reconstructing Pelvic Discontinuity

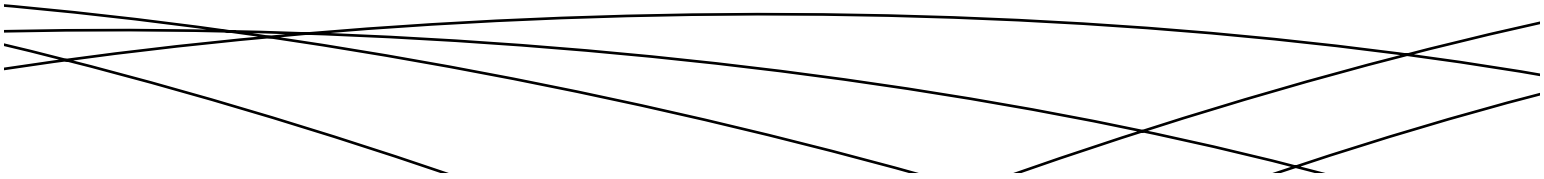
Ian J. Barrett, MD, Rafael J. Sierra, MD, David G. Lewallen, MD,
Daniel J. Berry, MD, **J. Ryan Martin, MD**

Introduction: The rarity of pelvic discontinuity has limited evaluation of different treatments. This study's aim is to report results of current treatments with emphasis on revision rates, radiographic discontinuity healing and clinical results.

Methods: We retrospectively reviewed 113 revision THA performed for unilateral pelvic discontinuity between 1997 and 2011. There were 19 men and 95 women (average age 63 years). Patients were followed a minimum of 2 years or to failure of reconstruction [average 5 years (2 to 15y)]. Charts were reviewed and preoperative, immediate postoperative, serial and last followup radiographs were examined to assess discontinuity healing and implant stability.

Results: The four most common treatment modalities included: uncemented cup with posterior plate N=50; cup-cage construct N=24; antiprotrusio cage with or without posterior plate and allograft bone N=22; and an uncemented cup alone N=12 .Average followup time for the four reconstruction types was similar (range 4 to 6.5 years). Both five year revision-free survivorship and healing of the pelvic discontinuity increased with increasing construct rigidity: cup only: 50% cup survival and 49% discontinuity healing, posterior plate and uncemented cup: 77% and 49%, cup cage constructs: 73% and 75%, and cage constructs: 87% and 76%. Healing was highest in the cup-cage and cage constructs with structural allograft with or without posterior plating. These were the constructs that provided the most rigid discontinuity fixation and mechanical cup fixation. Average pre-op HHS improved from 50 to 67 (p=0.017)

Conclusion: Improved survivorship and healing rates were seen when reconstruction cages were used as an adjunct to an uncemented cup or in combination with bulk allograft that bridged the discontinuity. Uncemented cups with or without a posterior plate often demonstrated cup osteointegration to the ilium but less than half the discontinuities healed.



How Does Acetabular Component Orientation Change from Supine to Standing in Patients with Total Hip Arthroplasty?

Selami Cakmak, Dov Goldvasser, MS, Andrew A. Freiberg, MD, Henrik Malchau, MD, PhD, Harry E. Rubash, MD, Young-Min Kwon, MD, PhD, **John V. Tiberi, MD**

Introduction: The importance of acetabular component position in total hip arthroplasty (THA) is widely recognized. Although rotational movement of the pelvis occurs, conventional imaging techniques are performed in a supine position. The "optimal" window for position was defined based on supine imaging. The purpose of this study was to quantify the difference between standing and supine acetabular component orientation.

Methods: One hundred and thirteen hips that had undergone THA with postoperative supine and standing images were identified. Supine images were obtained with conventional radiography. Standing images were obtained utilizing a low radiation, three dimensional x-ray orthopaedic imaging system. Digital edge detection software was used to obtain component orientation. "Functional" inclination was measured on the standing coronal image using a horizontal line as a reference. Sagittal images established ante- or retro-version.

Results: There were statistically significant differences in supine "anatomic" versus standing "functional" inclination as well as supine versus standing version ($p<0.0001$). The mean change, by absolute value, of inclination and version from supine to standing was 4.6° (0.01° - 16.2°) and 5.9° (0 - 17.2), respectively. With respect to inclination, 49 (43%) hips had a change $> 5°$, and 7 (6%) hips had a change $> 10°$. With respect to version, 69 (53%) hip has a change $> 5°$, and 17 (15%) hips had a change $> 10°$.

Conclusion: This is the largest study quantifying the difference in functional standing and anatomic supine acetabular component orientation in patients with THA using this imaging technique. Acetabular component orientation changes from the supine to the standing position. The amount of change is substantial in both position parameters, particularly version ($> 5°$ in more than 50% cases and $> 10°$ in 15% cases). Functional position needs to be considered when defining an "ideal" window for acetabular component position in THA.

Adverse Clinical Outcomes in a Primary Modular Neck/Stem System

Camilo Restrepo, MD, David A. Ross, BS, Santiago Restrepo, Nitin Goyal, MD,
Ryan E. Moore, MD, PhD, William J. Hozack, MD

Introduction: Adverse clinical outcomes due to corrosion reactions have been described with neck modular stems in total hip arthroplasty. One stem, the ABG-Modular has been voluntarily recalled due to higher than anticipated rates of failure in post-market analysis. We report our 2-year results using this stem.

Materials and Methods: 215 ABG-Modular stems were implanted in 202 patients. Cobalt-chrome heads were used in 95% of cases. 2-year clinical follow-up was available in 171 patients (85%). Patients were evaluated during clinical visits or by phone to assess for the presence of clinical symptoms.

Results: 55% of the patients had no clinical symptoms, 30% percent had groin pain possibly related to a corrosion reaction, and 15% had symptoms other than groin pain. The average time from surgery to onset of groin pain was 16.8 months. For patients experiencing symptoms of any type mean cobalt levels were 3.7ugL (range 0.5-13.2) compared to 2.5 ugL (range 0.3-3.9 ug/L) in asymptomatic patients ($p=0.019$). Abnormal MRI or ultrasound results including fluid collections and soft tissue masses were seen in 50% of patients with groin pain and 30% of patients with other clinical symptoms. Twenty patients (12%) have either undergone or scheduled revision surgery because of progressively disabling groin pain. Evidence of corrosion was seen at surgery in all patients. No peri-articular muscle damage was seen in any patient. Clinical symptoms have improved in all patients who underwent revision surgery.

Conclusion: Despite modest elevations in serum cobalt levels, abnormal imaging studies, adverse clinical symptoms, and early failure related to corrosion has been identified in 45% of patients with the ABG-Modular stem. The mating a cobalt chrome modular neck to a titanium stem in the ABG-Modular prosthesis, which mates a cobalt chrome modular neck to a titanium stem in conjunction with a cobalt chrome head, frequently results in a corrosion.

10 Year follow-up of Highly Cross-Linked Polyethylene using Radiostereometric Analysis (RSA)

Audrey Nebergall, BS, Meredith E. Greene, Harry E. Rubash, MD,
Janet Dorrwachter, Charles R. Bragdon, PhD, **Henrik Malchau, MD, PhD**

Introduction: HXLPE was introduced to decrease osteolysis and increase survivorship of total hip arthroplasty (THA). Larger heads showed increased wear of conventional polyethylene. Since in vitro studies showed reduced wear of HXLPE with larger heads, their preponderance has increased. We aimed to evaluate head penetration and the steady state wear of HXLPE articulating with 28mm or 36mm heads using RSA.

Methods: 29 patients received tantalum beads in their liner to measure head penetration into the HXLPE. 16 patients received a 28mm head and 13 patients received a 36mm head. RSA and plain radiographic follow-up was scheduled 4-6 weeks, 6 months, 1, 2, 3, 4, 5, 7, and 10 years postoperatively. The Wilcoxon signed-rank test determined differences in penetration over time ($p \leq 0.05$).

Results: 23 patients were followed at 6 months, 24 at 1 year, 19 at 2 years, 17 at 3 years, 9 at 5 years and 8 at 10 years. Head penetration used the postoperative film and steady state wear used the 1 year film as the baseline for comparison. At 10 years, the median$\pm$ standard error head penetration into the HXLPE liners and steady state wear rate was 0.18 ± 0.03mm and 0.06 ± 0.02mm/year, respectively, for the 28mm cohort and 0.10 ± 0.06mm and -0.04 ± 0.01mm/year, respectively, for the 36mm cohort. No change in steady state wear or penetration was found after bedding-in at any time.

Discussion: The results indicate that the two cohorts show low penetration and steady state wear of HXLPE at 10 years. There was no significant difference in the steady state wear or penetration over time. The results of our study, using the most accurate method of RSA to assess wear, are consistent with other THA populations with HXLPE. This suggests that the use of larger femoral heads is a viable option due to the low rates of HXLPE wear.

◊A Randomized Controlled Trial Comparing Wear of Oxinium and Cobalt-Chrome on Standard and Cross-Linked Polyethylene

Sunit Patil, FRCS, Emil H. Schemitsch, MD, **James P. Waddell, MD**, Zachary Morison, MSc

Introduction: Materials such as Oxinium (oxidized Zirconium) and cross-linked polyethylene (XLPE) have been used to reduce the polyethylene wear in total hip arthroplasty. The purpose of the current investigation was to assess the polyethylene wear rate in four bearing surfaces.

Methods: 80 patients (91 hips) undergoing total hip arthroplasty between November 2004 and October 2007 at a single center were randomized to one of four bearing surfaces; (1) cobalt-chrome (CoCr) and standard (ultra-high molecular weight) polyethylene, (2) CoCr and XLPE, (3) Oxinium and standard polyethylene, (4) Oxinium and XLPE. All patients received a porous coated cementless acetabular shell and a cylindrical proximally coated stem with 28mm femoral heads. Standardized radiographs were taken at each follow-up visit and the polyethylene wear was measured in a blinded fashion using a computer software package.

Results: There were 42 men and 38 women included in this study and the average age was 52 years (range, 22-67 years). The mean follow-up was 6.8 years (range, 2-8.3 years). The mean abduction angle for each group was 43, 47, 45, 46 degrees for Groups 1-4 and there was no correlation between abduction angle and wear rate ($r < 0.2$). There were no significant differences in the SF-12 scores in any of the groups. The linear wear rate for Groups 1 and 2 were 0.241mm/year and 0.076mm/year respectively ($p=0.00$) and Groups 3 and 4 were 0.238mm/year and 0.061 mm/year ($p=0.00$). There was no statistical difference in wear rates between Oxinium and CoCr heads when used with the same polyethylene liner ($p>0.24$).

Conclusion: Our findings demonstrate that cross-linked polyethylene results in significantly less wear than the standard ultra-high molecular weight polyethylene. These findings are in-line with most current literature on XLPE. However, we found no significant reduction in wear rate by using Oxinium in place of cobalt-chrome femoral heads at early follow-up.

◊The FDA has not cleared the following pharmaceutical and/or medical device (Biomet hip resurfacing implants) for use described in this presentation.

3 Year Multicenter RSA Evaluation of Vitamin E Diffused Highly Cross-Linked Polyethylene Liners and Acetabular Cup Stability

Nanna H. Sillesen, MD, Meredith E. Greene, Audrey Nebergall, BA, Poul T. Nielsen, MD, Mogens B. Laursen, MD, PhD, Anders Troelsen, MD, PhD, DMSc, Henrik Malchau, MD, PhD

Introduction: Vitamin E diffusion into highly cross-linked polyethylene (VEPE) is a method for enhancing long-term oxidative stability of hip arthroplasty liners. Early clinical outcome is important to document that there are no detrimental effects of new developments. The purpose of this study was to evaluate in vivo wear properties of VEPE and the stability of a porous-titanium coated acetabular cup using radiostereometric analysis (RSA).

Methods: 144 patients were recruited into a prospective 5 years RSA study at 2 centers. All patients received porous-titanium coated cups and either VEPE or non-vitamin E medium cross-linked liners (XLPE). Cobalt-chrome or ceramic femoral heads were used, 32mm or 36mm. At Center1 the acetabulum was under reamed by 1 mm and at Center2 it was reamed size-to-size.

Results: There was no statistically significant difference ($p=0.203$) in femoral head penetration into the VEPE liners at 3 years comparing the 32mm metal heads (-0.002 ± 0.02mm) with the 32mm ceramic heads (-0.04 ± 0.06mm). There was no difference ($p=0.087$) in head penetration into VEPE liners at Center1 compared with XLPE liners at Center2 (0.02 ± 0.05mm); however there was statistically significant less wear in VEPE than XLPE liners at 3 years at Center2 ($p=0.017$).

One year median proximal cup migration at Center1 (0.14 ± 0.03mm) was significant lower than at Center2 (0.38 ± 0.06mm) ($p=0.001$). Median cup migration at Center1 remained stable at 3 years (0.15 ± 0.05mm); however Center 2 showed significant continual cup-migration at 3 years (0.45 ± 0.09mm) ($p\leq0.002$).

Discussion: This study provides the first multicenter in vivo wear measurement of VEPE liners using RSA. The 3year VEPE results indicate low liner penetration regardless of head material or size with no significant difference between centers. Despite a statistically significant difference at Center2 between patients with VEPE and XLPE liners at 3 years the penetration measured is not clinically significant. The 3-year follow-up shows a low amount of early cup-movement.

Stratification of Total Hip Arthroplasty Survival according to BMI as a Continuous Variable

Atul F. Kamath, MD, Kristin Fruth, BS, Daniel J. Berry, MD, **Eric R. Wagner, MD**

Introduction: Body Mass Index (BMI) has been associated with increased rates of complications in total hip arthroplasty (THA). There has been no study translating risk of revision with respect to BMI as a continuous variable. Our purpose was to characterize the survival after THA across a continuous range of BMIs.

Methods: 21,406 consecutive THA patients from 1985-2012 were analyzed from a single-institution prospective total joint registry. The average BMI was 28.7 (range, 15-68). 7661 patients (35%) had a BMI >30, and 997 (4%) >40. The average age was 65 years (range, 11-98); 53% of patients were female. Average follow-up after surgery was 7.5 years +/-5.5. The risk of revision surgery associated with BMI was analyzed using the Kaplan-Meier survival method. Comparisons were made using the log-rank test and multivariate regression analysis model. Statistical significance was set at a p-value <0.05.

Results: 1781 revision surgeries were performed. Five-year survivorship rate was 96%; 10-year rate was 90%; and 15-year rate was 79%. The risk of revision surgery was the lowest for BMI 27-32. However, the risks significantly increased (in sigmoidal fashion) for BMIs <27 ($p<0.001$; hazard ratio 1.04) and >32 (<0.002; hazard ration 1.03). When referencing the normal BMI range (20-25), BMIs from 25-30 had a significantly decreased revision rate ($p<0.04$), while BMIs >45 had a significantly increased failure rate ($p<0.05$). Furthermore, when compared to non-obese patients (BMI <30), although obese (BMI 30-40) patients did not have a difference in implant ($p=0.32$), morbidly obese patients had a significant increase in risk of revision surgery ($p<0.003$). Other variables that worsened overall implant survival included younger age ($p<0.001$), inflammatory arthritis ($p<0.05$), post-traumatic arthritis ($p<0.001$), and osteonecrosis ($p<0.001$).

Conclusion: The rate of revision surgery after THA is associated with BMI. However, the effect of BMI on failure rate increases in a sigmoidal fashion for BMIs <27 and >32. Further study may examine etiologies for this relationship. This study informs the continued debate of impact of BMI on the outcomes after primary THA.

Percent Body Fat More Associated with Perioperative Outcomes after Total Joint Arthroplasty than BMI

Ramon A. Ruberte, MS, Robert J. Butler, DPT, PhD, J. Stephen Appleton Jr., MD,
Robin M. Queen, PhD, Samuel S. Wellman, MD, David Attarian, MD,
Michael P. Bolognesi, MD, **Cameron K. Ledford, MD**

Introduction: Obesity is classically defined by body mass index (BMI); however, BMI fails to distinguish fat mass from lean mass which can be distinguished by measuring percent body fat (PBF) using clinically efficacious methods. Since PBF provides a more patient-specific measure, it may be more helpful than BMI in identifying total hip (THA) and total knee arthroplasty (TKA) perioperative risks.

Methods: Prospectively collected perioperative outcomes were reviewed on 316 adult patients undergoing primary THA (168) and TKA (148). Height and weight were measured to calculate BMI while PBF was determined by bioelectrical impedance. Patients with BMI >30 kg/m2 and PBF >25% in men or PBF >31% in women were classified as obese. Statistical analysis was conducted utilizing independent samples t-test or one way ANOVA and all statistical significance was established at $p < 0.05$.

Results: 284 (89.9%) patients were obese by PBF while 182 (57.6%) were obese by BMI. PBF was significantly higher in those who underwent blood transfusion (mean $\pm$ sd,; 41.9 $\pm$ 12.0 vs. 37.7 $\pm$ 9.1), had longer length of stay (LOS) > 3 days (41.5 $\pm$ 9.5 vs. 34.2 $\pm$ 8.7), and were discharged to an extended care facility rather than home (41.8 $\pm$ 10.1 vs. 36.4 $\pm$ 8.6). No significant differences existed for BMI on these outcomes. Additionally, both BMI (34.6 $\pm$ 6.2 vs. 31.6 $\pm$ 6.0) and PBF (41.5 $\pm$ 9.5 vs. 37.7 $\pm$ 9.3) were significantly higher in the patients with postoperative hospital adverse events.

Conclusion: Higher PBF was associated with postoperative blood transfusion, longer hospital LOS, and discharge to an extended care facility while no such association was observed with BMI. These results suggest that PBF may be a more effective measure to use in screening for perioperative risks and determining outcomes associated with total joint arthroplasty, especially those performed in obese patients.

POSTER PRESENTATIONS

PRIMARY TOTAL HIP

1. Prospective Randomized Study of a Collagen/Thrombin and Autologous Platelet Gel during Total Hip Arthroplasty
Wael K. Barsoum, MD, Cleveland, OH

2. Oxidative Stability of a First Generation Highly Cross-linked UHMWPE with up to 11 Years In Vivo
Orhun K. Muratoglu, PhD, Boston, MA

3. Pre-Op THR Patient Pain and Functional Limitation Profiles are Consistent Across US Surgeons
David C. Ayers, MD, Worcester, MA

4. Postoperative Urinary Retention following Total Hip Arthroplasty Performed under Regional Anesthesia: Determination of Risk Factors
Eric H. Tischler, MD, Philadelphia, PA

5. Complications, Diagnosis, and Treatment of Adverse Tissue Reaction in Dual Modular Stems
Elie S. Ghanem, MD, Philadelphia, PA

6. Wear Analysis of Three Different Bearing Combinations in THA
Jon Hedgecock, MD, Rochester, NY

7. 3 year Follow-up of a Long-term Registry-based Multicenter Study on Vitamin E Diffused Polyethylene in Total Hip Replacement
Nanna H. Sillesen, MD, Boston, MA

8. Natural History of Pseudotumours in Metal-on-Metal Hip Replacements: A Longitudinal MARS MRI Study
Young-Min Kwon, MD, PhD, Boston, MA

9. Acetabular Component Positioning and Functional Outcomes in Patients
William B. Macaulay, MD, New York, NY

10. Delta Ceramic on Ceramic THA- Midterm IDE Study Results
William G. Hamilton, MD, Alexandria, VA

11. Outcomes of Total Hip Arthroplasty after Hip Arthroscopy are Inferior to Primary THA
Jonathan M. Vigdorchik, MD, New York, NY

12. Bariatric Orthopaedics: Total Hip Arthroplasty in Patients who Are Super-obese (BMI>50 kg/m2)
Michael A. Mont, MD, Baltimore, MD

13. Flexural Rigidity of Various Trunnion Designs in Modular Hip Stems: A Biomechanical and Historical Analysis
David A. Porter, MD, New York, NY

14. Radiographic Outcomes after Direct Anterior with Fluoroscopy vs Mini-Posterior Total Hip Arthroplasty Without: Reliable, Reproducible, and Similar
Kristen Poehling-Monaghan, MD, Rochester, MN

15. Does the Direct, Anterior Approach Improve Acetabular Component Positioning and Leg Length Restoration in Total Hip Arthroplasty?
Denis Nam, MD, New York, NY

16. Metal Transfer and Raman Spectroscopic Analysis of Retrieved Alumina-Zirconia Composite Ceramic Femoral Heads
Denis Nam, MD, New York, NY

17. HIV Infection and Risk of Perioperative Complications Following Total Hip Arthroplasty
Qais Naziri, MD, Brooklyn, NY

18. Characterization of Periprosthetic Femur Fractures in 32,644 Primary Total Hip Arthroplasties
Matthew P. Abdel, MD, Rochester, MN

19. Fracture of Highly Cross-Linked UHMWPE Liners: An Analysis of 75 Reports of a Single Design to the FDA
Michael P. Ast, MD, Lawrenceville, NJ

20. Perioperative Outcomes of Solid Organ Transplant Patients Following Total Hip Arthroplasty in the United States
Caleb R. Szubski, BA, Cleveland, OH

21. Cementless Acetabular Fixation without Bone Graft in High Grade Hip Dysplasia: Minimum 20 Year Follow-Up
Melissa D. Willenborg, MD, Iowa City, IA

22. Topical Versus Intravenous Tranexamic Acid in Total Hip Arthroplasty: A Double-Blind, Randomized Controlled Trial
W. Trevor North, MD, Berkley, MI

23. The Painful Reality of Modern Hip Stem Modularity – Catastrophic Adverse Tissue Responses in a Single Surgeon Series of 216 Cases
Danyal H. Nawabi, MD, FRCS, New York, NY

24. Patient's Preoperative Confidence Impact on Functional Outcome after Total Hip Arthroplasty (THA)
Carlos Higuera, MD, Cleveland, OH

25. Decreased Hospital Length of Stay after Total Hip Arthroplasty is Not Associated with Increased Readmission Rates
Jeffrey B. Stambaugh, MD

26. What is the Level of Evidence Substantiating the Medicare Local Coverage Determinations?
Matthew S. Austin, MD, Philadelphia, PA

27. Premature Failure at Short Term Follow Up in Primary Total Hip Arthroplasty Using A Modular Femoral Component
Paul H. Yi, BA, Chicago, IL

28. Total Hip Arthroplasty in Young Patients Comparison of Three Bearing Surfaces
John C. Clohisy, MD, St. Louis, MO

29. Prevalence and Predictors of Pseudotumor and Elevated Metal Ion Levels following Large-Diameter Head Metal-on-Metal Total Hip Arthroplasty
Nick G.Bayley, MD, Toronto ON, Canada

30. RCT Comparison of Delta Ceramic Versus Metal Against Contemporary Annealed Polyethylene in THA
Jean Langlois, MD, Paris, France

31. Early Failure in Metal on Polyethylene Total Hip Arthroplasty with Modular Stem-Neck Junction
Edward M. Vasarhelyi, MD, MSc, FRCSC, London ON, Canada

32. Differences in Patient Characteristics Prior to Total Hip Arthroplasty between Switzerland and the US
Anne Lübbeke, MD, DSc, Geneva, Switzerland

PRIMARY TOTAL KNEE ARTHROPLASTY

33. Tourniquet in Knee Arthroplasty – Duration of Inflation Does not Affect the Incidence of Venous Thromboembolism
Ibrahim J. Raphael, MD, Philadelphia, PA

34. In Vivo Performance of Third Generation Polyethylene in a Large Multi-Center Prospective Randomized Controlled Trial after Total Knee Arthroplasty (TKA): Minimum 5 Year Survivorship
Kirk Kindsfater, MD, Fort Collins, CO

35. HIV Infection and Risk of Perioperative Complications Following Total Knee Arthroplasty
Qais Naziri, MD, Brooklyn, NY

36. The Anatomic Graduated Component (AGC) Primary Total Knee Arthroplasty at 20-26.5 Year Follow-Up
John W. Barrington, MD, Plano, TX

37. Extramedullary Guides versus Portable Navigation for Tibial Component Alignment in Total Knee Arthroplasty: A Randomized, Controlled Trial
Denis Nam, MD, St. Louis, MO

38. Polished Tibial Trays Reduce Backside Wear, Independent of Post Location in Contemporary PS TKAs
Matthew P. Abdel, MD, Rochester, MN

39. No Increased Risk of Knee Arthroplasty Failure in Metal Hypersensitive Patients: A Matched Cohort Study
Dalibel Bravo, BS, Rochester, MN

40. Variability of Tibial Tray Rotation: How Accurate Are Our Most Reliable Methods? Rotational Verification with the Use of Intraoperative Sensors
Leah C. Elson, BSc, Sunrise, FL

41. Outcomes of Total Knee Arthroplasty in Relation to Osteoarthritis in the Contralateral Knee: Data from the Osteoarthritis Initiative
Ran Schwarzkopf, MD, MSc, Orange, CA

42. Perioperative Outcomes of Solid Organ Transplant Patients Following Total Knee Arthroplasty in the United States
Alison K. Klika, MS, Cleveland, OH

43. Causes of a Second Operation after Unicompartmental Knee Arthroplasty
Alvin Ong, MD, Egg Harbor Township, NJ

44. The Incremental Hospital Cost and Length-of-Stay Associated with Treating Major Complications Among Medicare Beneficiaries Undergoing Total Knee Arthroplasty
David S. Jevsevar, MD, MBA, St. George, UT

45. Use of Tranexamic Acid in Total Knee Arthroplasty: A Meta-analysis
Mazyar Irani, MD, Marroubra, Australia

46. Rivaroxaban versus Enoxaparin for Venous Thromboembolism Prophylaxis after Hip and Knee Arthroplasty
Michael A. Charters, MD, MSE, Detroit, MI

47. Patient Specific Versus Conventional Total Knee Arthroplasty: Perioperative and Cost Differences
Jacob R. Adams, MD, Beaverton, OR

48. Factors Influencing the Initial Strength of the Tibial Tray-Cement Interface Bond
Thomas P. Schmalzried, MD, Los Angeles, CA

49. The Role of Surgical Dressing in Total Joint Arthroplasty: Level I Randomized Clinical Trial
Bryan D. Springer, MD, Charlotte, NC

50. What We Can and What We Can't Learn from Minimum Twenty-Year Follow-Up Studies of Total Knee Replacement
Christopher T. Martin, MD, Iowa City, IA

51. What is the Most Accurate Insertion Platform for a Mobile-Bearing UKA? A Case-Control, Blinded Radiographic Analysis
John W. Barrington, MD, Plano, TX

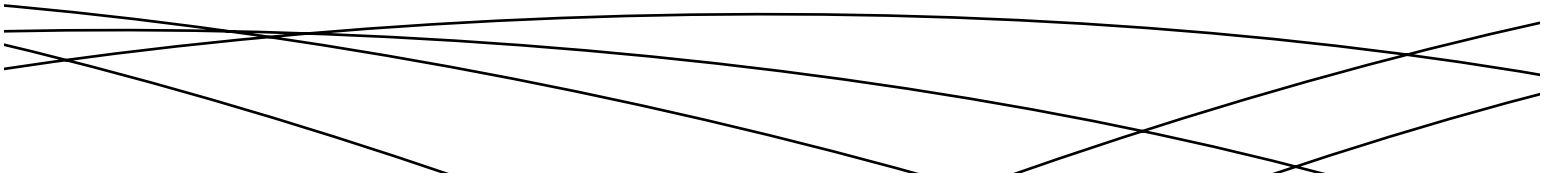
52. Obesity is Not a Risk Factor for Poor Pain and Function Two Years after Total Knee Replacement
Mark P. Figgie, MD, New York, NY

53. In-Hospital Complications, Renal Failure, and UTIs Increased in 4718 Obese Patients Undergoing TKA
Matthew P. Abdel, MD, Rochester, MN

54. Preoperative Predictors of Postoperative Pain Following Total Knee Arthroplasty
Nicolas O. Noiseux, MD, Iowa City, IA

55. Complications of Hip and Knee Arthroplasty in Patients with Cirrhosis of the Liver
John V. Tiberi, MD, Boston, MA

56. Cemented versus Cementless Total Knee Arthroplasty in Morbidly Obese Patients
Arthur L. Malkani, MD, Louisville, KY



57. Femoral Nerve Catheters are Associated with High Fall Risk Following Total Knee Arthroplasty Despite Fall Prevention Protocols
Christopher E. Pelt, MD, Salt Lake City, UT

58. Preoperative Predictors of Postoperative Opioid Usage, Pain Scores, and Referral to a Pain Management Service in Total Knee Arthroplasty
Trevor R. Banka, MD, New York, NY

59. Wound Complications with Therapeutic Anticoagulation After Total Joint Arthroplasty
Ryan M. Nunley, MD, St. Louis, MO

60. Threshold for Synovial Cell Count and Neutrophil Differential in Diagnosis of Periprosthetic Knee Infection: Multi-institutional Study
Benjamin Zmistowski, BS, Philadelphia, PA

61. Evaluation of the 3-D, Weight-bearing Orientation of the Normal Adult Knee using Low Dose Radiation
Denis Nam, MD, St. Louis, MO

62. Preoperative Patient Education for Hip and Knee Arthroplasty: Financial Benefit?
Christopher T. Parks, MD, Little Rock, AR

63. Two-Year Migration Results of Hydroxyapatite-Coated Uncemented Tibial Components in a Multi-Center RSA Study
Glen Richardson, MD, MSc, FRCSC, Halifax NS, Canada

64. Knee Manipulation Under Anesthesia in Total Knee Arthroplasty: A Matched Cohort Design
Ivan Dzaja, MD, London, ON, Canada

65. Outcomes in TKA Complicated by Infection: A matched Cohort Design
Ivan Dzaja, MD, London, ON, Cananda

66. Histopathological Evaluation of the Anterior Cruciate Ligament in Patients Undergoing Primary Total Knee Arthroplasty
Michael A. Mont, MD, Baltimore, MD

67. Results of Modular, Tapered Femoral Components in Hip Revision With and Without Extended Trochanteric Osteotomy
Michael J. Archibeck, MD, Albuquerque, NM

REVISION TOTAL HIP ARTHROPLASTY

68. Revision of Recalled Modular Neck Rejuvenate and ABG Femoral Implants
Christopher Walsh, MD, Northville, MI

69. The Use of Dynamic Hip Spacers Reduces Operative Time During Reimplantation: A Comparative Study
Gregory K. Deirmengian, MD, Philadelphia, PA

70. Preoperative Radiographic Evaluation of Patients with Pelvic Discontinuity
J. Ryan Martin, MD, Rochester, MN

71. Osseointegration of an Additive-Manufactured Cancellous Metal in a Load-Bearing Animal Model
Mark L. Morrison, PhD, Memphis, TN

72. Tranexamic Acid Reduces Length of Stay And Total Costs in Revision Total Hip Arthroplasty
Paul H. Yi, BA, Chicago, IL

73. Structural Bulk Allograft Supporting a Trabecular Metal Shell Provides Durable Results in Complex Revision Hip Arthroplasty
Hernan A. Prieto-Saavedra, MD, Rochester, MN

74. Corrosion and Fretting of Modular Taper Junctions in Total Hip Arthroplasty
Iustin Moga, MSIII, Washingto[redacted]C

75. Acetabular Cup Positioning in Revision Total Hip Arthroplasty with Paprosky III Acetabular Defects: Martell Radiographic Analysis
Young-Min Kwon, MD, PhD, Boston, MA

76. The Epidemiology of Revision Total Hip Arthroplasty in the United States
Kevin J. Bozic, MD, MBA, San Francisco, CA

77. Tritanium Jumbo Cups in Revision Total Hip Arthroplasty with Major Acetabular Defects
Morteza Meftah, MD, Houston, TX

78. Characterization of Periprosthetic Femur Fractures in 5417 Revision Total Hip Arthroplasties
Matthew P. Abdel, MD, Rochester, MN

79. Morbidly Obese Patients Have a Markedly Higher Risk of Failure following Revision Total Hip Arthroplasty for Infection
Matthew T. Houdek, MD, Rochester, MN

80. Bisphosphonates Reduce the Risk of Revision Following Total Hip Arthroplasty: Outcomes from a US Total Joint Replacement Registry
Stefano A. Bini, MD, Oakland, CA

81. Failure Analysis of Retrieved Antiprotrusio Cages
Jonathan M. Vigdorchik, MD, New York, NY

82. Results of a Novel Constrained Acetabular Component Design to Treat and Prevent Instability
Keith R. Berend, MD, New Albany, OH

83. Early Complications Following Revision of Large Diameter Monoblock Metal on Metal Total Hip Arthroplasty
Louis S. Stryker, MD, Charlotte, NC

84. Visual Assessment of Dual Mobility Acetabular Component System
Timothy M. Wright, PhD, New York, NY

85. Minimising Complications in the Revision of Failed Metal-on-Metal Hip Arthroplasty – Outcome in over 150 cases
Stephen A. Jones, MD, FRCS, Cardiff Wales, UK

86. The Role of Hip Aspiration in the Diagnosis of Infection in Metal on Metal Hip Arthroplasty
J. Stuart Melvin, MD, Charlotte, NC

REVISION TOTAL KNEE ARTHROPLASTY

87. The Effect of Obesity on the Revision Rate of Total Knee Arthroplasty: A Population Based Validation Study of a Pooled Electronic Healthcare Database
Kiel J. Pfefferle, MD, Akron, OH

88. The Epidemiology of Revision Total Knee Arthroplasty in the United States
Kevin J. Bozic, MD, MBA, San Francisco, CA

89. Revision Total Knee Arthroplasty For Patients Less than 55 Years of Age
James A. Keeney, MD, St. Louis, MO

90. Knee Arthrodesis is Most Likely to Control Infection and Preserve Function Following Failed 2 Stage Procedure for Treatment of Infected TKA: A Decision Tree Analysis
Chancellor F. Gray, MD, Philadelphia, PA

91. The Use of Metaphyseal Sleeves in Revision Total Knee Replacement
David F. Dalury, MD, Towson, MD

92. Flexion Instability after TKA: Analysis of Diagnostic Features, Radiologically Evident Surgical Corrections and Clinical Outcome
Niraj V. Kalore, MD, Blythewood, SC

93. The Outcome of Unexpected Positive Intraoperative cultures in Presumed Aseptic Revision Hip and Knee Arthroplasty
Anas Saleh, MD, Beachwood, OH

94. Comparative Epidemiology of Revision Total Hip and Knee Arthroplasty Populations
Kevin J. Bozic, MD, MBA, San Francisco, CA

95. Use of Screws and Cement in Revision TKA
Robert A. Malinzak, MD, Mooresville, IN

96. Short Cemented Stems versus Press Fit Fluted Stems in Revision Total Knee Arthropalsty
Arthur L. Malkani, MD, Louisville, KY

97. Why Are Total Knees Being Revised: A Review of 872 Consecutive Cases
David F. Dalury, MD, Towson, MD

98. Osteointegration of Non-cemented Metaphyseal Sleeves in Revision Total Knee Arthroplasty in Active Patients
Morteza Meftah, MD, Houston, TX

99. Autoclaving an Infected Component for use in an Articulating Spacer: Confirming Sterility and Biofilm Evaluation
Coy A. Wright, MD, Tampa, FL

100. Modes of Failure and Outcomes of Revision of Non-Modular Total Knee Replacements
Lucas Pugh, MD, FRCSC, Victoria, BC, Canada

101. Porous Tantalum Tibial Cones in Revision Total Knee Arthroplasty: Minimum 5-Year Follow-up
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Richard Iorio, MD, New Rochelle, NY

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Richard Iorio, MD, MD, New Rochelle, NY

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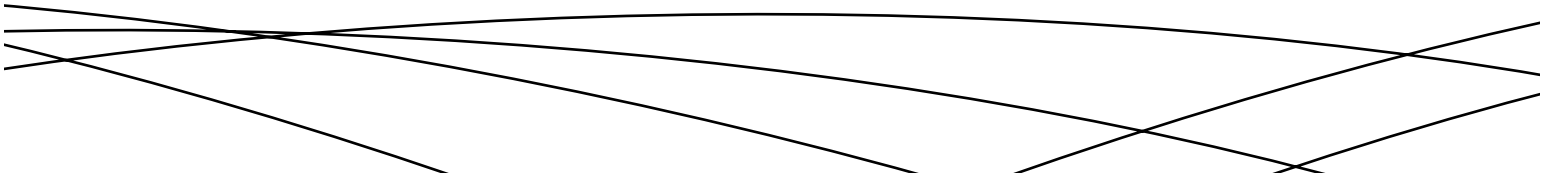
Viktor J. Hansen, MD, Boston, MA



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Atul F. Kamath, MD, Philadelphia, PA

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Andrew Pugely, MD, Iowa City, IA

Poster #1

Prospective Randomized Study of a Collagen/Thrombin and Autologous Platelet Gel during Total Hip Arthroplasty

David M. Joyce, MD, Amar B. Mutnal, MD, Alison K. Klika, MS, Caleb R. Szubski, BA, Viktor E. Krebs, MD, Ulf R. Knothe, MD, Robert M. Molloy, MD, **Wael K. Barsoum, MD**

Introduction: Total hip arthroplasty (THA) can be associated with substantial perioperative blood loss which may lead to adverse events including blood transfusion. The primary goal was to evaluate the effectiveness of a collagen/thrombin/autologous platelet gel in preventing blood loss during cementless THA resulting in reduced blood transfusions.

Methods: This prospective, double-blind, randomized study was designed to enroll at least 50 subjects into each arm. Sample size was estimated using an alpha of 0.05 and a standard deviation from prior studies to provide in excess of 80% statistical power for detecting < 100 ml difference in blood loss between the groups. Patients were randomized either to the treatment arm (i.e., standard hemostasis with hemostatic agent) or the control arm (i.e, standard hemostasis). Patients with heart disease, rheumatic conditions, coagulation abnormalities or significantly low preoperative hemoglobin levels were excluded. Primary outcome was transfusion event, while secondary outcomes included perioperative blood loss, SF-12 and HOOS.

Results: Five of 60 patients (8.3%) in the treatment group were transfused compared with 7/49 control group patients (14.3%) ($p=0.32$). Mean units transfused for the treatment group (2.2 ± 1.3) was not significantly different than the control group (1.6 ± 0.53) ($p=0.36$). Hemoglobin values for postoperative day 1, 2, and 3 were significantly higher in the treatment group ($p=0.002$, 0.044, 0.018, respectively). SF-12 and HOOS scores were not significantly different between groups.

Conclusion: In relatively healthy primary THA patients there were no significant differences in transfusion events and number of units transfused between groups, although postoperative hemoglobin values were consistently higher in the patients treated with the hemostatic agent. Our results do not support the use of this product in these patients, but suggest that it may benefit other populations, such as those who refuse blood transfusions, revision THA patients, or those with low preoperative hemoglobin values.

Poster #2

Oxidative Stability of a First Generation Highly Cross-linked UHMWPE with up to 11 Years In Vivo

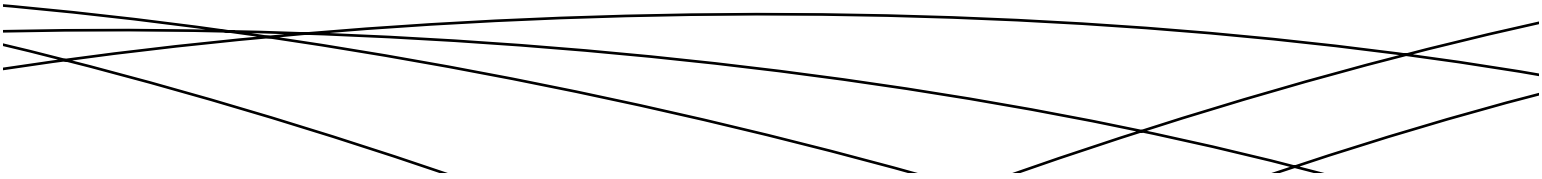
Shannon Rowell, Keith Wannomae, Henrik Malchau, MD, PhD, **Orhun K. Muratoglu, PhD**

Introduction: Introduced clinically fifteen years ago, irradiated and melted UHMWPE materials were predicted to have low wear rates and long-term oxidative stability. Recent reports have identified lipid absorption and cyclic loading as potential in vivo oxidation-inducing mechanisms. We hypothesize that this subsurface oxidation will begin to degrade material properties of the bearing and may compromise clinical performance in the long term. In this study we examine oxidation and material properties of surgically-retrieved irradiated and melted acetabular liners with up to 11 years in vivo service.

Methods: Eighty-eight surgically-retrieved acetabular liners with 0.1-11 years in vivo service were collected under IRB approval. Liner thickness ranged 4-18m; 45% fit large femoral head size (36mm+). None were revised for liner-related failures (fracture, poly wear). All retrievals were analyzed for oxidation and crystallinity at the rim. Forty-six were analyzed at the articular surface also for oxidation potential (HI) and cross-link density. Regression lines were fit for correlation; significance was calculated with an unpaired, student's t-test.

Results: Five retrievals showed surface oxidation at the rim; 20-of-46 retrievals showed sub-articular surface oxidation (12-of-13 liners implanted more than 6-years had oxidation, MaxOI=0.11-1.26). No correlation was found between in vivo oxidation and head size or liner thickness. A10-year retrieval showed heavy subsurface oxidation (MaxOI=1.26), 3x increase in oxidation potential, and material degradation with loss of cross-linking (-47%;p=0.0001) and increased crystallinity (6%;p=0.005). An oxidized five-year retrieval also showed a statistically significant loss of cross-linking at the articular surface (p=0.002).

Conclusion: Retrievals with low level subsurface oxidation (OI<0.2) showed no impact on their material properties. We identified two cases in which the bearing had undergone embrittlement and loss of cross-link density. Without any retrievals revised for polyethylene failure or reported wear, our hypothesis requires further investigation to ascertain into the long-term clinical impact, but proved positive for potential material degradation.



Poster #3

Pre-Op THR Patient Pain and Functional Limitation Profiles are Consistent Across US Surgeons

David C. Ayers, MD, Leslie R. Harrold, MD, MPH, Wenjun Li, PhD, Patricia D. Franklin, MD

Background: As the number of total hip replacement (THR) procedures increases dramatically in the US, questions about the consistency of patient selection based on significant arthritic pain and functional limitations have been raised. We evaluated patient-reported pre-THR pain and function scores across 21 US sites.

Methods: 2,928 consecutive THR patients who elected surgery between at any of 21 sites with more than 20 consecutive cases in a national database were identified. Patient demographics, and pre-KOOS pain scores and SF-36 PCS physical function scores were collected prior to surgery. Scores were not available to surgeons at the time THR was scheduled.

Results: A sample of 2,928 THR patients undergoing surgery at 21 sites reported complete scored pre-TKR KOOS pain and PCS function scores. The mean pre-TKR pain score was 42 and function score was 30, representing significant pain and disability at 2 standard deviations below the norm. Consistent median scores were reported across sites with pain ranging from 40-60 and median PCS from 27 to 36.

Conclusions: Despite the large numbers of patients electing THR, pre-operative pain and function scores suggest consistent patient selection criteria across US surgeons consisting of patients with significant pain and decreased function. These data suggest the growing THR utilization is reaching an appropriate patient population.

Poster #4

Postoperative Urinary Retention following Total Hip Arthroplasty Performed under Regional Anesthesia: Determination of Risk Factors

Eric H. Tischler, MD, Camilo Restrepo, MD, Mitchell Maltenfort, PhD, Jennifer Oh, Javad Parvizi, MD, FRCS

Introduction: Post-Operative Urinary retention (POUR) is a relatively common complication following surgery. It has been common belief that any patient undergoing surgery under regional anesthesia should receive a urinary catheter. At our institution, and based on a Level 1 study performed here, urinary catheter is not used routinely in patients undergoing THA under regional anesthesia. The purpose of this study was to evaluate the incidence of POUR and risk factors leading to urinary retention in patients undergoing THA using regional anesthesia who did not receive urinary catheterization.

Methods: A retrospective analysis was conducted to determine specific risk factors for POUR following THA performed under regional anesthesia (without the use of opiates in the spinal). Between June 2010 and June 2012, 422 consecutive THA patients were identified, all of whom were operated on by a single surgeon, received uniform spinal anesthesia, and did not receive an intraoperative indwelling catheter. POUR was defined as the need for either straight catheterization or placement of indwelling catheter following surgical intervention. A multivariate logistic regression was used to determine the risk factors that were associated with POUR.

Results: A 7.1% incidence of POUR was reported. Independent risk factors for POUR in this cohort were history of benign prostatic hyperplasia (BPH) ($p = 0.008$), previous urinary complications ($p = 0.0003$), and use of tobacco ($p = 0.06$). The higher volume of IV fluid administered to patients during the intraoperative period and bilateral surgery were both approaching significance with respective p-values of 0.1. There were no incidences of neurogenic bladder in this cohort.

Conclusion: Patients with history of BPH, prior urinary complications, and heavy smokers are at increased risk of POUR. We recommend increased surveillance of these patients to decrease complication rates while avoiding the use of routine urinary catheterization in patients undergoing THA using spinal anesthesia.

Poster #5

Complications, Diagnosis, and Treatment of Adverse Tissue Reaction in Dual Modular Stems

Elie S. Ghanem, MD, Carl T. Talmo, MD, Daniel M. Ward,
Claire E. Robbins, PT, DPT, MS, GCS, James V. Bono, MD

Introduction: Dual-modular stems allow optimization of joint biomechanics by restoring anteversion, offset, and limb length. A potential disadvantage is the generation of metal ions from fretting and crevice corrosion. The impetus of our study is to determine: risk factors for failure, evaluate the role of serum cobalt/chromium levels and MRI in diagnosing failures, and describe complications that may arise from revision surgery.

Methods: We identified 118 THAs (Rejuvenate, Stryker) implanted during 2009-2011 at our institution. Risk factors for failure including implant specifications and patient demographics were evaluated using Chi-square and multivariate analysis. Serum cobalt/chrome levels and MRI with MARS protocol were performed to diagnose symptomatic THA. Receiver operating characteristic curves (ROC) were used to determine optimal cut-off levels.

Results: 21 stems were revised due to adverse local tissue reaction (18%) using a Restoration Modular Stem (Stryker). Three THAs were treated and revised for periprosthetic joint infection (PJI) (2.5%). Complications encountered with revision included: greater trochanter and femur fractures requiring open reduction and internal fixation, recurrent dislocation, and RMS loosening. Multivariate analysis isolated small stem size, extended femoral heads, and neck length as risk factors for failure. Although the cobalt/chrome levels were higher in the failed group, the optimal cut-off as determined by the ROC curve had low diagnostic yield with an area under the curve of 0.68-0.76. MRI was sensitive in diagnosing a failed stem but lacked specificity when detecting the presence of pseudobursa.

Conclusion: Dual-modular stems have high failure due to corrosion at the neck/stem junction. The immunosuppressive effects of metal ions in the hip may explain the incidence of PJI. Small stems are associated with failure possibly due to the flexural rigidity mismatch with the modular neck. Revision surgery can be fraught with fractures and dislocations. We conclude that the deleterious effects of dual modularity outweigh the benefits.

Poster #6

Wear Analysis of Three Different Bearing Combinations in THA

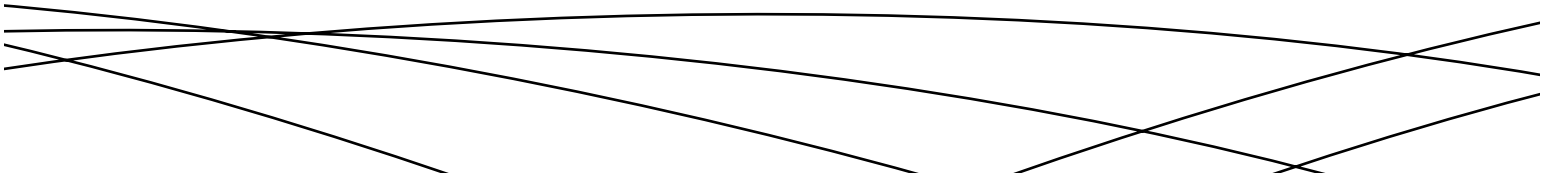
Curtis W. Hartman, MD, **Jon Hedgecock, MD,** Beau S. Konigsberg, MD,
John M. Martell, MD, Kevin L. Garvin, MD

Introduction: The early and midterm clinical outcomes of total hip arthroplasty using highly crosslinked polyethylene (HXLPE) have been outstanding. Reported wear rates with HXLPE have been very low. Alternative hard bearings (monolithic ceramics and oxidized zirconium) are commonly used to further improve the wear of HXLPE, although published results with these combinations are rare. The purpose of this study was to analyze the wear rates of three different bearing combinations in THA.

Methods: We evaluated 198 THAs with a minimum follow-up of five years (range 60-122 months) and a mean follow-up of 75.4 months. Hips were assigned to three groups based on the bearing couple. The bearing couple used in Group 1 was CoCr on HXLPE, Group 2 was CoCr on standard polyethylene, and Group 3 was oxidized zirconium on HXLPE. We measured the linear wear for each group using the Martell Method. Median wear rates for Groups 1 and 2 and Groups 1 and 3 were compared using the Mann-Whitney test for statistical significance.

Results: The median true linear wear rate for Group 1 was 7.5 µm/yr (± 75 µm/yr), Group 2 was 52 µm/yr (± 98 µm/yr), and Group 3 was 24 µm/yr (± 98 µm/yr). The wear rate for group 1 was significantly less than the wear rate for group 2 ($p = 0.001$). The wear rate for group 1 was not significantly different than the wear rate for group 3 ($p=0.144$). The Harris Hip scores improved from 51 (range 26-75) pre-operatively to 97 (range 66-100) at follow-up. There was no radiographic evidence of implant loosening or osteolysis.

Discussion: We found the wear rate of HXLPE was significantly less than the wear rate of standard polyethylene at an average follow-up of 6 years. The use of oxidized zirconium did not improve wear rates of HXLPE when compared to CoCr. Our data would suggest that any benefit to alternative bearings is dwarfed by the significant effect of crosslinking polyethylene.



Poster #7

3 Year follow-up of a Long-term Registry-based Multicenter Study on Vitamin E Diffused Polyethylene in Total Hip Replacement

Nanna H. Sillesen, MD, Meridith E. Greene, Audrey Nebergall, BA, James I. Huddleston, MD, Roger H. Emerson Jr., MD, Eduardo Garcia-Cimbrelo, MD, Peter Gebuhr, MD, Anders Troelsen, MD, PhD, DMSc, Henrik Malchau, MD, PhD

Introduction: Preclinical studies of vitamin E diffused highly cross-linked polyethylene (VEPE) have shown improved fatigue strength and enhanced mechanical material properties that are less prone to wear because of the antioxidative properties of the vitamin E. Both early and long-term clinical outcome is important to document that there are no detrimental effects of new developments and to evaluate the materials performances from clinical use.

Methods: 977 patients from 17 centers in USA and Europe are enrolled into a prospective 10year outcome study. Patients received either Porous Titanium Coated or Porous Plasma Sprayedacetabular shellswith either VEPE liners or medium cross-linked (XLPE) liners. At each follow-up interval, 3 radiographs were obtained, 5 patient reported outcome measures (PROMs) were completed (Harris hip score, case mix indicator, UCLA, SF-36, EQ-5D). Radiographs were measured for cup and stem position, as well as femoral head penetration into the liner. Postoperative complications and revisions were also collected.

Results: Mean age at surgery was 62±9 years, 51% were male, and 90% were white. At 3-year follow-up there were 15 dislocations in 11 patients and 13 revisions (4 periprosthetic fracture, 1 sepsis, 6 instability, and 2 implant mismatch at surgery). Fivepatients died due to causes unrelated to the operation. Wearanalysis of AP pelvis films with Martell methodfrom postop to 3 year showed a penetration rate at 0.01 mm/year for XLPE and a penetration rate of 0.003 mm/year for VEPE with no significant difference between them ($p = 0.43$). Improvement was seen in all PROMs pre-op to 3 years postop ($p < 0.0001$).

Conclusion: Early follow-up of VEPE liners provide encouraging clinical and radiographic results with few intra- and postoperative complications. PROMs indicate improvement in functionality and quality of life across the centers after the hip replacement. We have not observed any early adverse effects from diffusing the liners with vitamin E.

Poster #8

Natural History of Pseudotumours in Metal-on-Metal Hip Replacements: A Longitudinal MARS MRI Study

Young-Min Kwon, MD, PhD, Kshitikumar M. Agrawal, MD,
Andrew A. Freiberg, MD, Harry E. Rubash, MD, Henrik Malchau, MD, PhD

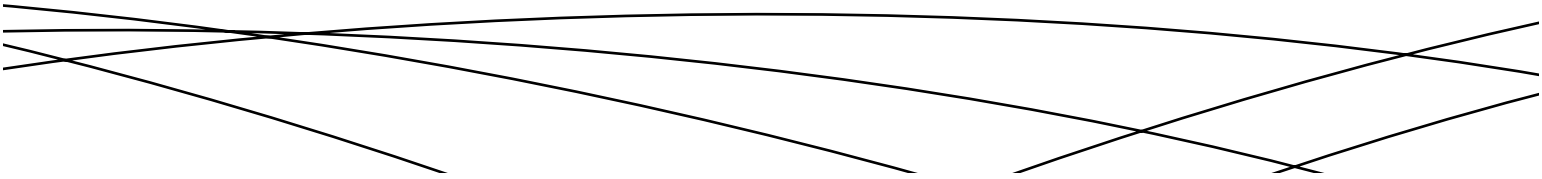
Introduction: Systematic treatment algorithms to optimize management of patients with metal-on-metal (MoM) hip arthroplasty recommend the use of MARS MRI to detect adverse local tissue reactions. However, recent studies have demonstrated a high prevalence (61%) of pseudotumours in patients with well-functioning hip prostheses. The inherent limitation of these cross-sectional studies is that the MRI assessments were evaluated at a single follow-up point in time. Thus, potential evolution or progression of pseudotumours detected by MARS MRI, especially in those patients with no or minimal symptoms, over time remain unknown.

Therefore, the aims of this longitudinal study were to: 1) determine the natural history of pseudotumours detected by MARS MRI in MoM patients; and 2) characterize MRI feature(s) associated with progressive pseudotumours.

Methods: A total of 38 MoM hips in 33 patients with pseudotumours confirmed on MARS MRI, who have elected to be treated non-operatively, were evaluated longitudinally (mean 13 months, range 12 months to 17 months). Pseudotumour progression was defined based on comparison between the initial and repeat follow up MARS MRI images in each patient.

Results: At the minimum of 1 year follow up, four patients (11%) with pseudotumours (thickened cystic wall $\geq$4mm and heterogeneous fluid) demonstrated MRI evidence of progression. Five patients (13%) were found to have 'regressed' with reduction in size of the pseudotumours. There was no measurable MRI progression of pseudotumours detected in the remaining 24 patients (76%).

Conclusions: This is the first longitudinal study evaluating the natural history of cystic pseudotumours, which were found to be non-progressive in the majority of MoM patients with no or minimal symptoms. The presence of MRI cystic wall thickening and heterogeneous fluid are associated with progressive pseudotumours. This information would be of critical importance in providing evidence-based clinical recommendations in evaluation and treatment of patients with MoM hip arthroplasty.



Poster #9

Acetabular Component Positioning and Functional Outcomes in Patients

Oladapo M. Babatunde, MD, Skylar Johnson, Kaicen Zhu, Katie Peyser,
Jeffrey A. Geller, MD, **William B. Macaulay, MD**

Introduction: While there have been several studies demonstrating the relationship between complications and poor positioning of the acetabular component in total hip arthroplasty (THA), there have not been any large studies investigating how outcomes in patients are affected by malpositioning. In our study we evaluated the relationship between acetabular component positioning and functional and quality of life outcomes.

Methods: After measuring the abduction and anteversion angles of the acetabular components in 193 hips we divided them into four groups: Group 1, hips were within the safe zones for anteversion and abduction, Group 2, within for abduction and outside for anteversion, Group 3, within for anteversion and outside for abduction, and Group 4, outside for both anteversion. We then compared the outcomes between the groups. Additionally we investigated the frequency of good and poor positioning in hips that had above and below average outcomes.

Results: Average follow-up was 52 months (12 - 137 months). One hundred and five (54.4%) out of the 193 hips had acetabular components out of the acceptable ranges for abduction and/or anteversion. The average change in functional score between well placed and malpositioned cups was not statistically different (SF12 14.4 versus 13.1 and WOMAC 36.6 versus 41.6 respectively). Adjusting for age, gender, and BMI and using pairwise comparisons there was no significance difference between groups for SF-12 or WOMAC outcomes. There was also no significant difference in dislocation rates between patients with acetabular cups within the acceptable zone (2.8%) compared to those not (2.7%).

Discussion and Conclusion: We found that functional and quality of life outcomes are not closely correlated with socket position. We also found that demographic factors such as BMI, age, and gender do not appear to influence the accuracy of cup placement. Additionally, the dislocation rate was not statistically different between well placed acetabular cups and poorly placed ones. This may suggest that that other factors such as previous surgery, soft tissue tensioning and patient noncompliance are just as important as socket positioning with regard to risk for dislocation and patient complications.

Poster #10

Delta Ceramic on Ceramic THA- Midterm IDE Study Results

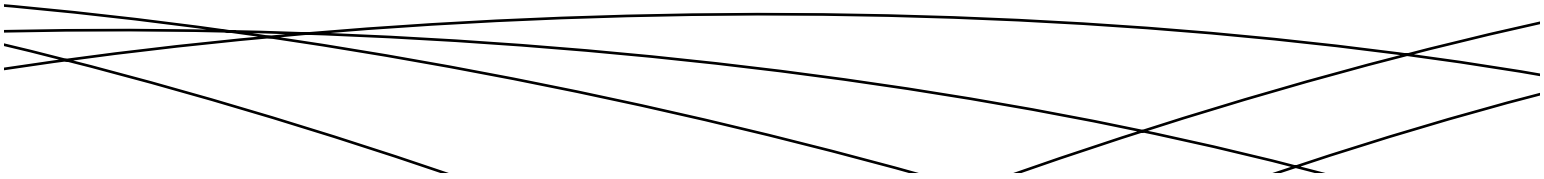
William G. Hamilton, MD, James P. McAuley, MD, FRCSC, Thomas J. Blumenfeld, MD, Douglas A. Dennis, MD, James Lesko, PhD, Sam Himden, BA, CCRA

Introduction: Ceramic on ceramic (COC) is an attractive bearing option for total hip arthroplasty (THA), but little published data exists on the Delta alumina matrix-composite ceramic (Delta COC) at midterm follow-up. This study reports results of an investigational device exemption (IDE) study of 28mm and 36mm Delta COC articulations.

Methods: From 2003-2007 345 subjects received a Delta COC THA in a prospective multicenter IRB approved IDE study with 28mm (n=177) or 36mm (n=168) articulations. Mean age was 56.9 (range 20 to 75), mean BMI was 29.5 (range 18.4 to 53.1). Subjects had clinical and radiographic evaluations yearly; the primary clinical endpoint was the latest, minimum 2-year Harris Hip (2+ year HH) score. Kaplan-Meier (KM) survivorship (failure = revision of any THA component) was reported. The following were evaluated for association with squeaking: cup abduction angle, age, sex, BMI, cup size, head size, and 2+ year HH score.

Results: At mean follow-up of 5.1 years (range 1.9 to 7.9) the 2+ year HH score was 94.4 (range 47 to 100). There were 3 (0.9%) postoperative liner fractures and no head fractures. Nine revisions were performed (28 mm: 1 liner fracture, 2 stem loosening, 1 infection; 36mm: 1 liner fracture, 2 stem loosening, 2 infection). KM survivorship at 6 years was 96.8% (93.7-98.4) among all subjects; 28 mm 97.7% (93.9-99.1), 36 mm 95.9% (89.9-98.3). Twenty-six (7.5%) subjects reported squeaking; among these, mean 2+ year HH score was 93.3 (range 50 to 100), none were revised. Two (0.6%) subjects could reproduce an audible sound in clinic. Of variables described above, only head size was statistically associated with squeaking (28mm: 7/177, 36mm: 19/168, p-value = 0.013).

Discussion: The Delta COC articulation in this study demonstrated excellent 2+ year HH scores and 6 year survivorship. Squeaking and liner fractures were observed with this bearing articulation.



Poster #11

Outcomes of Total Hip Arthroplasty after Hip Arthroscopy are Inferior to Primary THA

Jonathan M. Vigdorchik, MD, Michael P. Ast, MD, Stephen Lyman, PhD,
Douglas E. Padgett, MD, Amar S. Ranawat, MD

Introduction: Hip arthroscopy has been shown to be an effective treatment for a variety of pathologies when not associated with significant degenerative disease. Successful long-term outcomes have been demonstrated in prospective studies. When patients fail to achieve satisfactory outcomes after hip arthroscopy, the subsequent treatment is often total hip arthroplasty (THA). Little has been published in regards to the outcomes of THA in these patients. Our hypothesis is that patients who undergo THA within three years of hip arthroscopy have inferior clinical results and lower patient satisfaction.

Methods and Materials: 33 patients who underwent ipsilateral THA within 3 years of hip arthroscopy were matched to 99 controls. Patients were excluded if they had an arthroplasty on any other joint, a revision within the follow-up time period, or if they did not have complete baseline and 2-year evaluations. Patients were matched by age, sex, BMI, and pre-op physical function as measured by the SF-12 Physical Component Summary (PCS) scores. Patient reported outcomes were analyzed to determine clinical outcomes from both cohorts.

Results: At 2 years, WOMAC scores demonstrated inferior functional outcomes for patients who had undergone arthroscopy prior to THA ($p=0.05$). Further, these patients were significantly more likely to have joint stiffness when compared to matched peers ($p=0.0095$). These differences were both statistically and clinically significant.

Conclusion: The effects of the previous hip arthroscopy on outcomes of THA have never been evaluated. Those patients who undergo hip arthroscopy prior to THA appear to have significantly worse overall physical function, as well as an increased incidence of joint stiffness. While this study represents a relatively small sample size, it is the first of its kind to examine these outcomes, and should serve as a basis for continued research. This information proves especially useful to appropriately counsel patients prior to hip arthroscopy or THA.

Poster #12

Bariatric Orthopaedics: Total Hip Arthroplasty in Patients who Are Super-obese (BMI>50 kg/m2)

Kimona Issa, MD, Steven F. Harwin, MD, Qais Naziri, MD, Mark McElroy, MS,
Aiman Rifai, DO, Arthur L. Malkani, MD, **Michael A. Mont, MD**

Introduction: The purpose of this study was to assess the clinical and patient-reported outcomes of primary THA in super-obese patients compared to a matched cohort of patients who had a normal body mass index (BMI<25 kg/m2).

Methods: Thirty-five hips in 31 patients who had a minimum BMI of 50kg/m2 who underwent a primary THA at one of the two high-volume institutions between 2001 and 2010 were reviewed. This included 18 women and 13 men who had a mean age of 55 years (range, 36 to 71) who were followed for a mean of 5 years (range, 2 to 12 years). The underlying cause of hip disease was end-stage osteoarthritis in 26 and osteonecrosis in 5 patients. These patients were compared to a matched cohort of 93 patients (1:3 ratio) who had undergone THA during the same time period and by the same surgeons. Outcomes evaluated included implant survivorship, complication rates, Harris hip scores, SF-36 and UCLA activity scores, as well as patients' experience to find a treating surgeon.

Results: Super-obese cohort had 5.75 times higher odds ratio (p=0.15) of undergoing a revision surgery compared to the matching group. Overall implantsurvivorship in the super-obese group was 94% compared to 98.5%in the matching group. Super-obese cohort had significantly higher odds ratio of medical complications (OR: 7.7, p=0.017) compared to the matching group.At final follow-up, super-obese patients had achieved a significantly lower mean Harris hip scores (83 vs. 91 points; p=0.01), SF-36 physical (39 and 47; p=0.001) and mental (49 and 59 points; p=0.003) components scores, as well as activity scores (3.9 vs. 6.8 points; p=0.001) compared to the matching group.

Discussion: In light of these findings, the authors believe that super-obese patients may benefit from counseling with their treating surgeon to set realistic expectations regarding the outcomes of their procedure.

Poster #13

Flexural Rigidity of Various Trunnion Designs in Modular Hip Stems: A Biomechanical and Historical Analysis

David A. Porter, MD, Robert M. Urban, Joshua J. Jacobs, MD,
Jose A. Rodriguez, MD, H. John H. Cooper, MD

Introduction: There is renewed concern surrounding the potential for corrosion at the modular head-neck junction to cause early failure in modern hip implants. Although taper corrosion involves a complex interplay of many factors, previous studies have correlated decreasing flexural rigidity of the femoral trunnion with an increased likelihood of developing taper corrosion. The purpose of the present study is to measure flexural rigidity at the trunnions of modern femoral stems, and to compare these to older taper designs.

Methods: A multicenter retrieval analysis of 85 different modular femoral stem designs was performed to calculate the flexural rigidity of various femoral trunnions. Stems were implanted between 1991-2012 and retrieved between 2004-2012. There were 10 different taper designs from 16 manufacturers. Flexural rigidity was calculated according to previously described methods based on the taper geometry and the material properties of the stem.

Results: Mean flexural rigidity was 262 Nm2, however there was a wide range of values among the various stems spanning nearly an order of magnitude between the most flexible (80 Nm2) and most rigid (623 Nm2) trunnions. This variability was due in part to the taper geometry and in part to the modulus of elasticity of the stem's base alloy. There was a modest but significant negative correlation (-0.23; $p = 0.04$) between flexural rigidity of the trunnion and release date of the stem.

Conclusion: Femoral trunnions exhibit a wide variability in flexural rigidity that is design-specific. Small trunnions made from an alloy with a low modulus have a very low flexural rigidity that may predispose for corrosion at the modular head-neck taper. In addition, the historical trend toward more flexible trunnions may, in part, explain why taper corrosion is being seen with increasing frequency in modern hip arthroplasty.

Poster #14

Radiographic Outcomes after Direct Anterior with Fluoroscopy vs Mini-Posterior Total Hip Arthroplasty Without: Reliable, Reproducible, and Similar

Atul F. Kamath, MD, **Kirsten Poehling-Monaghan, MD,** Michael J. Taunton, MD, Mark W. Pagnano, MD

Purpose: One proposed advantage of direct anterior total hip arthroplasty (THA) is that intraoperative radiographic imaging is easily obtained which might make leg-length, hip offset, acetabular cup and femoral stem positioning more reliable. Others suggest that careful, systematic preoperative planning produces reliable and reproducible radiographic outcomes. We sought to determine if there was systematic benefit to the intraoperative imaging. We compared 2 THA cohorts: direct anterior (DA) with imaging and mini-posterior (MP) with pre-operative planning and no intraoperative imaging.

Methods: From July 2011- February 2012 we compared 126 consecutive DA THA with fluoroscopy to 96 consecutive MP procedures performed. Groups were similar in age (64+/-12), sex (50% female), and body mass index (30+/-5.7). Two fellowship-trained surgeons performed all cases using the same uncemented implants. Postoperative measurements of leg length, offset, acetabular abduction and anteversion were done with validated techniques. Independent reviewers used calibrated eight-week postoperative x-rays and digital templating software for analysis.

Results: The DA group had mean leg length increase 1.0mm (SD 4.1), while MP had a decrease 0.9mm (SD 5.6) (p=0.009). Femoral offset increased more in the MP group (3.0mm; SD 5.6) than DA (0.6mm; SD 4.4) (p=0.0009). Acetabular anteversion was higher in DA using two measurements: 35.8 degrees (SD 6.9) vs. 32.5 degrees (SD 7.4) Woo and Morrey (p=0.0009); and 52.7 degrees (SD 9.0) vs. 50.2 degrees (SD 9.5) ischio-lateral method (p=0.049). No differences in cup abduction [39.1 degrees (SD 5.0) for DA vs. 40.2 degrees (SD 5.7) for the MP] or varus/valgus stem position. More stems were flexed in the DA (38.4% vs. 12.5% for MP; p=0.0001). No components failed for subsidence or fracture.

Conclusion: Reliable, reproducible and similar THA radiographic outcomes were obtained with direct anterior/fluoroscopy and mini-posterior/no-fluoroscopy techniques. Having a well-defined preoperative and intraoperative plan appears more important than the specific surgical techniques in obtaining tight radiographic outcomes after THA.

Significance: Having a well-defined preoperative and intraoperative plan appears more important than the specific surgical techniques in obtaining tight radiographic outcomes after THA.

Poster #15

Does the Direct, Anterior Approach Improve Acetabular Component Positioning and Leg Length Restoration in Total Hip Arthroplasty?

Denis Nam, MD, Peter K. Sculco, MD, Edwin P. Su, MD,
Michael M. Alexiades, MD, Mark P. Figgie, MD, David J. Mayman, MD

Introduction: Use of the direct, anterior approach has increased in total hip arthroplasty (THA), with proposed benefits including improved acetabular component positioning and leg length restoration with the use of intraoperative fluoroscopy. The purpose of this study was to compare the accuracy of acetabular component alignment and leg length restoration in patients undergoing primary THA via three, surgical techniques: direct anterior (D-A), posterolateral conventional (P-C), or posterolateral using computer navigation (P-N).

Methods: This was a retrospective review of a consecutive series of 110, unilateral THAs (330 total) performed using each of the three, aforementioned techniques (two surgeons performed each technique). Einsel-Bild-Roentgen Analysis was used to measure the postoperative, acetabular abduction and anteversion on an AP, pelvis radiograph. The preoperative and postoperative leg length inequality (LLI) between the operative and nonoperative lower extremity was digitally measured.

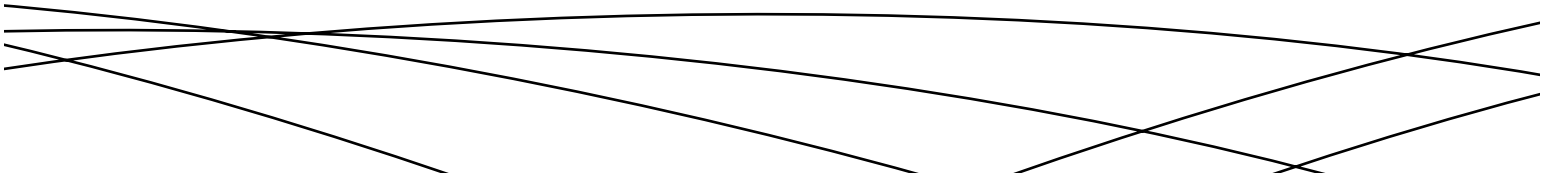
Two, blinded independent observers performed each measurement, and interclass correlations were calculated. Statistical analysis was performed using a one-way ANOVA and Fischer's exact test ($p<0.05$ = significant). A power analysis demonstrated the minimal effect size detectable with appropriate power (beta level = 0.80, alpha level= 0.05) to be a 14% difference in the number of "outliers" for acetabular component positioning.

Results: There was no significant difference between the cohorts for body mass index or degree of preoperative LLI ($p=0.1$ -0.47).

90.9% of acetabular components were within the targeted range for both abduction (40° +- 10°) and anteversion (15° +- 10°) in the P-N cohort, versus 68.2% in the D-A cohort and 70.0% in the P-C cohort ($p<0.001$). No significant difference in acetabular outliers for abduction or anteversion was appreciated between the D-A and P-C cohorts ($p=0.68$ - 1.0). No statistically significant difference was seen in the mean, absolute postoperative LLIs between the three cohorts ($p=0.12$ - 1.0).

Interobserver correlations were good to excellent for all measurements ($r=0.85$ - 0.91).

Conclusion: The direct, anterior technique does not improve acetabular alignment versus the posterolateral-conventional technique. No difference in leg length restoration was appreciated between the three, surgical techniques.



Poster #16

Metal Transfer and Raman Spectroscopic Analysis of Retrieved Alumina-Zirconia Composite Ceramic Femoral Heads

Denis Nam, MD, Marcella E. Elpers, BS, Susie Boydston-White, PhD, Michael P. Ast, MD, Douglas E. Padgett, MD, Timothy M. Wright, PhD

Introduction: A zirconia-toughened alumina (ZTA) bearing has been introduced in total hip arthroplasty (THA), in which yttria-stabilized, zirconia polycrystals are uniformly distributed in an alumina matrix. Zirconia's toughness is attributed to a tetragonal to monoclinic (t-m) phase change that occurs in response to a crack, hindering its propagation; however, it may also decrease its material stability. The purposes of this study were to investigate the degree of metal transfer, and the occurrence of t-m phase transformation using Raman spectroscopy, in a series of retrieved, ZTA femoral heads.

Methods: Twenty-seven ZTA heads were available for review. Two, independent graders assessed each head for metal transfer over 3 surface regions (apex, equator, below equator) and 2 female trunnion regions (deep and superficial 50%) using a previously validated grading system (1=no markings, to 5=markings over >20% surface area).

Raman spectra were collected with a confocal imaging system (488nm laser, microscope objective of 20X), with three scans taken in each surface region and areas of metal transfer. One-way ANOVA was used to compare metal transfer scores between the surface regions ($p<0.05$ = significant).

Results: The mean length of implantation was 2.2 + 3.4 years. The most common reasons for revision were osteolysis (9), device failure (6), and instability (5). Of the femoral heads, 66.7% had metal transfer within the apex (mean score 1.7 + 0.5), 96.3% in the equator (mean score 2.2 + 0.6), and 100% below the equator (mean score 2.7 + 0.9), which was significantly greater than the apex ($p=0.002$). All heads had metal transfer in both the superficial (mean score 3.1 + 0.3) and deep trunnion (mean score 3.6 + 0.5). Interobserver correlations were fair/moderate for all measurements ($r=0.59$ to 0.80).

Raman spectra demonstrated t-m phase transformations in all heads, with monoclinic (m) bands observed at 180, 383, 477, 537, 570 and 622 cm-1.

Conclusion: Our study is the first to include visual assessment and Raman spectra analysis of a large series of retrieved, ZTA femoral heads. The high occurrence of metal transfer and t-m phase transformation raises concerns about the long-term mechanical strength and stability of this material.

HIV Infection and Risk of Perioperative Complications following Total Hip Arthroplasty

Qais Naziri, MD, Kimona Issa, MD, Matthew R. Boylan, Harpal S. Khanuja, MD, Aditya V. Maheshwari, MD, Michael A. Mont, MD

BACKGROUND: Human Immunodeficiency Virus (HIV) infection has been previously reported as a potential risk factor for end-stage degenerative joint disease. Recent studies have shown successful mid-term outcomes following joint arthroplasty in HIV-positive patients, but little data exist on the risk of immediate perioperative complications.

METHODS: The Nationwide Inpatient Sample (NIS) was queried between 1998 and 2010 to identify a total of 543,085 patients with THA as their primary procedure code. We used discharge ICD-9 codes to identify 1,897 HIV-positive patients and used the remaining 541,188 patients as our HIV-negative reference group. We used multivariate logistic and linear regression, adjusting for age, gender, race, year of admission, and Deyo comorbidity score, to calculate odds ratios (ORs) of major perioperative complications (death, myocardial infarction, tachycardia, pulmonary embolism, pneumonia, acute renal failure, stroke) and minor perioperative complications (wound hemorrhage, wound complication, deep vein thrombosis, wound infection, implant infection, irrigation and debridement, post-operative dislocation, sepsis, urinary tract infection), as well as mean difference in log-transformed length of stay and total hospital charges, for HIV-positive versus HIV-negative patients.

RESULTS: The prevalence of major and minor complications among HIV-negative admissions was 2.65% and 4.81%, respectively, compared to 2.79% and 5.17%, respectively, among HIV-positive patients. Compared to patients without HIV, HIV-positive patients had an OR of major complication of 1.58 (95% CI, 1.17-2.14; $p=0.0030$) and an OR of minor complication of 1.76 (95% CI, 1.41-2.20; $p<0.0001$). Mean length of stay among HIV-positive patients was 13.71 (95% CI, 11.84-15.60; $p<0.0001$) percent longer, and total charges were 10.05 (95% CI, 7.87-12.26; $p<0.0001$) percent higher.

CONCLUSION: HIV-positive patients undergoing THA showed an increased incidence of major and minor perioperative complications, which may contribute to an increased length and cost of admission. While mid-term outcomes in HIV-positive patients are promising, orthopaedic surgeons and patients should be aware of the potential for increased risk of perioperative complications.

Poster #18

Characterization of Periprosthetic Femur Fractures in 32,644 Primary Total Hip Arthroplasties

Matthew P. Abdel, MD, Chad D. Watts, MD, David G. Lewallen, MD, Daniel J. Berry, MD

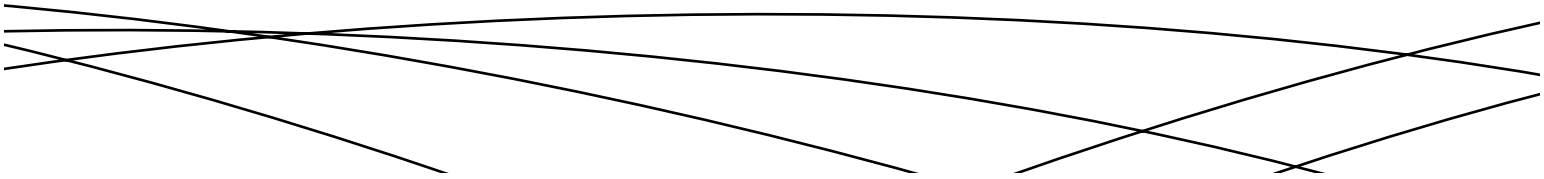
Introduction: Understanding the timing and circumstances under which periprosthetic femur fractures occur allows development of prevention strategies. The goals of this study were to define the demographic and operative risk factors, chronology, and character of fractures in a large cohort of primary total hip arthroplasties (THAs).

Methods: We retrospectively reviewed the total joint registry of an academic institution from 1969 to 2011. All patients undergoing primary THA were included. Periprosthetic fractures were analyzed based on demographics, timing, and type of fracture. Radiographs and the EMR were reviewed to characterize the fractures and determine subsequent treatments.

Results: During the study, 32,644 primary THAs were performed. There were 564 intraoperative periprosthetic femur fractures (1.7%); 529 occurred during placement of an uncemented stem (3.0%) and 35 during placement of a cemented stem (0.23%). Intraoperative fractures were more common in females and patients >65 years. 92% occurred during canal preparation or implant impaction; 69% involved the calcar area and 25% the greater trochanter. 85% were non-displaced and 75% were treated with cerclage cables/wires.

There were 557 postoperative periprosthetic femoral fractures; 335 after placement of an uncemented stem (7.7%) and 222 after placement of a cemented stem (2.1%). A postoperative fracture within 30 days of surgery was 10X more likely with an uncemented stem. 67% occurred after a fall. Of all postoperative fractures, 36% underwent ORIF and 21% had revision surgery. At 25 years the cumulative incidence of periprosthetic fracture was 4.7%.

Conclusions: Intraoperative periprosthetic femoral fractures occur 13.5X more often with uncemented stems. They are most common in female patients > 65 years. The majority are non-displaced calcar fractures treated with cerclage cables/wires. Postoperative fractures are also most common with uncemented stems. The majority require surgical intervention. By 25 years almost 5% of patients will have experienced a periprosthetic fracture.



Poster #19

Fracture of Highly Cross-Linked UHMWPE Liners: An Analysis of 75 Reports of a Single Design to the FDA

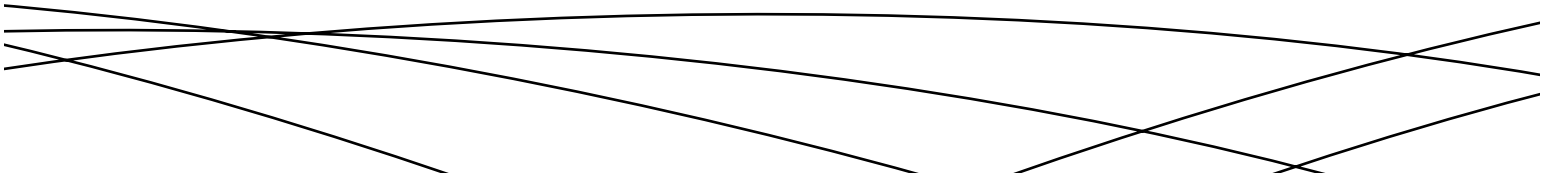
Michael P. Ast, MD, Thomas K. John, MD, Alejandro Gonzalez Della Valle, MD

Introduction: Cross-linking improves wear resistance but has been associated with decreased mechanical properties and reports of polyethylene fracture. We reviewed the reports of fractures to the US Food and Drug Administration (FDA) observed with a single type of highly cross-linked UHMWPE (HXLPE) acetabular liner. Our goals were to more accurately understand the incidence and cause of these fractures as well as to determine any factors that could minimize the likelihood of this complication.

Methods: A search of the FDA Manufacturer and User Facility Device Experience database was carried out for a single type of HXLPE acetabular liner. Catalog numbers, event date, need for re-operation, description by the submitting party, and manufacturer narrative, were evaluated.

Results: Among 420 records of adverse events, 75 reported on an unequivocal fracture of this type of liner. The reports of fractures increased from 2 observed from 1999 to 2003 to 37 between 2009 and 2012. The average time-in-situ of the liners was 27 months (1 to 96). The polyethylene thickness in the weight-bearing portion was <= 6 mm in 60 cases and <= 7 mm in 69 cases. The polyethylene thickness at the rim where most of the fractures occurred, was <= 3.7mm in 62 liners, and <= 4.7mm in 71 liners. Sixty five cups had a diameter of <=56 mm; and 56 fractured liners were articulating with large diameter heads (>=36mm).

Conclusions: While only 6 fractured HXLPE acetabular liners of this design have been reported in the orthopaedic literature, 75 have been reported to the FDA. This suggests that the orthopaedic community underestimates the prevalence of this complication. Thin HXLPE liners, articulating with large diameter heads were prevalent in this series and should be avoided whenever possible. A minimum polyethylene thickness of 4.7 mm at the rim may provide substantial protection against fracture.



Poster #20

Perioperative Outcomes of Solid Organ Transplant Patients following Total Hip Arthroplasty in the United States

Caleb R. Szubski, BA, Alison K. Klika, MS, Aiswarya Chandran Pillai, MD, MS, Nicholas K. Schiltz, BS, Siran M. Koroukian, PhD, Wael K. Barsoum, MD

Introduction: Immunosuppressive therapy, metabolic disorders, and post-transplant medications theoretically place solid organ transplant patients at higher risk for complications following joint arthroplasty. The objective of this study was to use a national administrative database to compare morbidity, acute complications, in-hospital mortality, length of stay (LOS), and admission costs for total hip arthroplasty (THA) patients with and without solid organ transplant history.

Methods: Primary THA (ICD-9-CM 81.51) patients from 1998 to 2009 (n=2,567,930; weighted frequency) were retrospectively queried from the Nationwide Inpatient Sample. After exclusions (n=324,837), remaining patients were assigned to transplant (n=6,319; liver, kidney, heart, lung, and/or pancreas) or non-transplant groups (n=2,231,446; no history of any transplant including solid organ or tissue). Acute complications included organ-specific complications, mechanical complications, dislocation, postoperative shock, hematoma, infection, venous thrombosis, and pulmonary insufficiency. Multivariable regression and general estimating equations examined the effect of transplant history on outcomes, adjusting for patient and hospital characteristics.

Results: Between 1998 and 2009, the volume of THA among transplant patients grew ~40% (444 to 620 cases/year), which was lower than that among non-transplant patients (+102%). Transplant THA patients were significantly sicker, with an elevated Elixhauser comorbidity index (7.69 vs. 1.21; $p<0.001$). Transplant patients had greater complication prevalence (7.9%), longer LOS (4.5 days), and higher admission costs ($15,518) than their non-transplant peers (5.7%; 3.9 days, $14,474; $p<0.001$). There were no in-hospital deaths in the transplant group, while 2,855 (0.1%) non-transplant patients died after THA. Adjusting for confounders, transplant patients stayed 0.38 days longer (OR, 1.08; 95% CI, 1.05-1.10; $p<0.001$) and had a 24% increased likelihood of a complication (OR, 1.24; 95% CI, 1.01-1.53; $p=0.04$) compared with non-transplant patients. There was no statistically significant increases in adjusted costs ($p=0.13$).

Conclusion: Transplant patients have greater morbidity, length of stay, and acute complications, yet comparable admission costs after THA compared with non-transplant patients.

Poster #21

Cementless Acetabular Fixation without Bone Graft in High Grade Hip Dysplasia: Minimum 20 Year Follow-Up

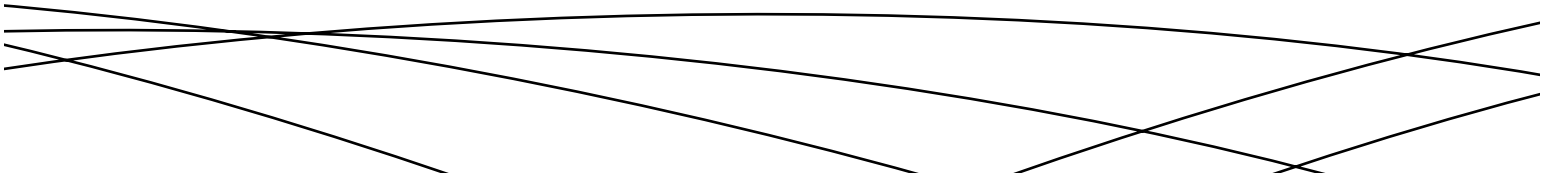
Justin Greiner, BS, John J. Callaghan, MD, **Melissa D. Willenborg, MD,**
Steve Liu, MD, Devon D. Goetz, MD, Richard C. Johnston, MD, MS

Introduction: THA in patients with high grade hip dysplasia has classically been performed using superior lateral bone grafts, initially with cemented and later with cementless acetabular fixation. We evaluated the minimum 20 year results of THA performed consecutively by a single surgeon in patients with high grade dysplasia that were treated with a cementless acetabular component without superior lateral bone graft fixation.

Methods: 18 consecutive hips in 14 patients with high grade hip dysplasia underwent THA using a cementless acetabular component with screw augmented fixation and a cemented stem. The average age at the time of surgery was 50 years (range 38 to 77). All patients were female. 0 to 33% of the acetabular component was left uncovered supero-laterally. At a minimum of 20 year follow-up, patients were evaluated clinically for need of revision and on radiographs for loosening, osteolysis and acetabular liner wear. Results were compared to the same surgeon's results of cemented THR in cases of hip dysplasia.

Results: At minimum 20 year follow-up, 9 patients (12 hips) were living and 5 patients (6 hips) were deceased. Average radiographic follow-up of the hips in living patients was 22.4 years (range 19.5 to 24). Eight hips required revision: 2 hips for femoral loosening, 5 hips for acetabular liner wear, and 1 hip for periprosthetic fracture. The average linear wear rate was 0.167 mm/year. No acetabular components were revised for loosening (compared to 12% of 66 cemented THR's performed for CDH by the same surgeon, difference $p < 0.001$). No acetabular components was radiographically loose (compared to 28% in the cemented series, $p < 0.005$).

Conclusion: At minimum 20 year follow-up of THA using cementless acetabular components without bone grafts for high grade CDH, no hip demonstrated acetabular loosening. Results were superior to the senior author's experience with cemented acetabular fixation.



Poster #22

Topical Versus Intravenous Tranexamic Acid in Total Hip Arthroplasty: A Double-Blind, Randomized Controlled Trial

W. Trevor North, MD, Nima Mehran, MD, Michael W. Laker, MD, Craig D. Silverton, DO, Kaiser Shah, BBA, Robb M. Weiir, MD, Jason J. Davis, MD, Lige M. Kaplan, MD

Background: Tranexamic acid (TA) has been used in many surgical subspecialties in the intravenous (IV) and topical form to reduce perioperative blood loss. Several studies identify IV TA's utility in total hip arthroplasty (THA). However, there has been no direct comparison of IV and topical TA in THA. This study aims to evaluate IV and topical TA's effect on postoperative blood loss and transfusion rates in THA.

Methods: Sixty patients were enrolled in a prospective, double-blind, placebo-controlled trial. Patients were randomized to 2.0g of topical or IV TA. In the IV group (n=32), patients received an infusion prior to incision and during fascial closure. The topical group (n=28) had TA applied to the wound following component placement. Each group received a placebo of normal saline (either IV or topical) for blinding purposes. Operative technique, drug administration and transfusion protocols were standardized. Patients meeting transfusion criteria (symptomatic Hgb<8.0g/dL or any patient with Hgb<7.0g/dL) were transfused. Postoperative blood loss was calculated using validated methods.

Results: Calculated blood loss was lower in the IV group (1173 $\pm$ 570 mL) than the topical group (1421 $\pm$ 281 mL)(p=0.077). The change in hemoglobin was reduced in the IV group (-3 $\pm$ 1.3 g/dL) compared with the topical group (-3.5 $\pm$ 1.2 g/dL)(p=0.093). There was no significant difference in the transfusion rates between the IV and topical groups(14.3% vs.15.6%)(p=0.885). Both IV and topical TA reduced the overall transfusion rate in THA by greater than 50%. No thromboembolic events were identified in either group.

Discussion: IV and topical TA are effective tools to reduce blood loss in THA. The desirable 50% reduction in transfusions comes without an increased risk of thromboembolic complications regardless of the preparation used. However, IV TA administration is much simpler and does not increase operative time, making it the more attractive option.

Poster #23

The Painful Reality of Modern Hip Stem Modularity – Catastrophic Adverse Tissue Responses in a Single Surgeon Series of 216 Cases

Danyal H. Nawabi, MD, FRCS, Allison Ruel, BA, Hollis G. Potter, MD, Geoffrey H. Westrich, MD

Introduction: Modularity at the head-neck junction in THA has an excellent record of safety and efficacy. Recently, a modular connection at the neck-stem junction has been introduced to offer flexibility for altering offset, version, and length. This design is now presenting with problems due to fretting and corrosion. The purpose of this study was to analyse a modern modular neck-stem THA.

Methods: We retrospectively reviewed 216 consecutive hips (195 patients; mean age 65.4 years) implanted by a single surgeon. All hips had a titanium-alloy stem of which 199 were modular (CoCr neck) and 17 were monolithic. Patients presenting with new-onset pain were worked up for infection prior to being investigated with metal-ion levels and MARS MRI. An ultrasound-guided biopsy was performed for select cases suspected of having an adverse reaction (ALTR) on MRI. Tissue samples were graded using the ALVAL score. Retrieved implants were examined with light microscopy.

Results: At a mean follow-up of 14.8 months (range 9-36), 41 hips (18.9%) have been revised and a further 21(9.7%) are awaiting revision. The Kaplan-Meier 2-year survivorship of this implant is 76.6%. An ALTR was the cause for revision in 38 of 41 hips. All cases of ALTR occurred in the modular neck cohort with no revisions in patients with monolithic stems. Metal ion levels in the ALTR cases showed higher levels of cobalt (mean=8.9 ng/ml) than chromium (mean=1.6 ng/ml). MARS MRI showed moderate to severe levels of tissue damage in 47 of 52 cases. Ultrasound-guided biopsy was positive for ALTR in 16/31 cases with a false-negative rate of 47%. The mean ALVAL score for the revised cases was 8.3. Evidence of fretting and corrosion was visible on all retrieved tapers at the neck-stem junction but not the head-neck junction.

Conclusion: A cobalt-chrome on titanium, modular neck-stem design has shown a catastrophic early failure rate due to ALTR, most likely occurring due to corrosion at the neck-stem junction. In the absence of infection, patients with new-onset pain with a modular neck THA must be evaluated with metal ion levels and MARS MRI.

Poster #24

Patient's Preoperative Confidence Impact on Functional Outcome after Total Hip Arthroplasty (THA)

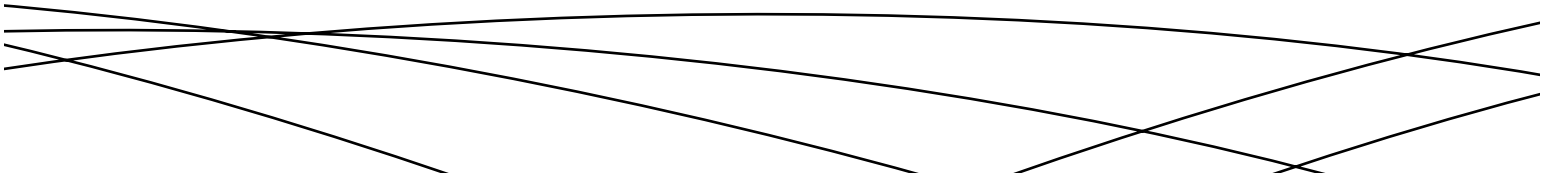
Joseph F. Styron, MD, PhD, Gregory J. Strnad, Wael K. Barsoum, MD,
Joseph Iannotti, **Carlos Higuera, MD**

Introduction: Patient medical comorbidities are well-established risk modifiers of THA patient outcomes. Patient's mental state preoperatively may influence postoperative functional outcomes though just like any medical comorbidity. This study sought to determine if patient confidence in attaining post-operative functional goals was associated with objective and subjective outcomes following THA.

Methods: Patients undergoing primary or revision THA at a single institution between 2008 and 2010 were administered a questionnaire consisting of demographics, body mass index, Hip Dysfunction Osteoarthritis and Outcomes Score (HOOS), SF-12 scores, the level of functionality they hoped to gain postoperatively and their confidence in attaining that goal (0-10 scale) preoperatively and postoperatively at last follow-up (minimum 12 months). Measured outcomes included length of stay, 30-day readmission, HOOS, and SF-12 physical component scores. Correlation of patient confidence in attaining treatment goals and the outcomes collected was established using multiple linear and logistic regression models that were adjusted for all variables, including baseline mental and functional scores.

Results: A total of 804 primary and 154 revision THA patients completed their post-operative questionnaires with an average follow-up of 491 and 487 days, respectively. Patients were confident in achieving their goals, with an average score of 8.0 ± 2.2 and 7.2 ± 2.8 for primary and revision THA patients, respectively. Having greater confidence was associated with a decreased rate of 30-day readmission for primary THA patients only ($p=0.006$). For both primary and revision THA patients, having greater confidence was associated with higher HOOS functional scores (primary $p<0.001$ and revision $p=0.004$), improved HOOS pain scores ($p<0.001$ and $p=0.011$), and improved SF-12 physical component scores ($p<0.001$ and $p=0.003$).

Conclusions: A patient's level of confidence in their ability to achieve specific functional outcomes following either primary or revision THA does affect their post-operative outcomes. When risk-stratifying patients for THA, patient's confidence may be as important as their medical comorbidities.



Poster #25

Decreased Hospital Length of Stay after Total Hip Arthroplasty is Not Associated with Increased Readmission Rates

Jeffrey B. Stambaugh, MD, Angela D. Keith, MS, Madelyn Curry, RN, BSN, John C. Clohisy, MD, Gail E. Pashos, BS

Introduction: There has been a series of perioperative changes at our institution to decrease the length of hospital stay associated with primary total hip arthroplasty (THA). Incremental changes over the past twelve years have included the adoption of preferred spinal anesthesia and multi-modality pain management in 2005 and early post-operative mobilization protocols with streamlined therapy services introduced in 2009. The purpose of our study is to investigate changes in hospital length of stay and readmission rates for primary THAs associated with incremental introduction of these rapid recovery protocols.

Methods: We performed a retrospective review of one surgeon's primary total hip replacement surgeries from 2000-2012 (2,182 THAs). The patient sample was divided into one of three cohorts: 2000-2004 (Group 1; 480 subjects), 2005-2008 (Group 2; 772 subjects), and 2009-2012 (Group 3; 930 subjects). Cohort determination was decided by the year that major protocol advancements were initiated. Average length of stay, thirty-day all-cause readmission, demographic and co-morbidity data were collected.

Results: The average length of stay for groups 1, 2 and 3 were 3.94 days, 2.66 days and 1.84, respectively. Results of regression analysis demonstrated a significant decrease in readmissions for decreasing hospital lengths of stay ($R2 = -.29$, $t(12) = 2.49$, $p = .02$). Moreover, there was a significant decrease in the proportion of readmissions compared to all cases between the three groups over time ($\chi 2 = 14.56$, $p = 0.0006$).

Conclusion: The results from our study indicate that the incremental introduction of rapid recovery perioperative protocols for primary THA can be associated with shorter hospital stays without increasing the risk of readmission.

Poster #26

What is the Level of Evidence Substantiating the Medicare Local Coverage Determinations?

Matthew S. Austin, MD, Michael R. Bloomfield, MD, Paul M. Lichstein, MD, MS, Javad Parvizi, MD, FRCS, Adolph J. Yates, MD

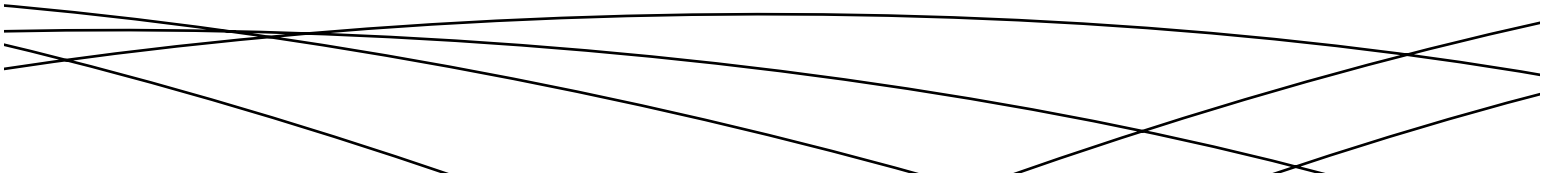
Introduction: Hip and knee arthroplasty account for large expenditures of Medicare resources and the medical necessity of these procedures has been targeted for so-called "claw-backs."

Recovery audit contractors (RAC) utilize Local Coverage Determinations (LCD) documents, specific to a geographic area, to retrospectively assess the medical necessity of a procedure that was already performed. Procedures that fail to meet the LCD criteria are then subject to "clawback" of the paid claim. LCDs currently target joint replacement and spine surgery. The Florida LCD for hip and knee arthroplasty was one of the first implemented. It requires documentation of three months of unsuccessful non-operative care prior to joint replacement. We sought to evaluate the quality and applicability of the evidence cited in the Florida LCD to patients undergoing arthroplasty.

Methods: Citations listed in the Florida LCD were collected and evaluated to determine the quality and applicability of the citations to patients under consideration for arthroplasty. The quality of evidence was assessed by applying, if possible, the Journal of Bone and Joint Surgery (JBJS)/AAOS LOE classification system. The applicability of the evidence was assessed by specifically looking for the efficacy of non-operative treatment in patients who would otherwise be considered candidates for arthroplasty.

Results: 23 citations were identified. 11/23 citations mentioned non-operative treatment. 5/23 citations provided references. Some Level I and II evidence supported specific non-operative treatments for the general diagnosis of arthritis. 0/23 citations provided Level I or II evidence substantiating the effectiveness of three months of non-operative treatment in patients who would otherwise be candidates for arthroplasty.

Conclusions: The requirement for completion of three months of non-operative treatment, in patients who would otherwise be considered candidates for arthroplasty, is not substantiated by the citations provided in the LCD document.



Poster #27

Premature Failure at Short Term follow up in Primary Total Hip Arthroplasty using a Modular Femoral Component

Paul H. Yi, BA, Michael B. Cross, MD, Rajeev Puri, MD, Mario Moric, Scott M. Sporer, MD, MS

Introduction: Modular femoral components allow the surgeon to intraoperatively adjust offset, leg length, and anteversion; however, modularity may increase the risk of dissociation, fracture, or corrosion at the modular junctions. The purpose of this study was to assess the early failure rate of a THA system that utilizes a modular neck.

Methods: A consecutive series of 221 primary THAs performed by one surgeon using a single THA system that features a star-shaped modular femoral neck were reviewed. Patients were evaluated clinically and radiographically at a minimum of five years. Clinical failure was defined as revision surgery for any cause. Kaplan-Meier survival curves were generated to assess survival with the endpoints of all-cause and implant fatigue failures. Receiver-operating-curves (ROC) were generated with area under the curve (AUC) to determine predictive risk factors for failure.

Results: Of the 221 original patients, 28 died before 24 months follow-up and 64 were lost to follow-up (29%). The remaining 129 patients had a minimum follow-up of 5 years (mean, 6.5 years; range, 5-8). At latest follow-up, there were 25 clinical failures requiring revision (19.4%), 21 of which were associated with the prosthesis: 13 dissociations of the modular neck from the stem, 8 prosthetic fractures, 3 episodes of recurrent instability, and one deep infection. Assuming there were no failures in patients lost to follow up, the failure rate is at least 13% in less than 7 years post-operatively. Kaplan-Meier survival curves revealed 81% survivorship at 7 years. Increasing body mass index and higher overall offset were both useful predictors of mechanical failure with AUC of 0.71 and 0.72, respectively.

Conclusions: The modular neck THA system utilized in this consecutive series of patients demonstrates an alarmingly high failure rate at short-term follow-up. Although modular components have their benefits, their widespread use should be approached with caution.

Poster #28

Total Hip Arthroplasty in Young Patients Comparison of Three Bearing Surfaces

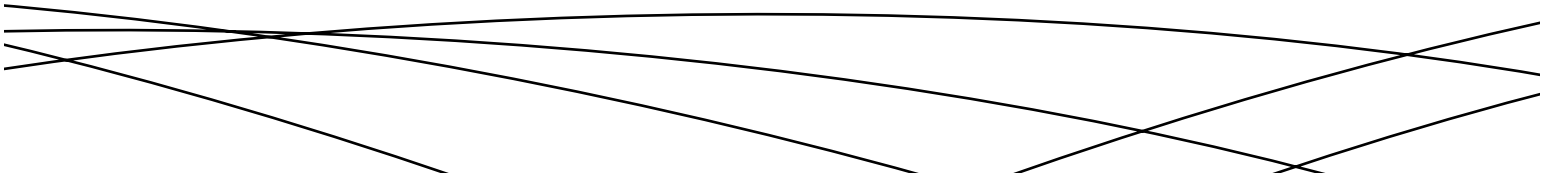
Gail E. Pashos, BS, Christopher D. Nelson, DO, John M. Martell, MD, **John C. Clohisy, MD**

Introduction: Optimal bearing surfaces used for total hip arthroplasty in the young patient continues to be debated, and the recent problems with hard on hard bearings underscores the importance of this topic. The goal of total hip arthroplasty in the young patient is to enhance function, decrease wear and osteolysis and to increase implant survival. The purpose of this study is to compare primary total hip arthroplasty outcome scores, wear analysis and revision rates in three consecutive longitudinal cohorts of young patients undergoing total hip replacement with distinct bearing surface combinations.

Methods: Three consecutive, prospective, longitudinal cohorts comprise this study. All patients were 50 years or less. The cohorts include: 1) CoCr on conventional polyethylene (112 hips/ 97 patients, average age 39.5 and BMI 28.8), 2) CoCr on HCLPE (122 hips/ 115 patients, average age 40.7 and BMI 28.4) and 3) alumina ceramic on HCLPE (161 hips /148 patients, average age 38.1 and BMI 29.1). Hip function was determined with the modified Harris hip (mHHS) and UCLA scores. Median linear polyethylene wear was measured by the Martell edge detection method (Hip Analysis Suite, version 8.0.1.7).

Results: Average HHS improved from 41 to 83.2 at 67.2 months in CoCr/conventional, 48.9-83 at 69.8 months in CoCr/HCLPE and 49.4-84.5 in ceramic/HCLPE. Median UCLA improved from 3 to 5 in CoCr/conventional and from 4-6 in the other groups. Clinical improvements between groups were not significantly different. Median linear wear rates were 0.148 mm/yr for CoCr/Conv, 0.047 mm/ year for CoCr/ HCLPE and 0.0375 mm/yr for ceramic/ HCLPE. There were two revisions for aseptic loosening in the CoCr/ HCLPE group and one each in the other two groups.

Conclusion: In the young THA patient population, HCLPE is associated with major reduction in wear with no catastrophic failures. Continued follow up is needed to determine long-term performance



Poster #29

Prevalence and Predictors of Pseudotumor and Elevated Metal Ion Levels following Large-Diameter Head Metal-on-Metal Total Hip Arthroplasty

Nick G. Bayley, MD, Habeeb A. Khan, MBBS, Paul Grosso, MD, FRCS(C), Thomas Hupel, David G. Stevens, MD, BSc, FRCS(C), Mathew G. Snider, MD, FRCSC, Paul R. Kuzyk, MD, MASc, FRCSC, Emil H. Schemitsch, MD

Introduction: Soft-tissue masses or "pseudotumors" around metal-on-metal total hip arthroplasty (MoM THA) have been frequently reported. Several risk factors including elevated metal ion levels have been associated with the presence of pseudotumor. Therefore, the goals of this study were to: 1) determine the prevalence of pseudotumors in patients undergoing large-diameter head MoM THA, 2) identify risk factors associated with pseudotumor formation and elevated metal ion levels, and 3) determine the early failure rate of large-diameter MoM THA in our cohort.

Methods: Between December 2006 and November 2012, 258 hips (215 patients) underwent large-diameter primary MoM THA. A subset of 199 hips (164 patients) with an average follow-up of 4.3 years (1-7 years) was recruited for ultrasound screening for the presence of pseudotumor. Whole blood cobalt and chromium ion levels, UCLA activity level, WOMAC score, patient demographics, as well as surgical, implant, and radiographic data were collected. Statistical correlations were determined to compare presence of pseudotumor and elevated ion levels with all other factors.

Results: A solid, cystic, or mixed mass was detected in 19.9% of hips. No correlation was found between the presence of pseudotumor and any risk factor. Cobalt and chromium ion levels were positively correlated with acetabular inclination angle ($p<0.05$), female gender ($p<0.01$), the presence of bilateral implants ($p<0.01$), and were negatively correlated with femoral head size ($p<0.01$), and BMI ($p<0.01$). A multivariate log-linear model for elevated cobalt and chromium ions had significant correlations ($p<0.05$) with smaller femoral head size, bilateral MoM THA, female gender, and low BMI. The overall survival of MoM THA was 96.5% at a mean follow-up 4.4 years (1-8 years).

Conclusions: Bilateral implants, smaller femoral head size, female gender, and lower BMI were correlated with elevated cobalt and chromium ion levels in MoM THA at mid-term follow-up.

Poster #30

RCT Comparison of Delta Ceramic Versus Metal Against Contemporary Annealed Polyethylene in THA

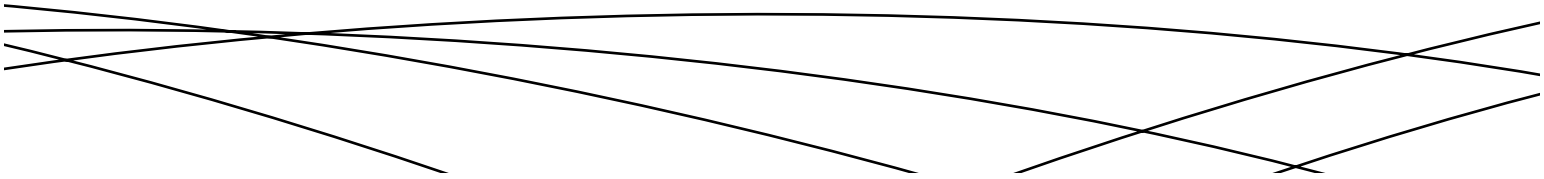
Amine Zaoui, Samer El Hage, **Jean Langlois, MD,**
Caroline Scemama, Jean Pierre Courpied, Moussa Hamadouche

Introduction: The purpose of this study was to compare the effect of femoral head material (delta ceramic versus metal) on polyethylene wear in a consecutive prospective randomized series of low friction total hip arthroplasty.

Methods: A total of 110 patients with a mean age of 60.6 $\pm$ 9.3 (34-75) years were randomized (power of 90% , alpha of 5%) to receive either a metal (55 hips) or a delta ceramic (55 hips) femoral head. The polyethylene socket was moderately cross-linked (3 Mrads of gamma radiation in nitrogen) and annealed at 130°C in all hips. All other parameters were identical in both groups. The primary criterion for evaluation was linear head penetration measurement using the Martell system, performed by an investigator blinded to the material of the femoral head. Creep and steady state wear values were calculated.

Results: At the minimum of 3-year follow-up, complete data were available for analysis in 38 hips at a median follow-up of 4.4 years (3.0 to 5.7), and in 42 hips at a median follow-up of 4.0 years (3.0 to 5.4) in the metal and delta ceramic groups, respectively. The mean creep, measured as the linear head penetration at one year follow-up, was 0.42 $\pm$ 1.0 mm in the metal group versus 0.30 $\pm$ 0.81 mm in the delta ceramic group (Mann and Whitney test, $p = 0.56$). The mean steady state penetration rate from one year onwards measured 0.17 $\pm$ 0.44 mm/year (median 0.072) in the metal group versus 0.074 $\pm$ 0.44 mm/year (median 0.072) in the delta ceramic group (Mann and Whitney test, $p = 0.48$). No case of delta ceramic femoral head fracture was recorded, and no hip had signs of periprosthetic osteolysis.

Discussion and Conclusion: This study demonstrated that up to 5-year follow-up, delta ceramic femoral head did not significantly influence creep neither wear of a contemporary annealed polyethylene. Longer follow-up is necessary to further evaluate the benefits of delta ceramic observed in vitro.



Poster #31

Early Failure in Metal on Polyethylene Total Hip Arthroplasty with Modular Stem-Neck Junction

Edward M. Vasarhelyi, MD, MSc, FRCSC, Brent Lanting, MD, FRCSC, Matthew G. Teeter, PhD, Douglas D. Naudie, MD, FRCSC, James L. Howard, MD, MSc, FRCSC

Purpose: The purpose of this study was to review the clinical, histological and biochemical findings of patients with a modular neck total hip arthroplasty (THA).

Methods: All patients who have been implanted with a modular neck between 2010 and 2012 were reviewed. Demographic and surgical data, patient symptoms and revisions were evaluated. In addition to patient clinical evaluations with WOMAC and Harris Hip Scores, work-up of this cohort included metal ion levels consisting of cobalt, chromium and titanium. Symptomatic patients were evaluated with MRI.

Results: A total of 91 patients were included. They had a mean age of 64.3+/-9.7 year, a mean BMI of 31.32+/-7.3 and a diagnosis of OA (90%), AVN (7%), and RA (3%) at the time of initial THA. A total of 14 patients (4 males, 10 females) have undergone revision THA for pseudotumour confirmed on MRI (5 hips), infection (5 hips), loose stem (2 hips), periprosthetic fracture (1 hip) or pain (1 hip). Three patients were deceased.

There were no statistical differences in metal ion levels in the unrevised and revised groups there were no statistically significant differences. The unrevised hips had mean levels of cobalt, chromium and titanium of 4.44+/-3.33, 0.81+/-0.62 and 3.63+/-1.72 ppb respectively. This compared to the mean levels of cobalt, chromium and titanium in the revised hips of 5.01+/-3.66, 0.71+/-0.49 and 2.71+/-1.19 ppb respectively.

Conclusion: There have been safety concerns regarding this modular THA system. This cohort of patients with a modular neck-stem junction is experiencing a high early revision rate. We are currently following all patients with these stems closely with clinical follow-up and metal ion levels. Any patients reporting hip symptoms are also evaluated with an MRI. Metal ion levels however might not serve as a useful indicator of failure.

Poster #32

Differences in Patient Characteristics Prior to Total Hip Arthroplasty between Switzerland and the US

Anne Lübbeke, MD, DSc, Panayiotis Christodilopoulos, Pierre Hoffmeyer, Patricia D. Franklin, MD

Introduction: Total hip arthroplasty (THA) results are often generalized across countries. However, patient- and environment-dependent factors may differ considerably between countries possibly leading to differences in results of one specific implant and to differences in the national revision burden. Our objective was to describe and compare preoperative patient characteristics prior to THA from two large cohort studies, one conducted in Switzerland and the other in the US.

Methods: Patient characteristics were collected prospectively on all elective primary THAs performed (1) at a large tertiary center in Geneva, Switzerland between 1/2010 and 12/2011 and (2) in FORCE-TJR, a diverse, national sample of 100 surgeons in the U.S. between 6/2011 and 8/2012. Information was obtained on age, sex, BMI, diagnosis, medical co-morbidities, and patient-assessed outcome measures (WOMAC pain and function (reduced form), general health questionnaire SF-12 (SF36/US) physical and mental component scores. Higher scores indicate less pain and better function/health. We calculated risk ratios, mean differences, and effect sizes to compare scores.

Results: 1,912 THAs from the U.S. cohort and 673 THAs from the Swiss cohort were evaluated. Patients in the U.S. compared to those in Switzerland were younger (64 vs. 68 yrs.), more often obese (BMI $\geq$30: 39% vs. 23%), had more diabetes, and reason for THA was more frequently primary OA. Patients in the U.S. had higher preoperative WOMAC pain scores (47 vs. 40 points) indicating less hip-specific pain preoperatively. Only small differences were observed for WOMAC function and SF-12, with the US reporting poorer global function pre-THA.

Conclusion: We found substantial differences in baseline characteristics, especially in age, obesity and diabetes prevalence, and preoperative hip pain levels between a U.S. and a Swiss cohort of THA patients. These findings have potentially important implications for the comparison of THA results, and they call for adequate risk adjustment in cross-cultural comparisons.

Poster #33

Tourniquet in Knee Arthroplasty – Duration of Inflation does not Affect the Incidence of Venous Thromboembolism

Ibrahim J. Raphael, MD, Camilo Restrepo, MD, Paul M. Lichstein, MD, MS, Javad Parvizi, MD, FRCS

Introduction: The relationship between tourniquet time, insufflation pressure, and the incidence of venous thromboembolism (VTE) in total knee arthroplasty (TKA) remains unclear and few previous studies have endeavored to investigate such correlation. The purpose of our study was to determine the role of tourniquet use in the development of VTE following TKA.

Methods: We reviewed all primary and revision TKA surgeries performed from 2005 to 2012, and contained within our prospectively collected database for which tourniquet time and pressure were recorded. We identified 6,001 patients and collected detailed data on age, gender, BMI, Charlson Comorbidity Index score, primary versus revision procedure, uni/bilateral procedure, type of anesthesia, type of anticoagulation, surgical time, tourniquet time, and tourniquet pressure. Patients with documented VTE, including pulmonary embolus (PE) and deep vein thrombosis (DVT), were identified. A multivariate logistic regression analysis controlling for potentially confounding variables was performed.

Results: Tourniquet time was not found to significantly impact the occurrence of DVT (OR=0.98, p=0.002) or PE (OR=0.99, p=0.804). The total operative time on the other hand reached borderline significance (OR 1.01, p=0.085). There was no statistically significant correlation between tourniquet pressure and the incidence of DVT or PE (OR=0.99, p=0.986) and (OR=0.99, p=0.818), respectively.

Conclusion: This study on a large cohort of patients undergoing primary and revision TKA did not find duration of tourniquet time or insufflation pressure to impact the incidence of VTE.

Poster #34

In Vivo Performance of Third Generation Polyethylene in a Large Multi-Center Prospective Randomized Controlled Trial after Total Knee Arthroplasty (TKA): Minimum 5 Year Survivorship

Kirk Kindsfater, MD, Donald L. Pomeroy, MD, Charles R. Clark, MD,
Thomas A. Gruen, MS, Jefferey Murphy, MS, Sam Himden, BA, CCRA

Introduction: Third generation polyethylene offers oxidative resistance and the benefit of reduced wear; however, its adoption in TKA remains limited due to the concern of mechanical failure. This study compared survivorship, clinical, radiographic, and safety performance of two polyethylene types.

Methods: This prospective, multicenter, randomized, IRB approved study accrued 926 knees in 767 patients between February 2005 and July 2007. The tibial tray and polyethylene locking mechanism was identical in both groups. Subjects were randomized to either the moderately crosslinked polyethylene (MCP) (4MRad) or a third generation crosslinked, remelted polyethylene (CRP) (5MRad) group. 65% were females, 99% were diagnosed with osteoarthritis, average age at surgery was 66 years, and 33 was the average BMI. Clinical and radiographic (blinded reviewer) comparisons were made using minimum 5-year (average 5.4 years, range 4.5 to 7.6 years) follow-up.

Results: Demographics, posterior cruciate retaining/sacrificing design, and alignment (anatomical) was similiar between groups, nor were differences observed in postoperative follow-up comparisons using American Knee Society, WOMAC, radiographic outcomes, and adverse event rates. The MCP group had 10 revisions compared to 6 for the CRP group, where revision was defined as removal of any component for any reason. The 6.04 year survivorship estimates were 96.8% for MCP (95% CI: 93.9%, 98.4%) compared to 98.1% for CRP (95% CI: 95.6%, 99.2%) providing a log-rank p-value of 0.42. There were no revisions for polyethylene wear, osteolysis, or tibial insert disassociation for either group.

Discussion: The concern of mechanical failure has been raised in regards to crosslinked, remelted polyethylene. The zero incidence revision for polyethylene failure (early wear, early catastrophic failure, and mechanical failure) in the CRP group is encouraging at five years. The survivorship, clinical, radiographic, and safety results demonstrated CRP is comparable to MCP. There are no concerning early findings associated with CRP polyethylene.

HIV Infection and Risk of Perioperative Complications following Total Knee Arthroplasty

Qais Naziri, MD, Matthew R. Boylan, Kimona Issa, MD, Harpal S. Khanuja, MD, Aditya V. Maheshwari, MD, Michael A. Mont, MD

Summary: This study compared the cost, length and risk of short-term complications during admission among HIV-positive and HIV-negative patients admitted for primary total knee arthroplasty.

Background: Human Immunodeficiency Virus infection has been previously reported as a potential risk factor for end-stage degenerative joint disease. Recent studies have shown successful mid-term outcomes following joint arthroplasty in HIV-positive patients, but little data exists on the risk of perioperative complications.

Methods: The Nationwide Inpatient Sample (NIS) was queried between 1998 and 2010 to identify a total of 1,157,315 patients with TKA as their primary procedure code. We used discharge ICD-9 codes to identify 563 HIV-positive patients and used the remaining 1,156,752 patients as our HIV-negative reference group. We used multivariate logistic and linear regression, adjusting for age, gender, race, year of admission, and Deyo comorbidity score, to calculate odds ratios (ORs) of major perioperative complication (death, myocardial infarction, tachycardia, pulmonary embolism, pneumonia, acute renal failure, stroke) and minor perioperative complication (wound hemorrhage, wound complication, deep vein thrombosis, wound infection, implant infection, irrigation and debridement, post-operative dislocation, sepsis, urinary tract infection), as well as mean difference in log-transformed length of stay and total hospital charges, for HIV-positive versus HIV-negative patients.

Results: The prevalence of major and minor complications among HIV-negative admissions was 3.02% and 4.58%, respectively, compared to 3.20% and 4.44%, respectively, among HIV-positive patients. Compared to patients without HIV, HIV-positive patients had an OR of major complication of 1.29 (95% CI, 0.83-2.00; $p=0.2641$) and an OR of minor complication of 1.51 (95% CI, 0.94-2.43; $p=0.0880$). Mean length of stay among HIV-positive patients was 19.71 (95% CI, 16.20-23.32; $p<0.0001$) percent longer, and total charges were 29.22 (95% CI, 24.43-34.18; $p<0.0001$) percent higher.

Conclusion: HIV-positive patients undergoing TKA had similar risk of perioperative complications compared to patients without HIV. Despite this finding, HIV-positive patients had significantly increased length and cost of admission.

Poster #36

The Anatomic Graduated Component (AGC) Primary Total Knee Arthroplasty at 20-26.5 Year Follow-Up

John W. Barrington, MD, Roger H. Emerson Jr., MD

Introduction: Primary TKA is among the most effective medical procedures in the world improving quality of life. The purpose of this longitudinal study is to evaluate the long-term results of one unconstrained CR-TKA with compression-molded polyethylene, introduced in 1983.

Methods: Between January 1985 and May 1991, a consecutive series of 435 primary CR-TKA were performed in 334 patients (58% female) with an average age of 67.8 years and prospectively followed in a practice-based registry. The diagnosis was OA in 85%, RA in 11%, and other in 4%.. Knee society scores (with 95% confidence interval), and survivorship via life-table analysis, were analyzed. Groups were compared using a two-sample unequal variance Student's T-test, two-tailed distribution. Power analysis determined that a minimum of 26 patients per group would be required for a probability level of p=0.05, effect size of 0.8, and statistical power level of 0.80.

Results: The survivorship with aseptic revision of the femoral or tibial component as the endpoint, was 96.8% at 20 years, and 96.5% at 25 years, with 15 failures in 435 knees. Five knees failed because of tibial loosening/subsidence. (p=NS for group comparison). Three femurs were revised for loosening (Universal n=2, or 4.8%; Anatomic n=1, or 0.3%. p=0.0008). Four knees were revised for late instability (p=NS). Three knees were revised for unexplained pain (p=NS)

Survivorship, with reoperation for any reason was 85.6% at 20 years, and 84.5% at 25 years. In addition to the 15 femur and/or tibia revisions, there were an additional 52 reoperations. There were 24 polyethylene failures (Non-Mod n=4, or 1.2%; Mod-1 n=17, or 21% {p<0.0001}). Twenty-one knees had patella revisions for loosening. Five knees were revised for infection. Two patients suffered extensor mechanism disruption.

Conclusion: This study demonstrates the long-term survivorship of one CR-TKA in a non-designing practice, and confirms the success of unconstrained articular geometry and compression-molded polyethylene.

Poster #37

Extramedullary Guides versus Portable Navigation for Tibial Component Alignment in Total Knee Arthroplasty: A Randomized, Controlled Trial

Denis Nam, MD, Elizabeth Cody, Joseph Nguyen, Mark P. Figgie, MD, David J. Mayman, MD

Introduction: Extramedullary (EM) tibial alignment guides have a limited degree of accuracy in total knee arthroplasty (TKA). The purpose of this study was to compare the tibial component alignment, and the ability to achieve a specific goal for alignment between a portable, accelerometer-based navigation device, and EM guides.

Methods: Five surgeons participated in this prospective, randomized, controlled trial. Patients received a TKA using either the navigation device (navigation cohort), or an EM guide (EM cohort) to perform the tibial resection. Intraoperatively, surgeons recorded their alignment goal, and an IM femoral guide was used for all TKAs.

Standing AP hip-to-ankle and lateral knee-to-ankle radiographs were performed. Two, independent observers in a blinded fashion measured the tibial and femoral component, and lower extremity alignment.

140 total patients were required to detect a 20% improvement in accuracy. Analysis after the enrollment of 100 patients revealed a statistically significant difference with adequate power, and enrollment was discontinued. Statistical analysis was performed using a Student's t-test and Fischer's exact test ($p<0.05$ = significant).

Results: 95.7% of tibiae in the navigation cohort were within 2° of perpendicular to the coronal, tibial mechanical axis, versus 68.1% in the EM cohort ($p<0.001$). 95.0% of tibiae were within 2° of a 3° posterior slope, versus 72.1% in the EM cohort ($p=0.007$). The difference between the surgeons' goal and postoperative alignment for varus/valgus was 0.9° +- 0.7° in the navigation cohort, versus 1.5° +- 1.1° in the EM cohort ($p<0.001$). For posterior slope, the difference was 0.9° +- 1.2° in the navigation cohort, versus 1.8° +- 1.7° in the EM cohort ($p=0.01$).

70.2% of femoral components in the navigation cohort and 66.0% in the EM cohort were within 2° of perpendicular to the coronal, femoral mechanical axis ($p=0.66$). 89.4% of TKAs in the navigation cohort and 74.5% in the EM cohort were within 3° of a neutral, mechanical alignment ($p=0.1$).

The blinded, interobserver correlation coefficients were good to excellent for all measurements ($r=0.84$ to 0.97).

Conclusion: This randomized, controlled study demonstrates that a portable, accelerometer-based navigation device significantly improves tibial component alignment versus EM guides in TKA.

Poster #38

Polished Tibial Trays Reduce Backside Wear, Independent of Post Location in Contemporary PS TKAs

Matthew P. Abdel, MD, Mark W. Gesell, MD, Christen W. Hoedt, BS, BA, Kathleen N. Meyers, MS, Timothy M. Wright, PhD, Steven B. Haas, MD

Introduction: Backside wear of the polyethylene insert in total knee arthroplasty (TKA) remains a source of wear generated debris, which can contribute to osteolysis. The location of the tibial post in different posterior-stabilized (PS) designs may influence the location of backside wear, as may the surface roughness. We examined retrieved polyethylene implants from 3 contemporary PS TKA designs with different tibial post locations and surface roughness to determine if post position or surface roughness influenced backside wear.

Material and Methods: We identified 385 PS tibial inserts retrieved from a large hospital database, including 145 Zimmer NexGen®, 142 Exactech Optetrak®, and 98 Smith and Nephew Genesis® II inserts. The tibial posts were examined and scored according to the location and quantity of damage. The backside of the inserts were then divided into quadrants and examined for evidence of burnishing, scratching, pitting, surface deformation, embedded debris, and delamination and subsequently scored utilizing a subjective grading scale.

Results: No correlation was found between the location of damage on the post and location of damage on the backside of the implant. The Genesis® II polyethylene implants, which articulate with a highly polished tibial tray, showed a significantly lower total backside damage score of 18.2 ± 6.1, compared to 23.3 ± 10.8 for Optetrak® and 23.9 ± 7.0 for NexGen® ($p < 0.01$). The Genesis® II and Optetrak® showed significantly more wear in the posteromedial quadrants of the implants. A linear regression analysis revealed that implant design with a highly polished tibial tray was the strongest correlate with wear damage. Age, length of implantation, and BMI did not affect damage wear scores.

Conclusion: Implant design with a highly polished tibial tray leads to decreased backside wear damage. However, tibial post design and location do not influence the location of backside wear.

Poster #39

No Increased Risk of Knee Arthroplasty Failure in Metal Hypersensitive Patients: A Matched Cohort Study

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Introduction: The purpose of this study is to investigate the effects of skin metal hypersensitivity on knee arthroplasty function and survivorship.

Methods: For the years 1997 through 2009, 127 patients underwent 161 knee arthroplasties after skin patch allergy testing (SPT). Cases were matched by age, sex, BMI, ASA score and implant manufacturer to 161 controls without metal allergy. The 322 knee arthroplasties were subsequently divided into 3 groups after review of patch testing: Group 1: positive SPT for metals (n=56), Group 2: negative SPT for metals (n=105) and Group 3 controls (n=161). Within the first group, 17 knees had a so-called hypoallergenic knee (Group 1a) while 39 cases did not (group 1b). Median follow-up was 5.3 yrs, and 79.5% were female. Revision, re-operation, and complications (Including: arthrofibrosis, instability, and infection) were assessed using the Kaplan Meier method and Cox models.

Results: Survivorship free of revision at 5 years was 98.1% [94.4-100; 95% CI] for group 1 and did not differ statistically from that of controls (97.6% [93.1-100; 95% CI]; HR=1.46, p=0.65). For group 1a, the 5-year rate of survivorship free of revision was 100%, while the corresponding rate for group 1b was 97.1% [91.8-100; 95% CI]. There was no significant difference in survivorship free of revision between groups 1 and 2 (98.1% [94.4-100; 95% CI] vs. 100%; HR=2.69, p=0.29). The most common complications seen were arthrofibrosis and instability seen in 34 knees (group 1: n= 5, group 2: n=18 and group 3: n=11) and in 11 knees (group 1: n=2, group 2: n=4 and group 3: n=5), respectively. The only significant difference with the numbers available for study was survivorship free of arthrofibrosis that was significantly worse in patients who were SPT negative compared to controls (HR=3.5, p=0.01).

Conclusion: Patients with a positive SPT have similar clinical outcomes with respect to implant survival, and complication rate compared to non-hypersensitive patients. To our knowledge this is the first study that negates a causal relationship between metal hypersensitivity and knee arthroplasty failure.

Poster #40

Variability of Tibial Tray Rotation: How Accurate are our Most Reliable Methods? Rotational Verification with the use of Intraoperative Sensors

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Introduction: Malrotation of the femoral and/or tibial component is associated with pain, accelerated wear of the tibial insert, joint instability, and unfavorable patellar tracking. No gold standard currently exists for ensuring optimal rotation of the tibial tray. Literature has suggested that implantation methods, which reference the tibial tubercle, reduce positioning outliers. Therefore, the purpose of this evaluation is to use data collected from intraoperative sensors to assess the true rotational accuracy of using the mid-medial third of the tibial tubercle in 145 TKAs.

Methods: 145 consecutive patients underwent primary TKA from the same surgeon. Femoral component rotation was verified via the use of the Whiteside line, transepicondylar axis, and appropriate patellar tracking. Tibial tray rotation was initially established by location of the mid-medial third of the tibial tubercle. Rotational adjustments of the tray were evaluated in real-time, throughout correction of tibiofemoral incongruency. The initial/final angles of tibial tray rotation were recorded.

Results: After the sensor-equipped tibial insert was implanted, it was shown that 63.1% ($p<0.0001$) of patients exhibited incongruency (70% were internally rotated; 30% were externally rotated). The average tibiofemoral incongruency was $6.3° \pm 4.3°$ from a neutral position. The 95% confidence interval of this cohort was calculated to be between 44.8% and 71.8% of incongruency.

Discussion: Malrotation in TKA is associated with poor clinical outcomes. No gold standard anatomic landmark currently exists for positioning the tibial tray, however the mid-medial third of the tibial tubercle is widely used. The data from this evaluation demonstrates that this landmark is insufficient for establishing optimal rotation ($p<0.0001$), and had guided the surgeon to an average of 6.3° outside of the optimized implant congruency zone. The large confidence interval indicates that the rotational alignment of the tibial tray—based on the location of the mid-medial third of the tibial tubercle—is inaccurate, and highly variable.

Poster #41

Outcomes of Total Knee Arthroplasty in Relation to Osteoarthritis in the Contralateral Knee: Data from the Osteoarthritis Initiative

Timothy L. Kahn, BA, Aydin Soheili, **Ran Schwarzkopf, MD, MSc**

Introduction: While total knee arthroplasty (TKA) generally has excellent outcomes, there is a significant proportion of patients who experience relatively poor post-operative function. Among others, one substantial factor associated with outcomes may be the health of the contralateral knee. In this study, we tested the hypothesis that the level of osteoarthritic symptoms in the contralateral knee at the time of TKA is associated with poorer post-operative outcomes in the operated knee.

Methods: Using longitudinal cohort data from the Osteoarthritis Initiative (OAI), we included 171 patients who received a unilateral TKA. We then compared their pre-operative Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores in the contralateral knee to post-operative WOMAC scores in the index knee (average 2.9 years between TKA and measurement; minimum follow-up of 6 months). We also compared the longitudinal change in contralateral knee WOMAC scores to post-operative knee index WOMAC scores. Kellgren and Lawrence (KL) grades were assigned to the pre-operative contralateral knee – these grades were compared to post-operative index knee WOMAC scores.

Results: All subsets of pre-operative contralateral knee WOMAC scores (Disability, Pain, Stiffness, Total) were associated with post-operative index knee WOMAC Total scores ($r=.336$, $p<.001$; $r=.319$, $p<.001$; $r=.270$, $p<.001$; $r=.339$, $p<.001$, respectively). Longitudinal change in contralateral knee WOMAC Total scores was associated with post-operative index knee WOMAC Total scores and overall change in index knee WOMAC Total scores ($r=-.176$, $p=.022$; $r=.312$, $p<.001$, respectively). Pre-operative KL grades did not show significant associations with post-operative index knee WOMAC scores.

Conclusion: Pre-operative contralateral knee WOMAC scores were positively correlated with post-operative index knee WOMAC scores, indicating that the health of the pre-operative contralateral knee is a significant factor in TKA outcomes. The level of function and pain in the contralateral knee should be more fully considered before unilateral TKA.

Poster #42

Perioperative Outcomes of Solid Organ Transplant Patients following Total Knee Arthroplasty in the United States

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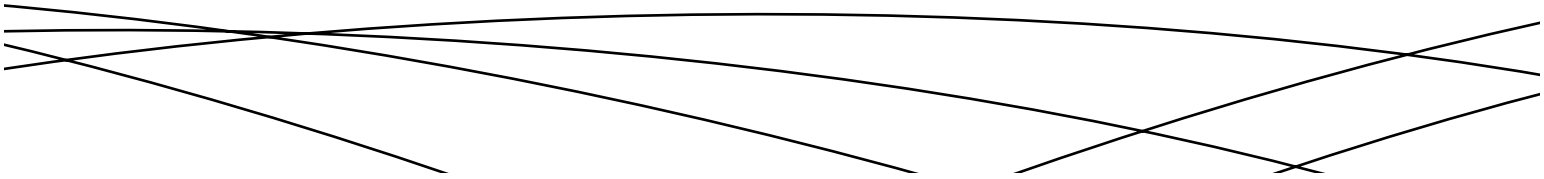
Introduction: Patients with a history of solid organ transplant may be at greater risk of complications following TKA due to immunosuppression and metabolic derangements secondary to organ dysfunction. The purpose was to use a large, nationally representative database to compare morbidity, length of stay (LOS), and charges for TKA patients with and without a history of solid organ transplant.

Methods: This retrospective study was a review of the Nationwide Inpatient Sample (NIS) from 1998 to 2010. Patients who had a primary TKA (81.54) were included (n=5,706,675, weighted frequency). 763,924 cases were excluded (age <18, fracture of lower extremity, metastatic cancer, previous/ bilateral arthroplasty, not "elective" admission). The remaining 4,942,751 patients were categorized as transplant (n=5,245; liver, kidney, heart, lung, pancreas) or non-transplant group (n=4,931,017). A multivariable regression model was used to identify association(s) between history of solid organ transplant and morbidity, LOS and hospital charges, while adjusting for patient and hospital characteristics.

Results: TKA volume increased among transplant patients at a rate of 382%, compared with 197% for non-transplant patients ($p<0.01$). Transplant patients had a significantly higher prevalence of renal failure, liver disease, uncomplicated diabetes, hypertension, deficiency anemia ($p<0.001$). Transplant patients suffered 1 or more complication at a rate of 7.3%, compared with 5.7% for the non-transplant group ($p<0.001$). Unadjusted trends for mean LOS show that transplant patients have a longer LOS (4.2 days) and higher mean charges per admission ($40,999) than non-transplant patients (3.7 days; $35,686; $p<0.001$). After adjustment, transplant patients stayed 0.46 days longer in the hospital ($p<0.01$) and had $3,480 increased charges ($p<0.01$).

Conclusion: The rate at which TKAs are performed on patients with a history of solid organ transplant is increasing at nearly twice that of non-transplant patients. Transplant patients have a significantly higher number of comorbidities, longer LOS, and greater charges associated with TKA.



Poster #43

Causes of a Second Operation after Unicompartmental Knee Arthroplasty

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Introduction: Unicompartmental knee arthroplasty (UKA) is becoming an increasingly popular treatment option in single compartment osteoarthritis. As a result, diverse second operations including revision total knee arthroplasty (TKA) will likely also increase. The objective of this study was to investigate the distribution of causes of second operations after UKA.

Methods: Retrospectively we reviewed 694 UKAs performed in 596 patients from January 2003 to December 2011. All UKAs were replaced at medial compartment of knee. Patients included 559 (80.4%) women and 136 (19.6%) men. The mean age at time of UKA was 61.5 years. Mobile-bearing designs were predominantly used (90.2%; 628 mobile, 67 fixed). The mean interval between UKA and second operation was 14.1 months.

Results: Second operation burden after UKA was 7.3%. The total number of second operations was 51 (45 mobile, 6 fixed). The most common cause of second operation after mobile-bearing UKA was dislocation of the meniscal bearing (34.8%), followed by component loosening (21.7%), cement loose body (15.2%), unexplained pain (13%), infection (6.5%), periprosthetic fracture (4.3%), and other (4.4%). In fixed type arthroplasty, there were 2 second operations resulting from loosening, 2 from unexplained pain and 1 from bearing wear. Multiform operations including manipulation, internal fixation for periprosthetic fracture, isolated bearing change, open debridement with bearing change, implant removal for early infection, revision UKA and conversion to TKA were performed according to cause. Conversions to TKA at second operation were performed in 17 cases.

Discussion and conclusion: The most common cause of second operation after mobile bearing UKA was dislocation of bearing. In fixed bearing arthroplasty, component loosening and unexplained pain were common even with small number of cases. A cause-based approach to both the primary and failed UKA may be helpful to minimize the possibility of second operation and to yield improved outcomes of revision TKA.

Poster #44

The Incremental Hospital Cost and Length-of-Stay Associated with Treating Major Complications among Medicare Beneficiaries Undergoing Total Knee Arthroplasty

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Background: The purpose of this study is to estimate the increment hospital costs and additional length-of-stay (LOS) for Medicare Beneficiaries (MBs) experiencing a major complication while undergoing TKA in a US hospital during Fiscal Year 2011.

Methods: This retrospective study uses the fiscal year 2011 Medicare Provider Analysis and Review (MedPAR) File to identify 355,564 MBs who underwent TKA in a US hospital. Hospital costs for each admission were estimated by multiplying billed charges for that admission by each hospital's overall cost-to-charge ratio for the fiscal year. Complications and comorbidities were coded using the appropriate set of ICD-9-CM codes and present on admission (POA) flags to classify complications from comorbid conditions present at admission. Separate multi-variate regression equations, controlling for 32 patients demographic and comorbid conditions, were used to estimate the incremental cost and incremental LOS for each complication.

Results: Among MBs undergoing TKA, a total of 42,164 (11.9%) experienced at least one study complication. The observed average hospital cost of MBs who experienced at least one of the major complications was $16,499 (mean stay 4.3 days) compared to an observed average cost of $14,163 (mean stay 3.3 days) among MBs without complications. The additional incremental costs for complications were: $1,763 hemorrhagic anemia requiring transfusion; $5,324 VTE; $5,898 ARF; $14,628 infection; $16,478 mortality; and $29,456 pneumonia. All estimated incremental cost and LOS coefficients were significant.

Conclusion: This study indicates that the three most resource intensive complications to treat following TKA are pneumonia, infection and in-hospital mortality. All three of these complications increase hospital costs by more than $15,000 and average LOS by at least 3.0 days, doubling the cost of a hospitalization compared to MB not experiencing any complications.

Poster #45

Use of Tranexamic Acid in Total Knee Arthroplasty: A Meta-analysis

Mazyar Irani, MD, Pierre Philippe Aubin, Mohammad Rahnavardi, Masumeh Talebi

Introduction: Total knee arthroplasty (TKA) can be associated with significant bleeding which can increase mortality, morbidity and the operative cost. Tranexamic acid (TXA) is an antifibrinolytic drug used as a blood-sparing technique in many surgical specialties. The present systematic review and meta-analysis was performed to assess the effect of tranexamic acid (TXA) in reducing postoperative and actual total blood loss following TKA.

Methods: A systematic review was performed and six electronic data bases, namely Medline, PubMed, Embase, Cochrane central register of controlled trials, Cochrane database of systematic reviews, and database of abstracts of effectiveness were searched for published studies between January 1998 and April 2013 using relevant keywords. Only randomised controlled trials (RCTs) were included. The primary outcome measures were intraoperative blood loss, postoperative blood loss, and actual total blood loss. Other outcome measures included frequency of blood transfusion, mean haemoglobin drop, and frequency of deep vein thrombosis (DVT) and pulmonary emboli (PE).

Results: Of the 375 publication retrieved, 42 potentially relevant papers were found. After applying inclusion and exclusion criteria, a total of 29 RCTs were identified and included for data extraction and analysis. The use of TXA decreased the postoperative blood loss by a mean of 345mL ($P<0.001$), and the actual total blood loss by a mean of 637mL ($P< 0.0001$). The number of patients who required blood transfusion reduced significantly with TXA (risk difference 46%, $P<0.001$). There was no significant increase in the frequency of a thromboembolic event or infection after using TXA.

Conclusion: The current meta-analysis suggests that using TXA can be beneficial in reducing transfusion requirements and perioperative bleeding following TKA. Further well designed RCTs are required before any strong recommendation can be made.

Poster #46

Rivaroxaban versus Enoxaparin for Venous Thromboembolism Prophylaxis after Hip and Knee Arthroplasty

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Introduction: The oral Factor Xa inhibitor rivaroxaban (Xarelto) has been the routine pharmacologic agent used for venous thromboembolism prophylaxis after primary hip and knee arthroplasty at our institution since 2012. The purpose of our study was to compare rates of venous thromboembolism and rates of major bleeding between rivaroxaban and enoxaparin after primary THA and TKA.

Methods: A retrospective cohort study was performed including 1795 consecutive patients who underwent primary THA or TKA at our institution in 2011 and 2012. Patients were excluded who had a bilateral procedure, were on other anticoagulants, when pre-operative creatinine was 1.2 or greater, or patients without 6 weeks of follow-up. After excluding these patients, 1089 patients were included in the study. Chart review recorded demographics, comorbidities, surgery performed, length of stay (LOS), deep venous thrombosis (DVT), pulmonary embolus (PE), and major bleeding events. Periprosthetic infection rates will also be presented at the AAHKS annual meeting. T-tests were used to compare continuous variables between treatment groups, and Chi-square tests were used to compare categorical variables between treatment groups ($\alpha = 0.05$).

Results: There were 779 patients (71.5%) who received enoxaparin and 310 patients (28.5%) who received rivaroxaban during the study period. There were no differences in demographics between the 2 groups: age (E 65.8 ± 10.6 vs. R 65.2 ± 10.0, $p = 0.399$, power $= 0.05$), male gender (E 29.8% vs. R 31.3%, $p = 0.677$, power $= 0.066$), BMI (E 31.9 ± 7.3 vs. R 32.1 ± 6.8, $p = 0.667$, power $= 0.05$), ASA (E 2.6 ± 0.5 vs. R 2.6 ± 0.5, $p = 0.583$, power $= 0.05$), procedure performed (E 60.7% TKA vs. R 59.7% TKA, $p = 0.804$, power $= 0.054$), or LOS (E 2.9 ± 2.0 vs. R 2.8 ± 1.9, $p = 0.745$, power $= 0.050$). Pre-operative creatinine was higher in the enoxaparin group (0.81 ± 0.19 vs. 0.72 ± 0.18, $p < 0.001$). With the numbers available for study, there were no demonstrable differences in DVT (E 2.3% vs. R 1.3%, $p = 0.400$, power $= 0.125$), PE (E 0.8% vs. R 0.3%, $p = 0.679$, power $= 0.066$), cerebrovascular events (E 0.3% vs. R 0.0%, $p = 0.913$, power $= 0.049$), or transfusion rates (E 13.4% vs. R 15.5%, $p = 0.412$, power $= 0.121$).

Conclusion: In the largest non-industry-funded study evaluating the Factor Xa inhibitor rivaroxaban, there were no statistically demonstrable differences between enoxaparin and rivaroxaban in terms of venous thromboembolism or major bleeding complications.

Poster #47

Patient Specific versus Conventional Total Knee Arthroplasty: Perioperative and Cost Differences

Alexander M. DeHaan, MD, **Jacob R. Adams, MD,** Matthew DeHart, Thomas W. Huff, MD

Introduction: The role of patient specific instrumentation in total knee arthroplasty (PSI-TKA) is yet to be clearly defined. Current evidence evaluating perioperative and cost differences against conventional total knee arthroplasty (C-TKA) is unclear. Through a large single-surgeon case series, we hypothesize that PSI-TKA has lower perioperative morbidity and no increased cost when compared to C-TKA.

Methods: A retrospective review of all primary TKAs was examined between July 2008 and April 2013. Patients received either a MRI based PSI-TKA or a C-TKA utilizing intramedullary femoral and extramedullary tibial referencing. Perioperative outcomes measured include tourniquet and total surgical time, room turnover time, blood loss, drain output, transfusion requirements, and hospital length of stay. Cost analysis evaluated multiple variables including the pre-operative MRI, implant and cutting blocks, operative time, and implant tray sterilization.

Results: 339 patients underwent 398 TKAs (PSI-TKA: 331; C-TKA: 67). The groups were similar with respect to age and BMI ($p>0.05$). The mean tourniquet and total surgical times were 21.5 minutes ($p=0.001$) and 24.3 minutes ($p<0.001$) less for the PSI-TKA group, respectively. The PSI-TKA's had a 20% shorter turnover time between cases ($p=0.08$). The PSI-TKA group had a lower post-operative change in hematocrit ($p=0.024$), although no differences with regard to drain output ($p=0.614$), transfusion rates ($p=0.062$), or hospital length of stay ($p=0.123$). At our institution, the PSI-TKA has an upcharge applied to the implant ($500) and there is cost associated with the MRI ($430-$1360). However, this increased cost is offset through money saved in operating room time (65$/minute x 24 minutes = $1560), turnover time efficiency, and fewer surgical trays requiring sterilization ($120-240/case).

Discussion: PSI-TKA resulted in decreased surgical time, decreased blood loss, and increased operating room efficiency when compared to C-TKA. Importantly, the pre-surgical costs of PSI-TKAs were more than offset through the increase in operating room efficiency.

Poster #48

Factors Influencing the Initial Strength of the Tibial Tray-Cement Interface Bond

Fabrizio Billi, Aaron Kavanaugh, BS, Hope Schmalzried, **Thomas P. Schmalzried, MD**

Introduction: The incidence of aseptic loosening of tibial components varies by surgeon (1), which implicates technical factors. We developed a laboratory model to investigate technical factors that influence the initial strength of the tibial tray-cement bond.

Methods: Forty-eight size 4 Triathlon tibial trays were cemented into an acrylic holder using two different cements: Simplex and Palacos; three different cementing times: early (low viscosity), per manufacturer (normal, medium viscosity), and late (high viscosity); two different cementation techniques: cementing tibial plateau only and cementing tibial plateau and keel; and two different fat (marrow) contamination conditions: metal/cement interface and cement/cement interface. A push-out test was performed at a velocity of 0.05 mm/s, and the load recorded continuously at a rate of 10Hz. Statistical analysis was performed using Welch's t-tests and Cohen's d tests.

Results: Compared to cementing under manufacturer-recommended conditions (normal), late cementing reduced the interface strength of Simplex by 47% ($p=0.02$) and Palacos by 63% ($p=0.05$). Early cementing increased interface strength of Simplex by 48% ($p=0.003$) and Palacos by 139% ($p=0.01$). Cementing the keel increased the bond strength of Simplex 153% ($p=0.001$) and Palacos 243% ($p=0.03$) over the respective normal cementing of the plateau only. Fat contamination of the metal-cement interface reduced the interface strength to practically zero ($p=0.0002$) for Simplex and -91% ($p=0.02$) for Palacos. Adding cement to the underside of the tibial tray prior to insertion with fat contamination reduced bond strength to -65% ($p=0.0002$) with Simplex and -1.6% with Palacos ($p=0.3$).

Conclusions: The tibial tray-cement interface is much stronger when the keel is cemented ($p<0.03$). Earlier application of cement to metal increases bond strength ($p<0.01$) while later application reduces it ($p<0.05$). Fat contamination of the tibial tray-cement interface dramatically reduces bond strength, but application of cement to the underside of the tibial tray prior to insertion mitigates this ($p<0.05$).

1. Arsoy et al. CORR, 2013;471(1):94-101

Poster #49

The Role of Surgical Dressing in Total Joint Arthroplasty: Level I Randomized Clinical Trial

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J. Bohannon Mason, MD, Susan M. Odum, PhDc

Introduction: Wound complications following total joint arthroplasty (TJA) are common. Wound healing issues and blisters have been reported in up to 30% of TJA patients. Wound complications are the leading cause of hospital readmission following total joint arthroplasty. There is a paucity of literature reporting the role of surgical dressings in minimizing wound complications. The purpose of this study was to compare the use of an occlusive, barrier dressing vs standard surgical dressing in TJA.

Methods: 270 patients were randomized to either an occlusive, antimicrobial surgical dressing or a standard surgical dressing. All wounds were closed in identical fashion. Dressings were changed per standard protocol or as needed. Outcomes included wound complications (blisters, maceration, prolonged healing etc), frequency of dressing changes, and patient satisfaction.

Results: There was a significant ($p<0.0013$) reduction in wound complications with the occlusive antimicrobial dressing compared with the standard dressing, including skin blistering ($p<0.01$). There was also a significant ($p<0.0001$) reduction in the number of dressing changes in the occlusive antimicrobial dressing vs the standard dressing (0.1 vs 2.3 changes, respectively). Patient satisfaction and perception of hygiene and sterility was significantly improved ($p=0.001$) with the occlusive antimicrobial dressing compared to our standard surgical dressing.

Conclusions: Wound complications are associated with superficial and deep surgical site infections following TJA. They remain the leading cause of 30-day readmission following TJA. The use of an occlusive, barrier, antimicrobial surgical dressing showed a significant reduction in the number of wound complications and blistering. The number of dressing changes (wound exposure to environment), patient satisfaction (ability to shower) and perception of sterility and hygiene was also improved significantly. Occlusive, barrier surgical dressing can play a role in preventing and promoting uneventful wound healing following TJA and may factor in to diminishing 30 day readmission rates following TJA.

Poster #50

What We Can and What We Can't Learn from Minimum Twenty-Year Follow-Up Studies of Total Knee Replacement

John J. Callaghan, MD, **Christopher T. Martin, MD,** David Hennessy, MD, Steve Liu, MD, Devon D. Goetz, MD, Andrew J. Pugely, MD, Yubo Gao, PhD, Richard Johnston, MD

Introduction: Optimally, long term TKR follow-up should provide information concerning durability and performance of the implant and procedure. The purpose of this study was to examine the minimum 20 year follow-up of three prospectively followed, consecutively performed cohorts of knee replacement patients to determine differences in implant durability and performance as well as to provide insight into the long term study of new designs, materials and techniques of knee replacement.

Methods: Three consecutive series of TKR cohorts were performed in a single orthopaedic practice and were prospectively followed for a minimum of 20 years: a rotating platform (119 knees), a modular tibial tray (101 knees), and a unicompartmental design (136 knees). Average age at surgery for all cohorts was 70 years. Survival curves of the patients themselves were generated for all three cohorts in addition to evaluation for revisions, radiographic loosening and osteolysis.

Results: Only 26 knees, 22 knees, and 19 knees for the respective cohorts were still alive at twenty-year follow-up. Revision rates for aseptic loosening were 0%, 5%, and 14%, respectively. The patient survivorship at 20 years for patients over 60 at the time of surgery was 23%, 19%, and 28%, respectively, and for patients under 60 at the time of surgery was approximately 57%, 50%, and 50%, respectively.

Conclusion: These three 20 year studies demonstrate the durability of TKR in these elderly cohorts. The revisions rates were 0%, 5%, and 14%, respectively. Unfortunately, few patients lived to 20 year follow-up. The study demonstrates the need to perform prospective follow-up studies on populations of younger patients in the future when attempting to evaluate differences in design and technique in order to have robust numbers of living patients at long term follow-up. Otherwise the statistical power of the conclusions related to durability and long term performance may be limited.

Poster #51

What is the Most Accurate Insertion Platform for a Mobile-Bearing UKA? A Case-Control, Blinded Radiographic Analysis

John W. Barrington, MD, Roger H. Emerson Jr., MD

Introduction: More than one million total joint arthroplasties (TJA) are performed annually in the United States, and approximately 6% of primary knee arthroplasties are unicompartmental knee arthroplasty (UKA).

One mobile bearing, metal-backed tibia UKA recently underwent instrument simplification, designed to minimize re-cutting the tibia and flex the femoral component approximately 10 degrees. A third insertion platform utilizes MRI-based cutting guides. The purpose of this case-control series was to use independent blinded radiographic analysis to determine the most accurate insertion platform for this mobile-bearing UKA.

Methods: Between October 2010 and October 2011, 100 consecutive mobile-bearing metal-backed UKA were placed by one of two experienced surgeons using traditional phase 3 (P3) instrumentation. Beginning in October 2011 through September 2012, 100 UKA were placed using new simplified instrumentation (MP). A third group of 40 UKA were placed using MRI-based cutting guides (MRI).

This blinded radiographic alignment study was performed on digital PACS images with an electronic goniometer sensitive to 0.1 degree increments. Images were measured via Knee Society guidelines, and for mechanical axis, femur rotation, AP tibia varus/valgus, lateral femoral flexion, lateral tibial slope alignment, and Kennedy Zone measurements.

Power analysis determined that a minimum of 26 patients per group would be required, given a probability level of $p=0.05$, effect size of 0.8, and statistical power level of 0.80.

Results: Femoral component flexion, as intended, was significantly different between P3 and MP, averaging -3.1 degrees (extension) with the P3 instrumentation (goal: 0), and 8.3 degrees (flexion) with the MP instruments (goal: 10) ($p<0.01$ comparing P3 to MP, and P3 to MRI).

Mechanical axis, femur rotation, tibia varus, and tibial slope were not statistically different between the 3 groups.

Conclusion: This blinded case-control study determined that recent instrument simplification and MRI-based cutting guide platforms were both accurate when utilized with one mobile-bearing UKA.

Poster #52

Obesity is Not a Risk Factor for Poor Pain and Function Two Years after Total Knee Replacement

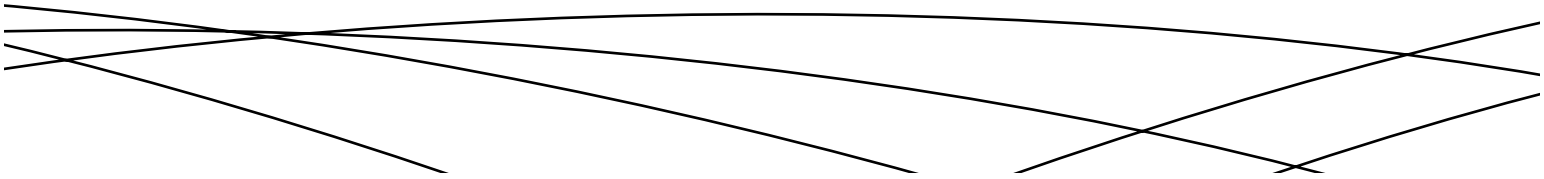
Susan M. Goodman, MD, Alejandro Gonzalez Della Valle, MD, Lisa Mandl, **Mark P. Figgie, MD**

Introduction: Physicians think obesity increases poor outcomes after TKR. Data are conflicting. This study assesses the association of body mass index (BMI) with outcomes after TKR.

Methods: Registry patients with a TKR between July 2007 and June 2009 and BMI>18.5 were enrolled. Poor pain and function were defined as WOMAC < 60. Data were collected pre-operatively and 2 years. Differences were compared using standard techniques.

Results: 2524 patients were included. BMI > 40 were more likely non-Caucasian, female, less educated with more co-morbidities. Pre-operatively, pain and function were least severe <25 BMI, increasing with BMI. Change in pain and function showed a step wise improvement across BMI categories. BMI > 40 improved most. In multivariate regressions, there were no statistically significant associations between any BMI category, co-morbidities and poor pain or function at 2 years. Being female increased the risk of pain (OR 1.6; 95% CI 1.2-2.2; p-value=0.0026) or poor function (OR 1.5; 95% CI 1.1-2.1; p-value=0.0071) at 2 years. Being Caucasian decreased the risk of pain (OR 0.6; 95% CI 0.4-0.9; p-value=0.0072) or poor function (OR 0.5; 95% CI 0.3-0.7; p-value=0.0072); high school education increased the risk of pain (OR 1.5; 95% CI 1.1- 2.1; p-value=0.0122) and poor function (OR 1.9; 95% CI 1.4-2.6; p-value=<0.0001) at 2 years. Age group 61-70 showed a decreased risk of poor pain compared to age <=60, (OR 0.5; 95% CI 0.4- 0.8; p-value=0.0008). At 2 years, 20.4% of patients lost weight, (mean loss 0.6 lbs +/- 2.7), greatest loss BMI >40 (2.7 lbs, +/- 5). There were no significant differences in expectations or satisfaction.

Conclusion: Obese patients have worse pain and function before TKR; outcomes at 2 years are not significantly different. Expectations and satisfaction are no different among BMI groups. Obesity should not be regarded as a risk factor for poor outcomes.



Poster #53

In-Hospital Complications, Renal Failure, and UTIs Increased in 4718 Obese Patients Undergoing TKA

Matthew P. Abdel, MD, Michael P. Ast, MD, Yuo-yu Lee, MS,
Stephen Lyman, PhD, Alejandro Gonzalez Della Valle, MD

Introduction: While others have analyzed the postoperative outcomes of TKAs in obese patients, there is a paucity of literature available in regards to in-hospital complications. As such, the goal of this study was to determine the rates of in-hospital complications for patients with varying degrees of obesity. Our secondary goals were to determine if length of stay and/or discharge disposition were affected based upon BMI.

Patients and Methods: We prospectively identified 4718 patients who underwent unilateral TKA for osteoarthritis between 2007 and 2010. There were 2526 non-obese patients and 2192 obese patients. Patients in the obese group were significantly younger in age ($p < 0.0001$), more likely to be female ($p < 0.0001$), and had longer operating room times ($p < 0.0001$) (Table 1).

Results: Obese patients were more likely to develop any in-hospital complication when compared to non-obese patients after adjusting for age, sex, race, educational status, insurance status, and discharge disposition (6.4% vs. 4.8%, respectively; $p = 0.0097$; OR = 1.5). When analyzing specific in-hospital complications, obese patients were more likely to suffer acute renal failure (ARF) ($p = 0.03$) and urinary tract infections (UTIs) ($p = 0.003$) (Table 2). There was no significant difference in several other post-operative complications analyzed. In regards to length of hospital stay, there was a statistically significant difference between obese and non-obese patients ($p < 0.0004$). Moreover, there was a significantly lower number of patients discharged directly to home in the obese group ($p = 0.0011$).

Conclusions: Obese patients undergoing primary TKA are at increased risk for all-cause in-house complications, ARF, and UTI. This is essential in perioperative management and obese patients should be counseled appropriately. Finally, BMI should be taken into account when analyzing reimbursements and healthcare policies as obese patients have higher in-house complications that require additional healthcare resources.

Poster #54

Preoperative Predictors of Postoperative Pain following Total Knee Arthroplasty

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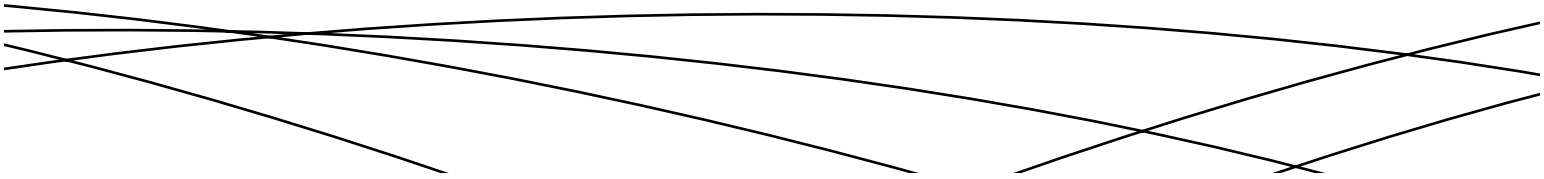
Kathleen A. Sluka, Barbara A. Rakel, PhD, RN

Introduction: Residual pain and dissatisfaction has been reported by 15 to 20% of patients undergoing TKA. Investigators are evaluating the factors that may contribute to pain and dissatisfaction. We have prospectively followed a cohort of patients who underwent TKA and who were evaluated pre-operatively and post-operatively with extensive pain, function, and patient reported outcome tools. The purpose of this study was to determine whether any of these assessment tools could predict intensity of pain post-operatively.

Methods: Demographics, analgesic intake, anxiety, depression, resting pain, pain with simple active ROM, and quantitative sensory tests were performed pre-operatively on 215 subjects undergoing TKA. On postoperative day 2 (POD#2), 6 weeks and 6 months, analgesic intake, resting pain, and pain with active ROM were again assessed. Composite scores were created for pain and coded as low, moderate, or severe pain.

Results: On POD#2, 58 subjects experienced low (27%), 98 moderate (46%), and 59 severe pain (27%). Significant predictors of severe postoperative pain with ROM were high preoperative pain with simple ROM, von Frey pain intensity score and heat pain threshold. People with ROM pain > 15/20 preoperatively were 20 times more likely to have severe pain with ROM on POD#2. This significant association continued at 6 weeks and 6 months with moderate correlation. When the influence of preoperative pain was eliminated, depression was a high predictor of post-op pain.

Conclusion: TKA patients with high levels of preoperative pain with active ROM, increased pain sensitivity, and depression are more likely to have severe ROM pain even six months after surgery. Intense knee ROM pain prior to TKA may be a predictive factor for worse or prolonged post-operative pain, and possibly for ultimately unsatisfactory results or imperfect knees. Patients with marked preoperative ROM pain should be counseled concerning this prognosis and aggressive preoperative and postoperative pain management strategies should be considered.



Poster #55

Complications of Hip and Knee Arthroplasty in Patients with Cirrhosis of the Liver

John V. Tiberi, MD, Viktor J. Hansen, MD, Naglaa H. El-Abbadi, MPH, Hany S. Bedair, MD

Background: Risk stratification is critical in patients with cirrhosis undergoing total hip arthroplasty (THA) and total knee arthroplasty (TKA). As opposed to the Child-Pugh scoring system, which has limited utility for orthopaedic surgeons inexperienced in assessing ascites and hepatic encephalopathy, the Model for End Stage Liver Disease (MELD) scoring system, used by the United Network for Organ Sharing, is an easily calculated, validated scoring system for severity of liver disease based on common laboratory values. The purpose of this study is to compare the outcomes following THA and TKA in a large series of patients with cirrhosis against controls and to use the MELD score as a predictor for risk of perioperative complications.

Methods: Our institutional database was used to identify all patients diagnosed with cirrhosis undergoing THA or TKA from 2000 – 2012 and controls without cirrhosis, matched by age, gender, procedure and year of surgery. Outcome parameters including perioperative and lifetime medical and surgical complications such as infection, reoperation, and death were compared. Regression analysis was used to determine a threshold MELD that predicted higher risk of complications among cirrhotics.

Results: One hundred fifteen patients with liver disease were identified. Compared to matched controls, patients with cirrhosis had statistically significant higher rates of UTI ($p<0.01$), transfusions ($p<0.01$), renal failure ($p=0.03$), hemorrhage ($p=0.04$), infections ($p=0.02$), dislocations ($p=0.01$), revision ($p=0.04$), longer lengths of stays ($p=0.03$), readmissions ($p<0.01$), and death ($p<0.01$). A MELD score ≥ 10 predicted a 2.5 times increased likelihood of any complication ($p=0.02$) and 3.7 times increased likelihood of death ($p<0.01$) compared to cirrhotics with a score less than 10.

Conclusion: Patients with cirrhosis undergoing THA and TKA should be counseled on increased risk of medical complications, surgical complications and death. Due to an extremely high rate of complications, alternative treatments for those patients with MELD > 10 should be considered.

Poster #56

Cemented versus Cementless Total Knee Arthroplasty in Morbidly Obese Patients

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Langan Smith, BS, Steven F. Harwin, MD, Michael A. Mont, MD

Introduction: Total knee arthroplasty in morbidly obese patients can be challenging due to multiple factors. Slight degrees of malalignment can lead to overload and hasten subsequent aseptic loosening in the morbidly obese. The purpose of this study was to determine if cementless TKA can be a viable option and improve survivorship in morbidly obese patients undergoing TKA.

Methods: Multicenter retrospective study comparing the clinical results of cemented versus cementless primary TKA in morbidly obese (BMI >40) patients. There were 170 patients with 137 females and 33 males in the cemented group with a mean BMI of 46 (40-63). In the cementless group there were 69 patients with 50 females and 19 males with a mean BMI of 45 (40-57). Clinical evaluation was performed using KSS scores, along with radiographic evaluation and complications.

Results: In the cemented TKA group there were 10 aseptic loosening (5.8%) and 4 infections (1 deep , 3 superficial) at a mean f/u of 50 months, minimum 2years. In the cementless group there were no cases of aseptic loosening but 3 infections (1 deep and 2 superficial) at a mean follow up of 28 months, min 2 years. There were 2 wound necrosis in the cementless group. There were no differences with respect to pre op and post op KSS scores and ROM. Other complications in both groups included soft tissue problems: hematoma, contracture, lymphedema, RSD.

Discussion and Conclusion: We had no cases of aseptic loosening in the morbidly obese cementless group. Although this is a short term follow up, our results are promising. Theoretically fixation at the cementless biologic bone metal interface maybe more forgiving to slight degrees of malalignment which can overload and accelerate loosening in cemented TKA (5.8%). A longer f/u of cementless TKA in morbidly obese patients is warranted.

Poster #57

Femoral Nerve Catheters are Associated with High Fall Risk Following Total Knee Arthroplasty despite Fall Prevention Protocols

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Christin Van Dine, MPAS, PA-C, Christopher L. Peters, MD

Background: Femoral nerve catheter (FNC) use is common for perioperative pain management following total knee arthroplasty (TKA). We hypothesized that despite the use of fall risk protocols, the incidence of inpatient falls and associated morbidity would be high following TKA with the use of FNC.

Methods: We retrospectively reviewed a series of 769 patients at a major academic tertiary referral center from the years 2005 to 2012 who underwent primary TKA with ultra-sound guided FNC, infusion of 0.125%-0.25% bupivacaine at 5mL/hr, for perioperative pain management. All patients were educated on fall risk and were instructed to ambulate only with assistance. A fall contract was added to the education component in 2010. All patients receiving a FNC also had a knee immobilizer placed postoperatively and were instructed to use it with any out of bed activity.

Results: Twenty patients (20/769, 2.6%) had documented falls during the study period. The mean age was 63 years (range, 44 – 84 years) and the mean BMI was 33.7 kg/m2 (range, 18.9 - 58.26 kg/m2). The average time to fall was 1.58 (range, 0.6 – 2.72) postoperative days. 70% (n=14) required additional imaging to rule out possible complications. Additional injury occurred in 3 patients including an ankle fracture treated non-operatively and wound dehiscence in two patients. 60% percent of the falls occurred when the patient was attempting to ambulate by themselves against fall risk precautions.

Conclusions: Despite the implementation of multiple fall prevention protocols, FNC's for TKA appeared to be associated with an increased risk of falls and associated morbidity. A fall rate of 2.6% makes this among the highest perioperative complications associated with primary TKA in our institution Consideration of alternative multimodal pain management strategies that preserve muscle strength and minimize required added precautions but maintain adequate pain relief and outcomes need to be considered.

Poster #58

Preoperative Predictors of Postoperative Opioid Usage, Pain Scores, and Referral to a Pain Management Service in Total Knee Arthroplasty

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Introduction: Pain after total knee arthroplasty (TKA) can adversely affect patients' recovery. Little is known about preoperative predictors of postoperative pain. The goal of this study was to identify preoperative predictors of postoperative pain scores, referral to pain management and narcotic usage.

Methods: A cohort of ninety-seven consecutive primary TKAs from one surgeon were followed prospectively. Pre- and 6-week post-operative WOMAC, visual analog scale (VAS) scores, narcotic usage and catastrophizing pain scores were collected. Multivariate logistic regression analysis determined the influence of preoperative variables on postoperative referral to a pain management service and narcotic usage. Spearman's rank correlation coefficients determined the relationship between self-reported preoperative pain tolerance and postoperative WOMAC and VAS.

Results: There was no relationship between self-reported preoperative pain tolerance and postoperative change in WOMAC (Spearman's ρ: 0.11, 95% CI: -0.09–0.31) or VAS pain scores (Spearman's ρ: -0.04, 95% CI: -0.24–0.17). Increasing age and BMI were associated with lower odds of being referred to pain management. One-unit increase in BMI had an OR 0.87 (CI 0.73, 0.98) and one-year increase in age had an OR 0.85 (CI 0.78, 0.98). After adjusting for all other variables, higher age, catastrophizing, rumination, and helplessness scores were associated with lower odds of using opioids postoperatively. One-unit increase in catastrophizing score had an OR 0.96 (CI: 0.87-0.99), one-year increase in age had an OR 0.95 (CI: 0.87-0.99), one unit increase in rumination had an OR 0.89 (CI: 0.74-0.97), and one unit increase in helplessness had an OR 0.92 (CI 0.87, 0.99).

Conclusion: Preoperative pain tolerance does not predict a patient's postoperative pain. Increasing age, BMI, and catastrophizing pain scores show slightly lower odds of postoperative opioid usage and referral to pain management after TKA. This information can help surgeons advise their patients preoperatively and set expectations during the recovery period.

Poster #59

Wound Complications with Therapeutic Anticoagulation after Total Joint Arthroplasty

Ryan M. Nunley, MD, James A. Keeney, MD, John C. Clohisy, MD,
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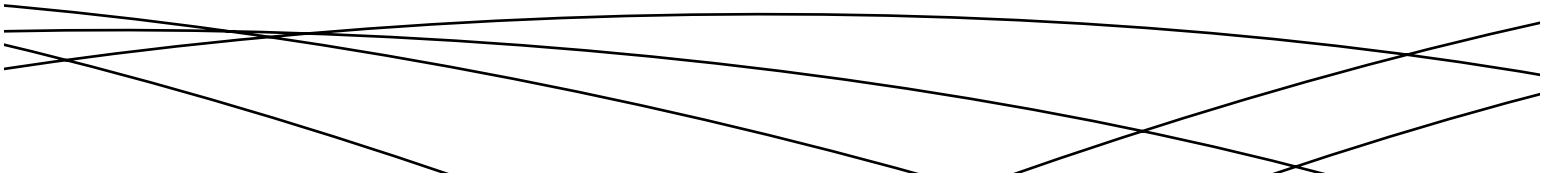
Introduction: Venous thromboembolic events (VTE) are the most common complication following total joint replacement. This study prospectively compared mobile compression devices (MCDs) and warfarin regarding safety and efficacy for preventing VTE post-operatively and monitored related complications.

Methods: Patients undergoing elective primary or revision knee or hip arthroplasty were enrolled in this prospective study. Patients were stratified to standard or high risk anticoagulation according to local clinical protocol. Standard risk patients wore MCDs 10 days and took aspirin six weeks post-operatively. High risk patients received adjusted-dose warfarin 4 weeks and compression stockings 6 weeks post-operatively. Patients were followed prospectively for 6 months and monitored for complications, symptomatic VTEs, and hospital readmissions. Changes in local clinical protocols affecting anticoagulation included changes in risk stratification and introduction of tranexamic acid (TXA) during surgery. Participants enrolled prior to changes in risk stratification were considered Phase 1; those after were considered Phase 2. Participants enrolled prior to institution of TXA were considered pre-TXA and after post-TXA.

Results: 2,053 participants were eligible for 6 week follow-up. Of those, 1,336 were standard risk and 717 were high risk. The rate of VTE (DVT/PE) at 6 weeks was 0.4% in both risk groups (p=0.82). No differences were found in procedure (knee vs. hip p=0.54; primary vs. revision p=0.22), phase (p=0.82), or TXA status (p=0.41). Rate of major bleeding was significantly higher in high risk patients (2.4%) than standard risk (0.6%; p=.001). Again, no differences were found in procedure (knee vs. hip p=0.87; primary vs. revision p=0.97), phase (p=0.74), or TXA status (p=0.78).

Conclusion: Using MCDs for preventing VTE was equivalent to warfarin, even after changes in risk stratification and introduction of TXA. Use of MCDs resulted in a statistically significant decrease in major bleeding events compared to warfarin, which is important for patient satisfaction and reducing hospital readmissions.



Poster #60

Threshold for Synovial Cell Count and Neutrophil Differential in Diagnosis of Periprosthetic Knee Infection: Multi-institutional Study

Benjamin Zmistowski, BS, Carlos Higuera, MD, Jane Liu, Wael K. Barsoum, MD, Jospeh Mendelis, BA, Craig J. Della Valle, MD, Javad Parvizi, MD, FRCS

Introduction: Synovial fluid analysis is an important tool in the work-up of suspected periprosthetic joint infection (PJI). Yet, there is conflicting guidance for the analysis of synovial fluid aspiration, including a lack of uniform thresholds for white blood cell (WBC) count and neutrophil percentage (PMN%). Therefore, a multi-institutional study was undertaken to reassess these thresholds, compare preoperative versus intraoperative sample collection, and assess variation in results between institutions.

Methods: The definition of PJI provided by the Musculoskeletal Infection Society (MSIS) was utilized to classify patients as septic or aseptic. Three institutions provided 782 (305 septic; 39.0%) patients undergoing knee revision with joint aspiration. A receiver operating characteristic (ROC) curve with Youden's J statistic was used to determine the appropriate thresholds for diagnosing PJI. Synovial fluid results were compared between institutions. A subset of 73 patients with both pre- and intraoperative aspirations served to investigate any differences in aspiration timing.

Results: From the entire cohort, an area under the curve of 0.95 and 0.93 with thresholds of 5287 cells/μL and 70% for synovial WBC count and PMN%, respectively, was found. When separating between institutions, significant inter-institutional differences were appreciated for WBC count ($p=0.01$ for infected and $p=0.02$ for uninfected) and PMN% ($p<0.001$ for uninfected cases). An appreciable, yet non-significant, rise in WBC count from pre- to intraoperative aspiration was noted for both septic (29,375 vs. 42,915; $p=0.14$) and aseptic (8,553 versus 9,869; $p=0.87$) cases. The diagnostic accuracies for pre- versus intra-operative synovial WBC count were indistinguishable (AUC=0.89 vs. 0.93; $p=0.46$).

Conclusion: Utilizing a large multi-institutional cohort and a strict PJI definition, synovial fluid WBC count and PMN% were reaffirmed as accurate markers of PJI. Differences in timing of joint aspiration were not appreciated. However, significant variation was noted between treating institutions and reflects the significant variability in the reported WBC count and PMN% thresholds.

Poster #61

Evaluation of the 3-D, Weight-bearing Orientation of the Normal Adult Knee using Low Dose Radiation

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Introduction: Concepts such as constitutional varus and kinematic alignment hypothesize that reproduction of a patient's native anatomy may improve results in total knee arthroplasty (TKA). However, prior assessments of normative, adult alignment are limited by the use of 2-dimensional imaging, in which limb rotation and anatomic variations affect alignment measurements. The purpose of this study was to use 3-D, weight-bearing images corrected for rotation, to report normative data of limb alignment and joint line orientation in asymptomatic, adult knees.

Methods: 100 subjects (200 lower extremities, average age 35 + 11.5 yrs, 58% female), with no history of symptoms or treatment, were prospectively recruited to receive weight-bearing, simultaneous biplanar imaging of both lower extremities using a novel, low-dose imaging technology. 3D images were created using parametric modeling and corrected for limb rotation, from which multiple anatomic parameters were measured.

The hip-knee-ankle angle (HKA) was used to categorize knees as varus (<-3°), valgus (>3°), or neutral (0° + 3°), and the mechanical lateral distal femoral angle (mLDFA) was used to assess if the knee joint line was perpendicular to the mechanical axis of the femur (90° + 3°), or if joint line obliquity was present (<87°or >93°). Student's t-tests were used to compare clinical measurements between males and females ($p<0.05$=significant).

Results: Of 200 knees, 70% were neutral, 19.5% were varus, and 10.5% were valgus, with males having more varus than females (-1.5° + 2.9° vs. 0.14° + 2.3°, $p=0.0004$). The proportion of male subjects with at least one knee in varus or valgus, was 40.5% and 11.9% respectively (vs. 15.5% and 19.0% in females).

52.5% of all knees had joint line obliquity (45.2% males, 57.8% females). Only 31% of knees were in both neutral alignment and lacked joint line obliquity.

Conclusion: The long-term impact of restoring a patient's native anatomy on TKA outcomes must still be determined, but currently, a neutral mechanical axis and perpendicular joint line does not restore the native anatomy in 69% of knees. This study is the first to provide 3-D, normative data of alignment and joint line obliquity in a population of asymptomatic, adult knees.

Poster #62

Preoperative Patient Education for Hip and Knee Arthroplasty: Financial Benefit?

Mark A. Tait, C. Lowry Barnes, MD, **Christopher T. Parks, MD**

Introduction: Total knee and hip arthroplasty is a commonly performed surgical procedure. As the population ages these procedure numbers are predicted to increase. Maximizing patient outcomes and decreasing healthcare delivery costs are essential to creating a higher value U.S. healthcare system. The purpose was to analyze the effect of a multidisciplinary preoperative education program (Joint Academy) on outcomes that effect overall cost of primary hip and knee arthroplasty.

Methods: 904 primary THA and TKA charts' from October 1, 2010 to September 31, 2011, at a single institution were retrospectively reviewed. We compared 102 patients who did not have preoperative education to 802 patients who did have preoperative education through the Joint Academy (JA). Patient length of stay (LOS), discharge disposition, and internal hospital cost were analyzed. Linear regression was performed to look for statistical significance.

Results: We found that patients that participated in JA had a LOS that was 2.12 days less than those that did not participate in JA. Also, JA patients were 62% more likely to be discharged to home versus patients in non-JA group. The JA group had an average lower internal hospital cost of $1,493 less than non-JA group. All referenced findings were statistically significant.

Conclusion: Considering future global or episodic payment plans, all costs of care delivery will be scrutinized. To our knowledge internal hospital costs have not been evaluated in other studies regarding preoperative patient education. The decrease in variable costs with JA patients may justify allocating resources to preoperative patient education programs, in turn decreasing overall cost of hip and knee arthroplasty.JA decreased patient LOS, improved chances of discharge to home, and decreased internal hospital costs. Multidisciplinary preoperative patient education may provide cost efficient means to reduce overall healthcare cost and improve patients' ability to return home more quickly.

Poster #63

Two-Year Migration Results of Hydroxyapatite-Coated Uncemented Tibial Components in a Multi-Center RSA Study

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Glen Richardson, MD, MSc, FRCSC, Elise Laende, Allan Hennigar, BSc

Purpose: To evaluate the fixation of uncemented tibial components with a surface coating of hydroxyapatite using RSA.

Methods: Thirty-one total knee arthroplasty patients were recruited in a consecutive sample survey in Halifax, Canada (n=16) and Perth, Australia (n=15) using the same inclusion/exclusion criteria and receiving the same uncemented implants with the same surgical approach. During surgery, tantalum markers were inserted into the proximal tibia and polyethylene. Using a calibration box, stereo RSA radiographs were taken post-operatively and then again at six weeks and three, six, 12 and 24 months following surgery. Health outcomes were recorded at each follow-up.

Results: The patients recruited at the two centers were of the same age group (66±6.2 years) and weight (88±15 kg), but differed in height (Halifax: 168±9.2 cm, Perth: 178±8.3 cm; p value = 0.004), BMI (Halifax: 31±4.7 kg/ m2, Perth: 27±2.9 kg/m2; p value = 0.005), and tibial component size (Halifax: mean size 4, Perth: mean size 6). The Oxford Knee functional score differed for the two centers pre-operatively (Halifax: 41±7.7, Perth: 31±7.6; p value = 0.003).

The migration results, calculated as maximum total point motion (MTPM), were at 1 year 1.21±1.02mm for Halifax and 0.46±0.12 mm for Perth and at 2 years 1.32±1.22 for Halifax and 0.52±0.12 mm for Perth. The migration between 1 and 2 years were 0.30±0.13 for Halifax and 0.26±0.13 for Perth (p value 0.096). The clinical precision of the MTPM metric from double exams of all patients is 0.18 mm. Tibial component size was found to be the only variable with a trend towards different migration patterns, independent of the mass of the subject.

Conclusions: Hydroxyapatite coated tibial implants have higher early migration but then stabilize between 1-2 years into an acceptable migration pattern. Migration may be related to the size of the component.

Poster #64

Knee Manipulation under Anesthesia in Total Knee Arthroplasty: A Matched Cohort Design

Ivan Dzaja, MD, Lyndsay Somerville, PhD, Edward M. Vasarhelyi, MD, MSc, FRCSC

Introduction: Stiffness after total knee arthroplasty (TKA) is a frustrating complication for both patient and surgeon. These patients may be considered for manipulation under anesthesia (MUA). The purpose of this study was to review outcomes after MUA. We hypothesized that MUA would safely improve range of motion (ROM) in this patient population.

Methods: A database query identified 79 patients that had MUA from a pool of 6043 TKAs. All patients identified were included in this study. These subjects were matched to a control group not requiring manipulation. We compared age, gender, BMI, type of TKA design (CR vs. PS) and number of surgical procedures prior to their TKA. Outcomes (ROM, WOMAC score, SF12 score, and Knee Society Score (KSS)) were compared.

Results: No difference in demographic data was found between the two groups with the exception of a higher BMI in the control group (33.7 vs. 31.6, p=0.02). Average time to most recent follow up was 36.4 months (3-120). MUA took place at a mean of 9 weeks after TKA (1-16).

No difference was seen with most recent postoperative SF12 or WOMAC scores.
The control group did have a higher KSS at most recent review (158.8 vs. 146.9, p=0.02).

Intraoperative measurements for MUA demonstrated an improvement in extension by 7o and flexion improved by 35.9o. There was no difference in ROM between the two groups during the first two years with the exception of the control group having improved flexion at 3 (109.4o vs. 102.6o, p=0.04) and improved extension at 1-year (0.8o vs. 2.7o, p=0.03).

No complications associated with manipulation were identified.

Conclusion: MUA is a safe and effective method to improve ROM post TKA in patients with poor motion in the perioperative period. MUA results in equivalent range of motion at 2-years to matched TKA patients not requiring manipulation.

Poster #65

Outcomes in TKA Complicated by Infection: A Matched Cohort Design

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James L. Howard, MD, MSc, FRCSC, Douglas D. Naudie, MD, FRCSC
Edward M. Vasarhelyi, MD, MSc, FRCSC, James McAuley, MD, FRCSC
Richard McCalden, MD, Steven J. MacDonald, MD

Introduction: Periarticular multimodal drug injection (PMDI) during total knee arthroplasty (TKA) has been reported with promising effects, but some results still remain controversial. Therefore, we conducted a systematic review and meta-analysis based on randomized controlled trials (RCTs) to evaluate the efficiency and safety of PMDI technique in TKA.

Methods: We systematically conducted an electronic search in the databases of PubMed, Embase, Cochrane Central Register of Controlled Trials, Web of Science, and the Chinese Biomedical Literature Database. Two independent reviewers completed data collection and assessment of methodological quality according to the Cochrane Handbook 5.1. The quality of evidence of outcomes was judged using GRADE criteria. Statistical analysis was performed using the RevMan 5.1 software.

Results: Ten RCTs including eight studies with 1216 TKAs in 835 patients met the inclusion criteria. The short-term results of meta-analysis showed that the technique of PMDI in TKA was associated with significantly improved pain scores on the day of surgery and postoperative 1 day [MD = -1.07, 95% CI (-1.43, -0.71), $p < 0.01$], better straight leg raise[OR = 4.02, 95% CI (2.25, 7.18), $p < 0.01$], reduced narcotic consumption within postoperative 24 hours [MD = -4.83, 95% CI (-6.61, -3.05), $p < 0.01$], and fewer rates of nausea or vomiting, and rash or pruritus [OR =0.34, 95% CI (0.22, 0.55), $p < 0.01$]. There were no statistically significant differences in operating time [MD = 0.17, 95% CI (-1.48, 1.82), $p = 0.84$], hospital stay [MD = -0.20, 95% CI (-1.18, 0.79), $p = 0.70$], wound complication [OR =0.79, 95% CI (0.31, 2.04), $p = 0.63$] and deep vein thrombosis [OR =0.87, 95% CI (0.42, 1.78), $p = 0.69$] between both groups. Regarding the quality of the results, four were high (operating time, wound complications, deep vein thrombosis, nausea or vomiting), three were moderate (pain score, hospital stay, straight leg raise), and two was low in (PCA, rash or pruritus).

Conclusions: PMDI in TKA has significant short-term advantages in pain relief, functional recovery, and narcotic consumption with fewer rates of complications. Further well-designed RCTs are still needed to investigate the long-term efficiency of PMDI during TKA.

Poster #66

Histopathological Evaluation of the Anterior Cruciate Ligament in Patients Undergoing Primary Total Knee Arthroplasty

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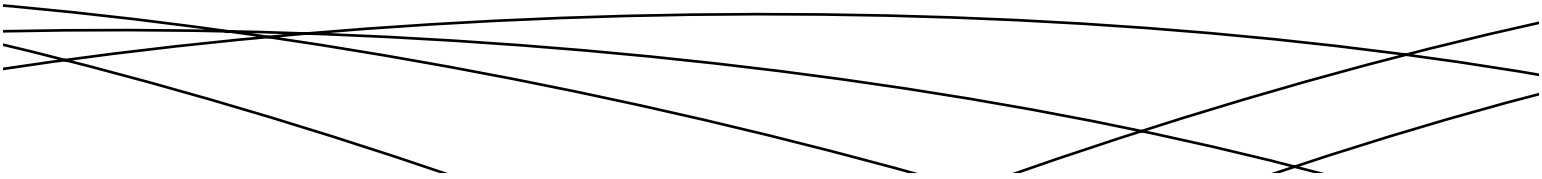
Kimona Issa, Samik Banerjee, MS, MRCS, **Michael A. Mont, MD**

Introduction: It is postulated that retaining both cruciate ligaments during TKA may improve gait, restore joint kinematics, and thus may lead to higher satisfaction. This is of particular importance when considering bicruciate-retaining or unicompartmental arthroplasty in the osteoarthritic knee. The aim of this study was to assess the gross and histopathological changes of the ACL for evidence of degeneration in arthritic knees undergoing TKA.

Methods: One hundred and sixty consecutive patients (174 knees) had their ACL evaluated at the time of primary TKA. Intraoperatively, the ACL was characterized as intact, frayed, torn, or absent. Each histological findings was quantified as absent, mild, moderate, or marked. The number of changes was scored and a subsequent total histological degeneration score was also generated for each ACL by the summation of each individual microscopic change score. The macroscopic and microscopic findings were compared to demographic factors, clinical factors, and radiographic evaluation (osteoarthritis grade and knee compartments affected).

Results: Of the 174 knees analyzed, the ACL was found to be completely intact in 43 patients (24%), frayed in 85 patients (49%), torn in 15 patients (9%), and absent in 31 patients (18%). Histological changes were detected in 85% (121/143) of specimens analyzed. There was a significant correlation noted between higher age and increased CPP deposits, myxoid deposits, number of changes, and total degeneration score ($p < 0.04$). There was no correlation between body mass index and the histological or macroscopic changes. Patients with high-grade osteoarthritis had significantly more CPP deposits ($p = 0.02$) and increased number of changes ($p = 0.04$).

Conclusion: A variety of histopathological degenerative changes can be found in the ACL in patients undergoing TKA. We believe that the histological findings should be taken into consideration when planning a cruciate retaining knee in older patients with higher radiographic osteoarthritis grade.



Poster #67

Results of Modular, Tapered Femoral Components in Hip Revision with and without Extended Trochanteric Osteotomy

Michael J. Archibeck, MD, Joshua T. Carothers, MD,
Krishna R. Tripuraneni, MD, Richard H. White, MD

Introduction: The use of modular, tapered, fluted femoral components in hip revision has expanded secondary to ease of use and the ability to obtain fixation in the setting of isthmic deficiencies. In such cases, exposure and implantation are often facilitated with the use of an extended trochanteric osteotomy. The purpose of this study is to review the minimum two-year results of such devices implanted with and without an extended trochanteric osteotomy.

Methods: Between 2003 and 2010 we performed 50 hip revisions (50 patients) in which a modular, tapered femoral component was used. In 24 of these cases an extended trochanteric osteotomy was used. At a minimum of two year follow up we reviewed the available clinical and radiographic data.

Results: Of the 50 patients, three died prior to two year follow up and six were lost, leaving 41 patients for a minimum 2 year follow up (mean 4 years, range 2 to 7yrs). There were two early reoperations. In the group performed with an ETO (21), there was one case of radiographic loosening, on case of subsidence >2mm (4mm), one case of ETO nonunion, and two cases of cable breakage. In the cases performed without an ETO (20), there was one case of radiographic loosening not operated on (34mm subsidence), three cases of subsidence > 2mm (3, 7, and 10mm), and one case of poor distal fill that did not loosen. These differences did not reach statistical significance (p=0.19).

Conclusion: The use of modular, tapered, fluted stem has proved to be valuable in a variety of revision settings including periprosthetic fractures, isthmic deficiencies, and in cases of bone loss. Our review demonstrated a high clinical success rate in this complex patient population. We found a slightly increased incidence of early subsidence >2mm or lack of distal fill when the device is inserted without an ETO.

Poster #68

Revision of Recalled Modular Neck Rejuvenate and ABG Femoral Implants

Christopher Walsh, MD, Jospeh P. Nessler, MD, David C. Markel, MD

Introduction: Hip stems with modular necks were designed to provide more options for anatomic hip reconstruction. Increased revision rates associated with the modular stems suggested underlying adverse local tissue reactions (ALTR) related to the implant and led to a voluntary recall. This study describes the experience and findings associated with revision surgery in a large cohort of patients implanted with the recalled stems.

Methods: A review of prospectively collected data was performed on patients who were implanted with modular neck hip implants between October 2007 and February 2012 and underwent subsequent revision surgery. Demographic data, metal ion levels, revision findings, and pathology findings were obtained, and descriptive statistics were performed.

Results: A total of 361 hips (268 Rejuvenate, 93 ABG) in 350 patients were implanted with modular femoral stems during the study period and 107 hips have undergone revision. The cause of revision was ALTR in 103, infection in 2, and 2 for periprosthetic fracture. At revision, a necrotic rind was found in 84 patients, synovitis in 102, bony erosion in 88, and tissue necrosis in 80. The femur was well fixed in all but 1 case and the acetabular component was well fixed in all but 5 cases. An osteotomy was required to remove the femoral component in 45 cases. The acetabular component was revised in 47 cases and the polyethylene liner was exchanged in the other 56 cases. Black, metallic sludge and corrosion at the neck-stem junction were noted in the operative report in 101 cases. On histologic analysis, 90 had chronic inflammatory changes, and 58 had degenerative changes.

Conclusion: The revision of stem modular neck is likely to be complicated by tissue necrosis, synovitis, bony erosion and stem-neck corrosion. Despite using advanced techniques for explantation, osteotomy was frequently required, leading to associated morbidity from implant removal.

Poster #69

The Use of Dynamic Hip Spacers Reduces Operative Time during Reimplantation: A Comparative Study

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Introduction: During two-stage exchange arthroplasty either a dynamic or static antibiotic impregnated spacer may be used. Some of the potential advantages of dynamic spacers include ease of ambulation between stages, ease of reimplantation, and improved functional outcomes. The purpose of our study was to investigate whether the use of dynamic spacers can reduce operative time during reimplantation.

Methods: Using our institutional database, we identified all patients who underwent 2-stage exchange arthroplasty for treatment of PJI from 2006 -2012. Detailed data was collected on all of these patients, including the operative time during reimplantation for patients who received dynamic versus static spacers. Cox regression analysis was used to determine independent risk factors for increased operative time.

Results: We identified 223 patients who underwent reimplantation of either the knee (154) or the hip (69). The mean operative time during reimplantation was 122 minutes (range: 92-178 minutes) for 20 patients with a dynamic hip spacer compared to 158 minutes (range: 86-339 minutes) for 49 patients with a static hip spacer. For 73 patients with a static knee spacer the mean reimplantation time was 131 minutes (range: 57-302 minutes) compared to 131 minutes (range: 74-313 minutes) for 81 patients with a dynamic knee spacer. The use of dynamic hip spacers was independently associated with decreased operative time. Factors leading to an increase in operative time during reimplantation were increased bone loss and elevated BMI.

Discussion: We demonstrated that dynamic hip spacers are associated with decreased operative time during reimplantation. It is possible that better maintenance of the effective joint space and soft tissue tensioning that can be achieved with dynamic hip spacers results in ease of revision compared to static spacers. Given the expense associated with operative time, this factor should be considered in substantiating the cost of dynamic hip spacers.

Poster #70

Preoperative Radiographic Evaluation of Patients with Pelvic Discontinuity

J. Ryan Martin, MD, Ian J. Barret, MD, Rafael J. Sierra, MD,
David G. Lewallen, MD, Daniel J. Berry, MD

Introduction: No study has examined radiographic parameters and the utility of specific views in the pre-operative identification of pelvic discontinuity.

Methods: We retrospectively identified 133 hips with intra-operative diagnosis of pelvic discontinuity. All preoperative films were reviewed including AP Pelvis, true lateral hip films, Judet, False Profile and CT scans. All radiographs were read by the senior authors to identify the following parameters suggestive of PD: visible fracture line, medial migration of the inferior hemipelvis, and obturator ring asymmetry.

Results: All 133 hips were surveyed with AP pelvis views, 132 with true lateral hip view, 47 with Judet views, 8 with a false profile view, and 14 with a CT scan. Utilizing only the AP view, the fracture line was visible in 116 (87%), medial migration of the inferior hemipelvis was present in 126 (94%), and obturator ring asymmetry in 114 (86%). 93 out of 133 (70%) met diagnostic criteria for pelvic discontinuity, defined as coincidence of all three radiographic parameters. Of the 16 hips without evidence of fracture line on AP radiograph, inclusion of a lateral view detected fracture in 5 , Judet views an additional 8 (out of 10 evaluated) and CT an additional 2 (out of 3 evaluated). Judet films significantly enhanced fracture detection with only two fractures missed among the 47 hips evaluated with a combination of AP and Judet views.

Conclusion: Pelvic discontinuity can be diagnosed reliably by the presence of three radiographic parameters: a visible fracture line, medial migration of the inferior hemipelvis, and obturator ring symmetry. AP pelvis have fairly good sensitivity (85%) for the detection of PD. Additional views are useful for visualization of fracture lines especially when fractures are obscured by hardware on the AP view. CT scans suffered were at best of equal utility to Judet views in visualization discontinuity.

Poster #71

Osseointegration of an Additive-Manufactured Cancellous Metal in a Load-Bearing Animal Model

Michael Williams, MSc, Sona Obzerova, Michael Hall, BSc, Melissa Anderson, BSc,
Paul A. Gunning, MSc, FRMS, **Mark L. Morrison, PhD,** Mathias P. Bostrom, MD

Introduction: The goal of this study was to compare the osseointegration of a clinically successful, sintered-bead coating to a porous, cancellous metal fabricated through additive manufacturing.

Methods: Semi-circular implants were fabricated with one of two ingrowth structures on the upper and lower surfaces. A sintered-bead (SB) coating was fabricated by sintering small, CP-Ti beads onto Ti-6Al-4V substrates. Cancellous metal (CM) implants were fabricated by laser sintering of Ti-6Al-4V powder where both the solid and porous features were built layer-by-layer from a virtual model.

Biologic fixation was assessed using a validated, load-bearing ovine model. Bilateral defects were created in the cancellous bone of the rear, proximal tibias of adult sheep parallel to and 3 mm below the medial tibial plateaus. One of each type of implant was randomly assigned to a limb and press-fit into each bilateral defect. At 6 and 12 weeks, tibias were subjected to push-out testing (n=18/treatment/time point) or examination by histology, histomorphometry and backscattered-electron microscopy (n=10/treatment/time point).

Results: All animals were fully weight bearing and had normal gait/ambulation. CM exhibited significantly higher push-out forces than SB at both time intervals ($p<0.001$). At both time points, the mean push-out strengths of the CM were 44% and 52% higher, respectively, than those of the SB.

Histology showed no obvious adverse cellular activity in either test group at either time point. Both histomorphometry and backscattered electron microscopy demonstrated similar levels of bone ingrowth for both structures at both time intervals.

Conclusion: After 6 and 12 weeks in situ, CM exhibited significantly higher push-out strengths compared to clinically successful SB. Histomorphometry and backscattered electron microscopy indicated that similar levels of bone ingrowth occurred with the two porous structures at both time points. Based on these results, the improved osseointegration provided by the additive-manufactured, CM could provide enhanced stability for orthopaedic implants.

Poster #72

Tranexamic Acid Reduces Length of Stay and Total Costs in Revision Total Hip Arthroplasty

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Briana J. Jegier, PhD, Gunnar B. Andersson, Craig J. Della Valle, MD

Introduction: Although several studies have shown that tranexamic acid (TXA) reduces blood loss during total joint arthroplasty, its economic impact is unclear. The purpose of this study was to determine if TXA decreases hospital resource utilization and costs for patients undergoing revision THA.

Methods: We retrospectively reviewed 154 consecutive patients who underwent revision THA. TXA was administered based on surgeon preference. Bivariate analysis and multiple linear regression modeling were used to evaluate the impact of TXA on hospital resource utilization and cost. A priori power analysis determined that 37 patients would be required in each group to detect a medium effect size ($f2 = 0.15$) for difference in cost with 95% power.

Results: Sixty-two revision THAs (40%) received TXA while 92 (60%) did not. Charlson Comorbidity Index was similar between groups (0.1 for both, $p = 0.5$). Mean blood loss (810 mL vs 791 mL, respectively; $p = 0.86$) and units transfused (mean, 3.0 for both, $p = 0.57$) were not significantly different between groups with the numbers available for study. The average length of stay, however, was significantly shorter in patients receiving TXA (3.3 vs. 4.6 days, $p<0.001$). Direct costs ($14,708 vs. $17,381, $p = 0.03$), and total cost ($22,827 vs. $26,618, $p = 0.04$) were both significantly lower in patients receiving TXA. A greater proportion of patients receiving TXA were discharged to home as opposed to an extended care facility (74% vs. 56%, $p = 0.04$). Regression analysis indicated that TXA resulted in a mean cost reduction of $3,347 ($p = 0.01$).

Conclusion: Our data suggest that TXA in revision THA is a cost-saving intervention that reduces hospital resource use and facilitates discharge from the hospital that is more often to home. As the demand for revision THA rises, cost-effective interventions such as TXA must be considered.

Poster #73

Structural Bulk Allograft Supporting a Trabecular Metal Shell Provides Durable Results in Complex Revision Hip Arthroplasty

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Michael E. Kralovec, MD, Rafael J. Sierra, MD, Miguel E. Cabanela, MD

Background: The use of a highly porous revision shell supported by either metal augments or allograft bone has become a commonly used reconstruction technique. Allograft reconstruction has the disadvantage of potential graft resorption or nonunion to host bone resulting in late failure of the construct. The use of allograft bone in the presence of highly porous TM shell has not been reported.

Materials and methods: Between 2000 and 2010, 53 patients (55 hips) underwent acetabular reconstruction with a structural bulk allograft and a TM revision shell. Average followup was 5.2 years (range 2 to 12 years). There were 10 male and 43 females with an average age of 62 years (range 34-86). Pre-operative, intraoperative and post-operative data and radiographs were reviewed to assess acetabular bone deficiency preop (Paprosky) and postoperatively to assess cup fixation, and graft location (Lewallen), % coverage and union to host bone (Knight).

Results: 5 Paprosky 2A (9.3%), 11 2B (17%), 11 2C (24.5%), 11 3A (20.7%) and 16 3B hips (28.3%). The configuration of the graft was classified as Type 1 (Flying Buttress) in 12 hips, Type 2 (Support Dome) in 27 hips and Type 3 (Footings) 19 hips. All grafts were healed to host bone at latest follow-up. 15 cases (26%) had partial bone graft resorption. 1 acetabular component was revised. 2 more components had radiographic evidence of loosening but were unrevised at latest followup. Survivorship-free from radiographic acetabular loosening as endpoint was 93% at 5 and 10 years. The 5 and 10-year survivorship-free with revision for any reason as endpoint was 87% and 83%, respectively.

Conclusion: 94% of acetabular components obtained stable osseointegration onto host bone. Allograft bone restored bone stock with minimal graft resorption. This reconstruction compares favorably to the use of allograft bone with past generation acetabular components, but longer followup is needed to determine the longevity of the reconstruction.

Poster #74

Corrosion and Fretting of Modular Taper Junctions in Total Hip Arthroplasty

Iustin Moga, MSIII, Philip C. Noble, PhD, Melvyn A. Harrington, MD

Introduction: Revision Total Knee Arthroplasty (TKA) can lead to significant blood loss due to extensive soft tissue and bone trauma. Tranexamic Acid (TXA) has been used successfully in primary TKA. The purpose of this study is to determine its efficacy in revision TKA.

Methods: This is a retrospective review of 113 patients undergoing revision TKA. There were 68 patients in the control group that did not receive TXA and 45 patients in the treatment group that received one intravenous 10mg/kg dose of TXA 10 minutes prior to tourniquet release. Groups were stratified into patients receiving a femoral and tibial revision, single component revision, or an isolated liner exchange. Hemoglobin levels were evaluated pre and post operatively. The incidences of blood transfusion, number of units transfused, length of hospital stay, and the presence of thromboembolic events
were assessed.

Results: There were no differences between groups with respect to age, preoperative hemoglobin, intraoperative blood loss, and length of hospital stay. In the control group, 13 out of 68 (19.1%) patients required a transfusion versus 2 out of 45 (4.4%) patients in the treatment group ($p=0.012$). The control group used 25 units of blood compared to 3 units used by the treatment group ($P=0.008$). When stratified by type of revision, there were more patients transfused in the control group when both the femur and tibia were revised ($p=0.013$). Each group had 1 patient with a post operative DVT. The control group had 1 patient with a PE.

Conclusion: Patients receiving TXA during revision TKA experienced a significant reduction transfusion and blood units utilized compared to the control group. Given the drawbacks of allogenic blood transfusion, we strongly recommend the use of TXA in revision TKA especially when two or more components are being revised.

Poster #75

Acetabular Cup Positioning in Revision Total Hip Arthroplasty with Paprosky III Acetabular Defects: Martell Radiographic Analysis

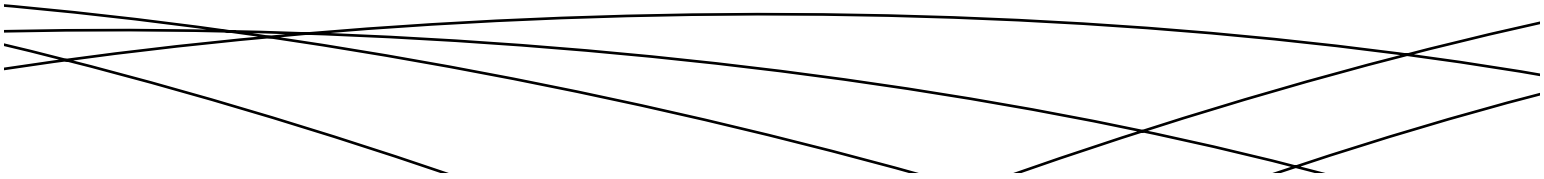
Ho-Rim Choi, MD, David Anderson, Scott Foster, Matthew Beal, Jo Ann Lee, Christopher Barr, Henrik Malchau, MD, PhD, Joseph C. McCarthy, **Young-Min Kwon, MD, PhD**

Introduction: Optimal cup positioning is a fundamental requirement for satisfactory results of total hip arthroplasty (THA). While there are a number of papers describing cup positioning in primary THA, there is paucity of data regarding cup position in revision situation. The purpose of this study was to evaluate the accuracy of cup position in the setting of revision THA with large acetabular bone defects.

Methods: With a definition of safe zone of abduction (30-50 degrees) and anteversion (5-25 degrees), acetabular cup position was measured by a program using the latest followup radiographs of Pelvis AP and shoot-through hip lateral view for 34 patients with Paprosky type III acetabular bone defects. Multivariate analysis was performed to identify risk factors for cup malpositioning: age, gender, laterality, type of defect (Paprosky IIIA vs. IIIB), amount of bone graft (≤90ml vs. >90ml), cup size (large vs. extra large), and cup fixation (screw vs. non-screw).

Results: Twenty-four cups (71%) for abduction and 26 cups (76%) for anteversion were located in the safe zone. Nineteen cups (56%) were within the safe zone for both abduction and anteversion. There was no dislocation but one cup out of the safe zone resulted in early cup failure due to aseptic loosening. Uni- and multi-variate analysis demonstrated that no factors were identified as independent predictors of malpositioning: age($p=0.30$), gender($p=0.56$), laterality($p=0.79$), type of defect($p=0.83$), bone graft($p=0.10$), cup size($p=0.18$), screw fixation($p=0.94$).

Conclusion: In the present study, the acetabular cup positioning in patients with Paprosky type III defects was optimal in half of cases. The prevalence of optimal acetabular cup position was similar to those reported in primary THA, suggesting that the presence of large acetabular bone defect may not necessarily be a significant risk factor for suboptimal acetabular cup positioning in the setting of revision THA.



Poster #76

The Epidemiology of Revision Total Hip Arthroplasty in the United States

Kevin J. Bozic, MD, MBA, Atul F. Kamath, MD, Edmund Lau, MS,
Kevin C. Ong, MD, Steven M. Kurtz, PhD, Vanessa Chan, MPH,
Harry E. Rubash, MD, Thomas P. Vail, MD, Daniel J. Berry, MD

Introduction: As surgical techniques and THA implant designs have evolved, the indications for revision THA have changed. The purpose of this study was to evaluate the causes of revision THA, and to describe the patient characteristics and resource utilization associated with revision THA procedures in the United States.

Methods: The Nationwide Inpatient Sample was used to evaluate the cause of failure for 235,857 revision THA procedures between Q4 2005 and 2010. Patient characteristics, procedure information, and resource utilization were compared across revision THA procedures.

Results: The number of revision THA procedures increased from 40,555 in 2006 to 49,857 in 2010. Revision THA procedures were more common in women (58%) and were most commonly performed in 75-84 year olds. A Major severity of illness score was recorded in >50% of patients. Dislocation (22%), mechanical loosening (20%), and periprosthetic joint infection (PJI) (15%) were the most common reasons for revision. Revisions for mechanical loosening increased between 2005 and 2010, while revisions for dislocation decreased during the same time period. All-component revisions accounted for 42% of all revisions in 2010, while acetabular component revisions accounted for 16%, femoral component revisions 15%, isolated head/liner revisions 13%, and arthrotomy/removal of prosthesis 9%. Across all time points, Medicare payer status accounted for >60% of revisions. Revision THAs were more common in large, urban non-teaching hospitals and the South and Midwest regions. PJI and periprosthetic fracture accounted for the longest average length of stay (>8 days), and the highest average hospitalization cost (both >$30,000).

Conclusion: Revision THA procedure rates are on the rise. Elderly and female patients with major comorbidities represent a large proportion of the revision population. Dislocation, mechanical loosening, and PJI account for the majority of THA procedures. Revision THA for PJI and periprosthetic fracture are associated with longer average LOS and higher resource utilization.

Poster #77

Tritanium Jumbo Cups in Revision Total Hip Arthroplasty with Major Acetabular Defects

Morteza Meftah, MD, Amar S. Ranawat, MD, Chitranjan S. Ranawat. MD

Introduction: Jumbo cups (larger than 58mm in females and 62mm in males), theoretically have lowered the percentage of bleeding bone that is required for osseointegration in severe acetabular defects. The purpose of this study was to analyze the safety and efficacy of Tritanium jumbo cups (Stryker, Mahwah, New Jersey) in patients with major acetabular defects (Paprosky type IIIa and IIIb) and assess the extent of osseointegration.

Methods: Between February 2007 and August 2010, 28 hips (26 patients, mean age of 69 years) underwent acetabular revision arthroplasty for Paprosky type IIIa and IIIb defects using Tritanium jumbo cups. 14% of the hips had pelvic discontinuity. 8 hips were revised for failure of cemented socket, 17 hips for failure of non-cemented socket, and 3 his for second stage revision for periprosthetic infection. The average time from index surgery to revision was 16.5 $\pm$ 10.3 years (1.4 - 32). No structural allograft or cup/cage combination was used in this series. Wedge interference fit was achieved by implanting a 2-5mm oversized Tritanium jumbo cup as compared to the final reamer diameter, supplemented with screws to enhance initial fixation.

Results: Patients were prospectively followed with a mean follow-up of 4 $\pm$ 1.3 years (2 - 5). There were no intra-operative fractures, post-operative dislocation, infection, instability, loosening, or cup migration at the time of follow-up. The mean anteversion and abduction angles were 43 $\pm$ 4.6 and 19.5 $\pm$ 4.4 degrees, respectively. Radiographic assessment showed osseointegration in all cups, ranging from 30% to 75% of the cup surface area as assessed in both anteroposterior (AP) and false profile (FP) views in Charnley zones I through VI. The most osseointegration was seen in zone I (superior) and zone VI (posterior).

Discussion and conclusion: This study demonstrates excellent safety and efficacy of Tritanium cups in revision total hip arthroplasty with major bony defects. Minimum 30% of bleeding surface is required for osseointegration with these cups.

Poster #78

Characterization of Periprosthetic Femur Fractures in 5417 Revision Total Hip Arthroplasties

Matthew P. Abdel, MD, Matthew T. Houdek, MD,
David G. Lewallen, MD, Daniel J. Berry, MD

Introduction: Understanding timing and circumstances under which periprosthetic femur fractures occur allows development of prevention strategies. This study's goals were to define demographic and operative risk factors, chronology, and character of fractures in a large cohort of revision total hip arthroplasties (revTHAs).

Methods: We retrospectively reviewed the total joint registry of an academic institution from 1969 to 2011. All patients undergoing revTHA were included. Periprosthetic fractures were analyzed based on demographics, timing, and type of fixation. Radiographs and the EMR were reviewed to characterize fractures and determine subsequent treatments.

Results: The incidence of intraoperative periprosthetic femoral fracture during revTHA was 12.3% (668/5417) (Table 1). They were 3X higher for uncemented (18.6%) than for cemented stems (5.8%) ($p < 0.001$). Intraoperative fracture incidence varied by uncemented stem type: fully coated (20%); proximally coated (19%); fluted, tapered (16%) ($p < 0.05$). The majority of fractures occurred with placement of femoral component (35%), removal of the prior component (31%), and trial reductions (23%); 33% involved the diaphysis, 21% the subtrochanteric area, and 20% the greater trochanter. 69% were non-displaced and 40% were treated with cerclage cables/wires.

There were 281 postoperative femoral fractures (20-year cumulative probability = 11.4%). Risk was not different for cemented (10.8%) or uncemented (12.1%) stems ($p = 0.17$). Postoperative fractures were more common in males < 70 years ($p = 0.02$). Periprosthetic fractures occurred more frequently early after uncemented femoral revision, but later after cemented revisions. Fracture etiology was fall in 47%. Vancouver classification was: AG 30.1%, B1 22.1%, C 16%, B2 15.3%, B3 12.3%, and AL 4.3%.

Conclusions: Intraoperative periprosthetic femoral fractures occur 3X more often with uncemented stems and are commonly non-displaced diaphyseal or subtrochanteric fractures. While postoperative fracture risks are equivalent between uncemented and cemented components, they occur at notably different time periods based on stem fixation.

Poster #79

Morbidly Obese Patients Have a Markedly Higher Risk of Failure following Revision Total Hip Arthroplasty for Infection

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David G. Lewallen, MD, Tad M. Mabry, MD

Introduction: Morbid obesity (BMI ≥40) is associated with complications including infection and implant failure following primary total hip arthroplasty (THA). To our knowledge, this has not been examined in the revision setting. The purpose of this study was to compare the results of two-stage revision THA for infection in a morbidly obese (BMI ≥40) patient cohort compared to a non-obese (BMI ≤30) patients.

Methods: We reviewed the medical records of patients undergoing a two-stage revision THA for a prosthetic joint infection from 1987-2007. Thirty-three patients were identified who had a BMI ≥40. They were then compared 1:2 with a cohort of sex-matched, age-similar non-obese (BMI ≤30) patients. Primary outcomes examined included reinfection, reoperation, and removal of components. Clinical outcomes were quantified using the Harris Hip Score.

Results: In the morbidly obese group, there were 14 males and 19 females, with an average age of 63.2 years and an average BMI of 44.9. There were 28 males and 38 females with an average age and BMI of 63.2 years and 24.8, in the non-obese group. Average follow-up was 8.1 years in the morbidly obese group and 10.3 years in the non-obese group. Compared to non-obese patients, morbidly obese patients had an increased risk for reinfection (18% vs. 2%; p=0.005), resection of components (30% vs. 5%; p=0.0001) and reoperation for any reason (61% vs. 12%; p=0.0001). Hip scores significantly improved postoperatively ($p<0.001$), with no significant difference between the two groups at 2 (78.5 vs 81.9) and 5 (77.9 vs 80.9) years. However at 10-years the average score was significantly lower (p=0.0007) in the morbidly obese group (64.3 vs 81.3).

Conclusion: Morbidly obese patients have increased rates of reinfection, reoperation, and component resection, along with worse mid-term clinical outcome scores compared to a non-obese patient cohort following revision THA for prosthetic joint infection.

Poster #80

Bisphosphonates Reduce the Risk of Revision following Total Hip Arthroplasty: Outcomes from a US Total Joint Replacement Registry

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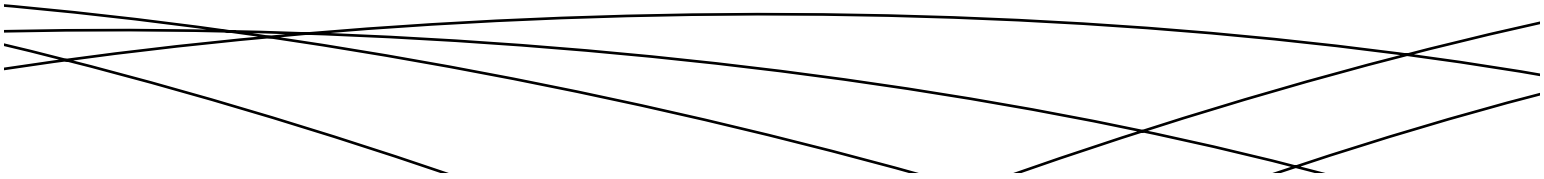
Stefano A. Bini, MD, Elizabeth W. Paxton, Robert S. Namba, MD

Introduction: The purpose of this investigation was to determine if bisphosphonate use in primary total hip arthroplasty (THA) patients is associated with a change in risk of revision or periprosthetic fracture. We also studied the risk of revision and periprosthetic fracture based on quantified bone mineral density and age.

Methods: A retrospective cohort of primary THA patients performed between 04/2001-12/2010 was conducted. Data sources included a Total Joint Replacement Registry, an integrated electronic health record, and an osteoporosis screening database. The outcome was revision surgery for any cause, aseptic revisions, and peri-prosthetic fractures. Patient, surgeon, and hospital factors were evaluated as confounders.

Results: A cohort of 12882 primary THAs, where 17.8% were bisphosphonate users, was evaluated. Compared to bisphosphonate users the incidence of all cause (1.3% vs. 2.2%) and aseptic revision (1.0% vs. 1.6%) during the mean follow up of 3.5 years (SD=2.5) was higher in non-bisphosphonate users. Incidence of peri-prosthetic fractures was higher in bisphosphonates users (1.44% vs. 0.42%). Overall, a significant risk reduction of all cause (HR= 0.48, 95%CI 0.31-0.74) and aseptic (HR=0.47, 95%CI 0.28-0.76) revision was observed in patients ≥65 years old on. A lower risk of all cause revision and aseptic revision was observed in patients with osteopenia (HR= 0.51, 95% 0.27-0.95, HR=0.53, 95%CI 0.29-0.99, respectively) and osteoporosis (HR= 0.11, 95% CI 0.01-0.88, HR=0.33, 95%CI 0.11-1.00, respectively). The adjusted risk of peri-prosthetic fractures in patients on bisphosphonates is higher than patients not on bisphosphonates (HR=1.92, 95%CI 1.13-3.27), the risk is higher in patients <65 years old (HR=4.55, 95%CI 1.05-19.6).

Discussion and Conclusion: Bisphosphonate use is associated with a lower risk for revision in patients undergoing primary THA for osteoarthritis. Bisphosphonates were associated with a higher risk of periprosthetic fractures in younger patients with normal bone mineral density.



Poster #81

Failure Analysis of Retrieved Antiprotrusio Cages

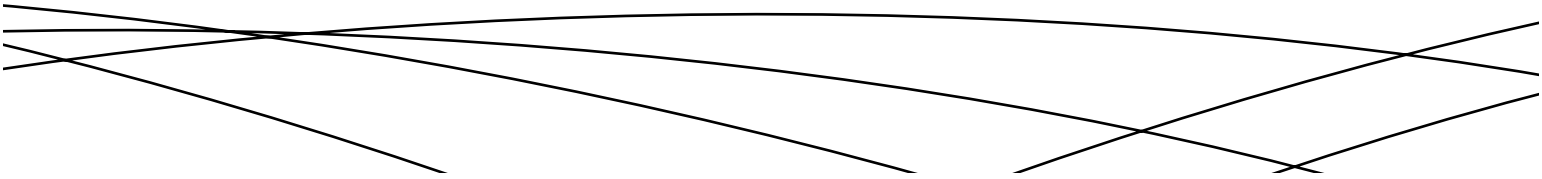
Jonathan M. Vigdorchik, MD, Susannah Gilbert,
Joseph Lipman, MS, Mathias P. Bostrom, MD

Introduction: Reported results with antiprotrusio cages (APCs) for acetabular reconstruction are variable with revision rates between 0% and 24%. The objective of this study was to use radiographic and clinical data from retrieved APCs in correlation with visual inspection of fracture locations to determine which factors influence failure.

Methods: A retrieval database was queried and 24 antiprotrusio cages, from a single manufacturer, were identified. Medical records and sequential radiographs were reviewed. Cages were manually examined for gross macroscopic findings, breakage, location of breakage, and to confirm radiographic findings.

Results: Average length of implantation was 42.5 months. Average abduction angles of the cages were 56 degrees and of the cemented polyethylene cups were 44 degrees. The center of rotation was an average of 10-mm lateral and 5-mm superior to the native center. Fourteen of the 24 cages were broken and 10 were intact. Seven cages were implanted in the setting of a pelvic discontinuity: six of these (87%) were broken. Five cages were implanted with a constrained liner: two (40%) were broken. Of the broken cages, 10 of 14 broke through a screw hole in the ischial flange. In the intact group, 6 of 10 failed by pullout of the ischial screws. Broken cages were more likely to be revised to custom triflange cups, while intact cages were revised to noncemented hemispherical cups.

Conclusions: All cages had superior and lateralized centers of rotation. Two-thirds of the cages failed with breakage or pullout at the ischial flange. Pelvic discontinuity was a large risk factor for a broken cage. Intact cages that failed were able to be revised successfully to hemispherical cups unlike cages that had fractured. Future design and technique modifications that can minimize ischial flange breakage or screw pullout may result in superior outcomes in these complex acetabular reconstructions.



Poster #82

Results of a Novel Constrained Acetabular Component Design to Treat and Prevent Instability

Keith R. Berend, MD, Adolph V. Lombardi, Jr., MD, FACS, Michael J. Morris, MD, Joanne B. Adams, BFA, Michael A. Sneller, BS, Kenneth L. Brown

Introduction: Constrained acetabular components are to be used sparingly and in salvage reconstruction situations. In these cases, the results are plagued with recurrent dislocation, mechanical failure of the device, and loosening related to increased constraint. A novel constraining mechanism with an increased range of motion was developed to possibly reduce this failure rate. The purpose of this study is to report the mid-term survivorship and failure modes of a novel constraining mechanism in complex total hip arthroplasty (THA).

Methods: Between October 2003 and November 2010, 195 constrained acetabular components of a novel design allowing higher range of motion before impingement were implanted in 193 patients. There were 144 revisions, 37 radical debridement/reimplantation for infection, and 14 complex primary procedures. The constrained device was used utilized to treat instability in 51 hips (26%) and in cases of increased risk for instability or intraoperative instability in the remaining 144 hips. 60% of patients were female. These patients had an average of 3.1 previous surgeries per hip prior.

Results: At an average 3.8 years follow-up there have been 4 dislocations (2.1%). Aseptic acetabular failure occurred in 7 hips (3.6%) for an overall constrained mechanism aseptic or mechanical failure rate of 5.6%. 15 Hips failed from infection, 1 stem loosening, and one constraining mechanism was exchanged for early infection.

Discussion: Many previous constraining designs have had high early failure rates from recurrent instability and aseptic acetabular loosening. This novel device is designed to allow a greater range of motion before prosthetic impingement while maintaining high pull out strength. At 3.8 years, there is a low rate of dislocation and mechanical acetabular failure with the use of this device in the treatment and prevention of THA instability.

At 3.8 years, there is a low rate of dislocation and mechanical acetabular failure with the use of this novel constrained device in treatment and prevention of THA instability.

Poster #83

Early Complications Following Revision of Large Diameter Monoblock Metal on Metal Total Hip Arthroplasty

Louis S. Stryker, MD, Susan Odum, PhDc, Thomas K. Fehring, MD, Bryan D. Springer, MD

Background: Relatively large percentages of monoblock metal on metal total hip arthroplasties undergo early failure and require subsequent revision. The types and rates of early complications following these revisions remains unreported.

Methods: A retrospective review our institution's total joint registry identified 114 patients who underwent revision of a monoblock metal on metal total hip arthroplasty. Mean patient age at revision was 60 years (range, 17-84 years) with a female majority (65%) and a mean interval from index arthroplasty to revision of 47 months (range, 1-114 months). Mean post-revision follow-up was 14 months (range, 0-122 months). Revision diagnoses included metallosis (51%), aseptic loosening (27%), infection (7%), pain (6%), malposition (4%), instability (3%), iliopsoas impingement (2%), and periprosthetic fracture (1%).

Results: 20% of patients (23/114 patients) sustained at least one early complication following revision of monoblock metal on metal total hip arthroplasty with 16% (18/114 patients) requiring at least one additional subsequent surgery. Mean time from revision to complication was 5 months (range, 0-54 months). The most common complications included: aseptic loosening (6%), deep infection (6%), dislocation (4%), and acetabular fracture (3%). Of the 18 patients undergoing additional surgery, 50% (9 patients) involved some form of acetabular revision, of which 56% (5 patients) required custom triflange reconstruction and another 22% (2 patients) necessitated constrained liners. Six patients (5%) required at least one additional surgery following revision with 2 patients undergoing 4 additional surgeries following the index revision.

Conclusions: Complications and re-operation rates following revision for failed monoblock metal on metal total hip arthroplasty are high (20% and 16%, respectively). Surgeons should anticipate the most common modes of failure (aseptic loosening, deep infection and dislocation) and develop strategies to prevent their occurrence.

Poster #84

Visual Assessment of Dual Mobility Acetabular Component System

Marcella E. Elpers, BS, Thomas K. John, MD, Christina Esposito,
Timothy M. Wright, PhD, Geoffrey H. Westrich, MD

Introduction: A dual mobility hip bearing which has an inner and outer bearing surface is used for two reasons: a small femoral head can reduce wear and a large femoral head can reduce the risk of dislocation. Our goal was to evaluate the polyethylene bearing surfaces of a dual mobility design to determine if there was evidence of (1) severe damage and (2) motion at that bearing surface, as predicted by simulator studies.

Materials and Methods: Twenty-nine dual mobility acetabular components were identified in our ongoing implant retrieval system. Patient demographic data were collected from medical records. The outer articular surface of the polyethylene liner was evaluated over 12 zones (quadrant 1, 2, 3 and 4 for the rim, equator and pole regions) for 7 modes of surface damage on a scale of 0 to 3, using a previously published grading system.

Results: The average length of implantation time of 17.3 $\pm$ 21.3 (2-96, range) months. The majority of these components were coupled with a dual-taper modular femoral stem and revised due to adverse local tissue reactions (41%). Dislocation occurred in 17% of patients, with one intra-prosthetic dislocation where the femoral head dissociated from the acetabular liner. The overall average damage score was mild, at 51.4 $\pm$ 14.6. The dominant damage modes were scratching (22.6 $\pm$ 7.4) and pitting (25.1 $\pm$ 8.5). Seven outer bearing surfaces had metallic embedded debris.

Conclusions: With the addition of a second articulating surface, there is always concern for increased wear. The outer bearing surface in our series did show a surprising amount of pitting and scratching, however machine marks were still visible on this outer surface on many of the retrieved components, suggesting that the outer bearing is not the primary source of motion within the acetabular system, consistent with hip simulator testing.

Poster #85

Minimising Complications in the Revision of Failed Metal-on-Metal Hip Arthroplasty – Outcome in over 150 cases

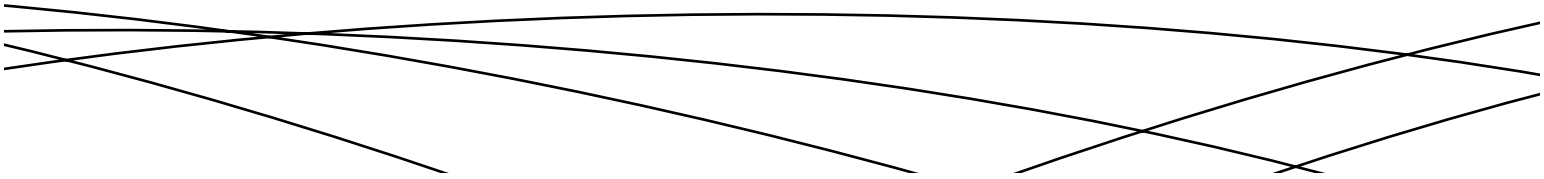
Stephen A. Jones, MD, FRCS, Rhodri Williams, Atif Sabah

Introduction: High rates of complications have been reported in patients undergoing revision for adverse reactions to metallic debris generated by MoM articulations. We present our revision strategy and outcome that attempts to minimise complications particularly dislocation in this challenging patient group.

Method: We reviewed a consecutive single surgeon revision series performed on failed MoM cases treated in a tertiary referral centre. All underwent pre-op clinical evaluation, plain x-ray, MARS MRI and metal ion measurement. The revision principals utilised in this case series were:
- Avoid all Cobalt/Chromium in revision implant
- Highly Porous In-growth Surface Acetabular Component
- Liner options – largest head size possible
- Bearing – Ceramic-on-Polyethylene or Ceramic-on-Ceramic
- Constrained liner option (utilised if >50% abductor destruction)

Results: Total cohort 158 cases with a minimum 2-year follow-up and in 76% cases the femoral stem was retained. Nine dislocations occurred (5.7%) with two patients requiring re-revision to a constrained liner for continued instability. One deep infection and two superficial infections, one partial sciatic nerve palsy, also one femoral revision for stem subsidence and one socket failure that required a cup-cage reconstruction. A constrained liner was required because of extensive abductor damage in 12% of cases in the remainder a 36mm or 40mm bearing were used in 95% of cases. Those that dislocated all had abductor muscle damage but less than 50% destruction. No patients with isolated posterior soft tissue damage dislocated.

Conclusion: In the revision of failed MoM THA soft tissue damage is main challenge. Planning revision surgery is vital and surgeons need strategy to decrease risk of dislocation. For isolated posterior soft tissue destruction the use of 36 & 40mm heads provide satisfactory joint stability.



Poster #86

The Role of Hip Aspiration in the Diagnosis of Infection in Metal on Metal Hip Arthroplasty

James S. Melvin, MD, Robert Cope, MS, Thomas K. Fehring, MD, Susan Odum, PhDc

Introduction: The diagnosis of infection after total hip arthroplasty (THA) remains challenging, especially for metal on metal (MOM) articulations. Synovial fluid analysis is often employed in the work up for infection, but little data exists for interpretation of synovial fluid across different bearings. This study investigates the performance of synovial fluid analysis in the diagnosis of infection in MOM hip arthroplasty.

Methods: Between 2001 and 2012, 1409 consecutive revision THA's were reviewed. 51 patients met inclusion criteria of pre-revision hip aspiration yielding a cell count prior to MOM revision. Infection was defined as final histopathology consistent with infection. Standard synovial fluid cut-off's of synovial cell count (SCC) >3000 cells/uL and neutrophil percentage (NP) >80%, in addition to serum CRP > 0.8mg/dL and ESR > 22mm/hr, defined a positive test for infection, respectively.

Results: There were 47 uninfected cases and 4 infected cases. The mean SCC, NP, CRP and ESR in the infected cases was 61,936 cell/uL, 92.6%, 4.0 mg/dL, and 74mm/hr, respectively, and 2,634 cell/uL, 53.4%, 1.8mg/dL and 19.3mm/hr in the uninfected cases, respectively. SCC > 3000 cells/uL was 75% (20%-96%) sensitive and 87% (74%-95%) specific with an AUC of 0.8 (CI 0.55-1). NP > 80% was 100% (30%-100%) sensitive and 78% (62%-90%) specific with an AUC of 0.79 (CI 0.54-1). CRP > 0.8gmg/dL was 75% (20%-96%) sensitive and 48% (32%-64%) specific with an AUC of 0.63 (CI 0.37-0.89). ESR > 22mm/hr was 100% (40%-100%) sensitive and 68% (52%-82%) specific with an AUC of 0.85 (CI 0.37-0.89).

Discussion and Conclusion: Our data suggest that standard cut-offs of >3000 cell/uL for SCC and NP >80% can aid in the diagnosis of infection in MOM articulations. These cut-off values appear to perform similarly to metal on poly bearings and, thus, can offer an additional clue towards the sterility of the joint.

Poster #87

The Effect of Obesity on the Revision Rate of Total Knee Arthroplasty: A Population Based Validation Study of a Pooled Electronic Healthcare Database

Kiel J. Pfefferle, MD, Karen M. Gil, PhD, Stephen D. Fening, PhD, Matthew F. Dilisio, MD

Introduction: The aim of this study is to validate the use of a novel pooled electronic medical records database of over 16 million patients from 13 major United States healthcare systems for orthopaedic research. Our hypothesis was that, consistent with prior reports in the literature, obese patients possess a greater risk of revision total knee arthroplasty (TKA) when compared to a non-obese cohort within this database.Additionally, given the large sample size available, subgroup analyses were performed to expand previous findings.

Methods: A novel software platform (Explorys) was utilized for this retrospective cohort study. Relative risk (RR) of revision TKA was determined in cohorts of varying body mass indices (BMI) relative to patients who were normal/overweight (BMI 18 – 30). The effect of increasing BMI within men and women was also assessed. The Pearson's Chi Square test was used for statistical analysis ($p < 0.05$).

Results: Within this database, 70,070 patients were identified that had undergone a TKA. RR of revision increased as a function of BMI and was significantly increased in the group of all patients with a BMI greater than 30 ($p=0.013$), the subgroup of all patients with a BMI greater than 40 ($p=0.006$), all men with a BMI greater than 30 ($p=0.009$), and the subgroup of men with a BMI greater than 40 ($p=0.005$) compared to normal/overweight patients. RR of revision were significantly greater in men than in women (all $p<0.05$).

Conclusion: The results of this study support our hypothesis that obese patients possess a statistically significant greater risk of revision TKA within this database. The large sample size allowed for expansion of previous results to include analysis of sex. This study contributes to the validation of these platforms to investigate associations across large populations.

Poster #88

The Epidemiology of Revision Total Knee Arthroplasty in the United States

Kevin J. Bozic, MD, MBA, Atul F. Kamath, MD, Edmund Lau, MS,
Kevin Ong, PhD, Steve M. Kurtz, PhD, Vanessa Chan, MPH,
Thomas P. Vail, MD, Daniel J. Berry, MD, Harry E. Rubash, MD

Introduction: The mechanisms of failure in revision total knee arthroplasty (TKA) should guide efforts to improve clinical outcomes. The purpose of this study was to characterize the epidemiology of revision TKA in the United States with respect to patient, hospital, geographic, and payer characteristics.

Methods: The Nationwide Inpatient Sample was used to evaluate the cause of failure for 301,718 revision TKA procedures performed between Q4 2005 and 2010. Patient characteristics, procedure information, and resource utilization were compared across revision TKA procedures.

Results: The number of revision TKA procedures increased from 48,260 in 2006 to 67,534 in 2010. Revision TKA procedures were more common in women (58%), and were most commonly performed in 65-74 year olds. A Moderate severity of illness score was recorded in >60% of patients. Periprosthetic joint infection (PJI) (25%) and mechanical loosening (18.5%) were the most common reasons for revision; osteolysis (2.9%) and periprosthetic fracture (1.6%) were least common. All-component revision accounted for 37% of all revisions in 2010, while arthrotomy/removal of prosthesis accounted for 13%, isolated tibial insert revision accounted for 12%, tibial component revisions 10%, patellar component revisions 5%, and femoral component revisions accounted for 4%. Medicare payer status accounted for >50% of revisions. Revision TKA procedures were more common in large, urban non-teaching hospitals and in the South and Midwest regions. PJI and periprosthetic fracture were associated with the longest length of stay (>7 days). The highest average hospitalization costs were for periprosthetic fracture (~$35,000).

Conclusion: The burden of revision TKA is growing. Elderly and female patients with a moderate number of comorbidities represent a large proportion of the revision population. PJI and mechanical loosening are the most common causes of revision TKA. Revisions for PJI and periprosthetic fracture are the most resource intensive.

Poster #89

Revision Total Knee Arthroplasty for Patients Less than 55 Years of Age

James A. Keeney, MD, Jeffrey B. Stambough, MD, Angela D. Keith, MS, Kelly A. Morris, Geneva Baca, BA, John C. Clohisy, MD

Introduction: Total knee arthroplasty (TKA) is being performed for an increasing number of younger patients who are expected to contribute an increased TKA revision burden. The results of revision TKA for patients younger than 55 years of age at the time of surgery have not been defined.

Methods: Retrospective review of preoperative and postoperative clinical, functional, and activity scores for 78 young revision TKA patients (83 knees) at a mean follow-up of 6 years after surgery, compared to an age and gender matched cohort of primary TKA patients with mean 6 year follow-up. Mean BMI was similar for both groups (34.9 vs 33.6 kg/m2, $p = 0.33$).

Results: The most common indications for revision TKA included aseptic loosening (27%), infection (19%), stiffness (13%) and instability (13%). Revision TKA patients experienced improvement in Knee Society clinical score (16 points), Knee Society functional score (30 points), SF-12 Mental Function score (7.3 points) and UCLA activity level (1.1 points). Among primary TKA patients, the improvement in Knee Society scores ($p<0.02$), and SF-12 Physical Function Scores ($p<0.001$) were more substantial. Mean UCLA activity scores increased modestly from baseline in both groups ($p = 0.55$). 17% of revision TKA patients experienced a postoperative complication within the first year, and 14% underwent a revision surgery within 2 years of their revision TKA. The most common reasons for re-revision were infection (6%) or instability (4%).

Conclusion: Revision TKA can be effective for improving pain and function for patients less than 55 years of age with failed primary TKA. Improvement is not as substantial as for patients undergoing primary TKA, increases in patient activity level are modest, and over 20% of patients either experienced a postoperative complication or required subsequent re-revision surgery. Recurrent infection and instability are the most frequent challenges to improved pain and function for this patient group.

Poster #90

Knee Arthrodesis is Most Likely to Control Infection and Preserve Function following Failed 2 Stage Procedure for Treatment of Infected TKA: A Decision Tree Analysis

Chancellor F. Gray, MD, Chia Wu, Keith D. Baldwin, MD, MPH, Gwo-Chin Lee, MD

Introduction: In the United States, for chronic, first time infected TKA, the gold standard remains a 2-stage reimplantation (2SR) procedure. However, there is a lack of consensus on the ideal treatment of subsequent reinfections. The purpose of this study was to use published data on infected TKA to determine the treatment method likely to yield the highest quality of life for a patient following a failed 2SR by decision tree analysis.

Methods: We performed a systematic review to determine the expected success rates and functional outcomes of a 2SR procedure, chronic suppression, arthrodesis, and amputation for treatment of infected TKA. Utility and disutility tolls were derived for each treatment option and a decision tree analysis was conducted. The efficacy of each treatment node was calculated based on the systematic review.

Results: 18 studies met inclusion criteria. The composite success rate for 2SR was 79.1% (range 33.3%-100%). The utility and disutility toll (cost for treatment) for 2SR were 0.473 and 0.20, respectively; the toll for undergoing chronic suppression was set at 0.05; the utility for arthrodesis was 0.740 and for amputation 0.423. In all iterations of the decision tree analysis with varying sensitivities, knee arthrodesis emerged as the treatment most likely to yield the highest expected quality of life following a failed 2SR for infection.

Discussion: We found that 2SR is successful in only 79% of reported cases. We also describe the typical rate at which salvage procedures are utilized after a failed 2SR. Finally, our study suggests that a successful fusion optimizes the patient's expected quality of life after a first failed 2SR. This outcome held up through sensitivity analysis.

Conclusion: Based on best available evidence, knee arthrodesis should be strongly considered as the treatment of choice for patients who have persistent infected TKA following a failed 2-stage reimplantation procedure.

Poster #91

The Use of Metaphyseal Sleeves in Revision Total Knee Replacement

David F. Dalury, MD, William P. Barrett, MD, Adam C. Lawrence,
Shelley Turner, Danielle M. Chapman

Introduction: Bone loss is a common finding in the revision total knee replacement (RTKR) setting. Reconstruction of this bone loss can be challenging. Options include increased resection levels, bone grafts, bone substitutes and metal devices. Metaphyseal sleeves are one such metal device. We report on the efficacy and outcomes in a consecutive series of RTKR patients retrospectively reviewed who were treated with a metaphyseal sleeve.

Methods: From the database of 2 separate centers, we identified a total of 46 consecutive knees in 45 patients who received at least one metaphyseal sleeve (femoral or tibial or both) during a RTKR surgery. Two patients died and 4 were lost to follow up leaving a total of 40 knees in 40 patients as our study group. Mean age was 73 years. Patients were followed a minimum of 3 years (range 3 to 12). A total of 32 femoral sleeves and 40 tibial sleeves were used and 34 patients (34 knees) had both.

Results: At minimum 4 year follow up, one tibial sleeve required revision for loosening at 4 years follow-up. All other sleeves were osseous integrated. No others were at risk of failure. On final x-ray evaluation femoral valgus alignment was a mean of 5 degrees (range 3-8); tibial alignment mean was 90 degrees (range 87-92). Mean Knee Society Scores, in the non-revised group, increased from a preop total of 30 to 92 post op. Average flexion was 125 degrees preop and 120 degrees post op.

Conclusion: At short term follow up, we had one failure in our group of 45 patients. All other sleeves in this study were well aligned and bone ingrown. Metaphyseal sleeves are an effective and versatile way to reconstruct bone loss in the setting of RTKR and allow for acceptable alignment.

Poster #92

Flexion Instability after TKA: Analysis of Diagnostic Features, Radiologically Evident Surgical Corrections and Clinical Outcome

Arun Kannan, MBBS, MS, Robert O'Connell, **Niraj V. Kalore, MD,**
Brian Curtin, MD, William A. Jiranek, MD, FACS

Introduction: Instability is a leading cause of early revision of total knee arthroplasty (TKA), with little published data on the results of revisions performed for flexion instability. Our aims were to study clinical features of flexion instability, radiologically evident corrections and clinical outcome after revision.

Methods: With IRB approval, we studied a retrospective cohort of 24 consecutive patients (15 CR and 9 PS), with mean age of 66 years, who underwent revision for flexion instability. Data was collected through chart review and telephone interview. Mean follow-up was 41 months (range, 12 to 76 months). Posterior condylar offset ratio (PCOR), tibial slope and level of joint line were studied as measures of radiological correction. Patient reported knee society score (KSS) and a 7-point Likert-type scale for perception of improvement were recorded. Statistical Analysis: Paired t-test with $p < 0.05$ as significant.

Results: Difficulty in transitioning activities was the most consistent symptom. Presence of symptoms from the time of primary TKA (21/24), and soft tissue tenderness (21/24) were other predominant clinical features. Posterior sag was present in 13 of 15 CR TKAs. The median duration between primary TKA and revision was 27 months (range, 12-189 months). The mean PCOR showed a significant increase ($p<0.0001$) and tibial slope showed a significant decrease with surgery ($p<0.0003$). There was no change in the level of the joint line ($p>0.05$). One patient died and 3 did not have adequate follow-up. The mean KSS and KSS function scores improved significantly from 35.1 and 42.5 to 66.5 and 66, respectively ($p<0.0001$). Sixteen of 20 patients reported perceptible improvement. There were 4 minor reoperations and one ORIF for postoperative periprosthetic fracture, but no re-revisions.

Conclusion: Revision TKA for flexion instability increased PCOR and decreased the tibial slope and produced satisfactory improvement in clinical outcome.

Poster #93

The Outcome of Unexpected Positive Intraoperative Cultures in Presumed Aseptic Revision Hip and Knee Arthroplasty

Anas Saleh, MD, Kevin Bloom, Mark Habeish, Mario Farias-Kovac, Carlos Higuera, MD, Wael K. Barsoum, MD, Alison K. Klika, MS

Introduction: Intraoperative cultures obtained during revision total hip or knee arthroplasty (THA or TKA, respectively) have traditionally been considered the gold standard in the diagnosis of periprosthetic joint infection. When these cultures are unexpectedly positive during an aseptic revision procedure, they pose a management dilemma for the surgeon and infection disease specialist. The purpose of this study was to describe the prevalence of unexpected positive cultures in aseptic revision THA and TKA, the long-term implications of these positive cultures, and compare treatment methods.

Methods: This was a retrospective study of 683 consecutive revision THA and TKA procedures performed for any aseptic indication between June 2007 and December 2009. Patients were excluded if intraoperative culture data were not available (n=177), if there was clinical suspicion of infection (n=3), if frozen section indicated acute inflammation (n=2), or if patients were receiving antibiotic treatment at the time of revision (n=3). The remaining 498 eligible revisions were used as the study cohort. Clinical characteristics and laboratory data were obtained for patients with at least 1 unexpected positive culture.

Results: Of the 498 patients, 61 (12%) had at least 1 unexpected positive culture. The majority of cultures grew coagulase-negative Staphylococcus species (37 cases, 61%). Mean follow-up was 1.9 years (range, 0.04 – 5.66). Thirty-six patients (59%) received 6 weeks of intravenous antibiotics, whereas 25 (41%) were treated as 'contaminants' and did not receive antibiotic treatment. Of those who received antibiotics, 8 patients were re-admitted for a diagnosis of periprosthetic joint infection. Patients that did not receive antibiotics did not present back with periprosthetic joint infections.

Discussion and Conclusion: In our series, there was a 12% chance of encountering an unexpected positive intraoperative culture in aseptic revision THA and TKA. Of those, 13% became re-infected despite appropriate antibiotic therapy, and no patients were under-treated.

Poster #94

Comparative Epidemiology of Revision Total Hip and Knee Arthroplasty Populations

Kevin J. Bozic, MD, MBA, Kevin C. Ong, MD, Edmund Lau, MS, Atul F. Kamath, MD, Steve M. Kurtz, PhD, Vanessa Chan, MPH, Thomas P. Vail, MD, Harry E. Rubash, MD, Daniel J. Berry, MD

Introduction: Revision total hip (RTHA) and knee arthroplasty (RTKA) represent significant clinical and economic challenges. The purpose of this study was to evaluate epidemiologic trends associated with RTHA and RTKA, and to identify key differences that might guide care.

Methods: The Nationwide Inpatient Sample was used to evaluate 235,857 RTHA and 301,718 RTKA procedures between Q4 2005 and 2010. Patient characteristics, procedure information, and resource utilization were compared across RTHA and RTKA procedures.

Results: RTKA increased from 48,260 cases in 2006 to 67,534 in 2010 (revision burden (RB): 8.9% to 9.3%); RTHA increased from 40,555 in 2006 to 49,857 in 2010 (RB: 15.1% to 14.2%). RTHA was more common in older patients (75-84 years) compared to RTKA (65-74). The majority of revisions were performed in female, white, Medicare patients in large urban hospitals in the South and Midwest. Periprosthetic joint infection (PJI) (25%) and mechanical loosening (18.5%) were the most common reasons for RTKA, compared to dislocation (22.1%) and mechanical loosening (20.3%) for RTHA. The greatest gender differences were in periprosthetic fracture (both RTKA and RTHA) and dislocation (RTHA). RTHA patients were generally sicker (>50% major severity of illness (SOI)) than RTKA patients (65% moderate SOI). All-component revision was higher in RTHA (42.8%) than in RTKA (36.5%). Average length of stay (LOS) was longer for RTHA (6 days) than for RTKA (<5 days). PJI and periprosthetic fracture were associated with the greatest LOS and costs for both RTHA and RTKA. Average hospitalization costs were greater for RTHA (~$25,000) than RTKA (~$23,000).

Conclusion: While both RTHA and RTKA bear significant clinical and economic burdens, RTHA patients tend to be older, sicker, and carry greater costs of care. The revision burden for THA is 52% greater than for TKA, but RTKA procedures are increasing at a faster rate than RTHA procedures.

Poster #95

Use of Screws and Cement in Revision TKA

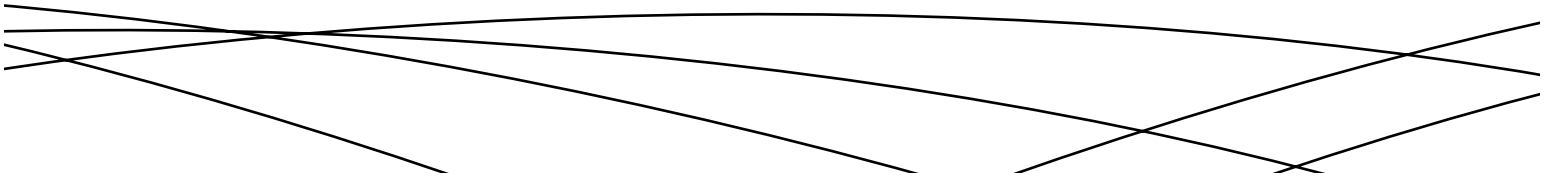
Michael E. Berend, MD, E. Michael Keating, MD, **Robert A. Malinzak, MD**

Introduction: Revision knees are burdened by massive defects. Do we need to sculpt bone to accommodate wedges and augments or can we easily achieve successful long term revision survivorship with screws and cement?

Methods: Between July 1989 and December 2010 we retrospectively reviewed the clinical outcomes of n= 674 consecutive revision TKR's occurring 630 patients. Average age was 69.0(+/-9.9)[33, 91], BMI 31.7(+/-6.6)[19.8, 55.0] with 58.4% (368 of 630) were females. Average followup of the revised prosthesis was 6.3 (+/-3.6)[2,17] years. Data was examined by Kaplan-Meier survival analysis and risk of failure was analyzed by Cox Regression with the covariates of age, bmi and pre revision deformity.

Results: Revision procedures receiving screws had greater deformities compared to procedures not receiving screws ($p<.0001$). Kaplan-Meier survivorship for aseptic loosening at 10 years postoperatively was .9371 for revision-TKR's without screws and .9372 for revision-TKR's with screws ($p=.7846$, Log rank Test). Kaplan-Meier survivorship for aseptic loosening at 10 years was .9823 for revision-specific prostheses in revision procedures, and .9273 for primary prostheses used in revision procedures ($p=.3713$, Wilcoxon test). At 15 years, aseptic survivorship was .9823 for revision-specific prosthesis and .9095 for primary prosthesis used in revision procedures ($p=.8242$, Log Rank test, with the numbers available). Older patients had greater survivorship for aseptic loosening in revision-TKR ($p=.0101$), and patients with higher BMI had greater survivorship in revision-TKR ($p=.0316$).

Conclusion: Screws and cement for revised TKR's reported similar if not improved long term survivorship compared to less-deformed revised-TKR's through 17 years postoperatively. Revision specific prosthesis is likely essential for revision-TKA, as indicated by the relative underperformance of primary prosthesis in revision-TKR. Screws augmentation can result in good long term outcome in revision total knee arthroplasty. Advantages include intra-operative efficiency, significantly decreased cost, and often no additional bone cuts.



Poster #96

Short Cemented Stems versus Press Fit Fluted Stems in Revision Total Knee Arthropalsty

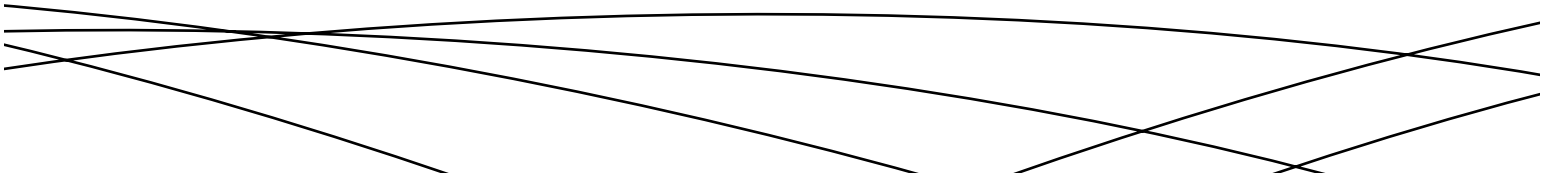
Samrath Bhimani, Christopher A. Samujh, MD, Langan Smith, BS,
Kirby Hitt, MD, **Arthur L. Malkani, MD**

Introduction: In revision Total Knee Arthroplasty (TKA), most cases require the use of stemmed components to gain secure fixation and prevent future loosening. The purpose of this study is to compare the clinical results of short cemented stems and press-fit fluted stems in revision TKA using a contemporary revision knee system.

Method: This is a retrospective multicenter review of 147 patients (61 males, 63 females) with a mean age of 63, and mean follow up of 34 months undergoing revision TKA with the same implant system. The cemented group had 107 patients that underwent revision with short cemented stems. The press-fit group had 40 patients that underwent revision using hybrid fixation with press-fit fluted stems of varying length. Clinical evaluation consisted of Knee Society Scores (KSS), radiographs, and the incidence of repeat revision. Preliminary statistical analysis was performed using Microsoft Excel.

Results: There were no statistically significant differences between the two groups with respects to age, BMI, pre-operative KSS, average follow-up, and survivorship. The KSS for the entire cohort improved by a mean of 50 and 63 points respectively. The cemented group had 3 repeat revisions which were all due to infection. The press fit group had 5 repeat revisions; 2 for infection, 2 for post operative periprosthetic fracture, and 1 for aseptic loosening of the tibial tray.

Conclusion: Our findings demonstrate that good results can be obtained using either short cemented stems, or press-fit fluted stems in patients undergoing revision TKA. Although the amount of repeat revision in the press fit group was higher than the cemented group, it was not statistically significant. Because of variable patterns and magnitudes of bone loss in patients undergoing revision TKA, we recommend the use of implant systems that offer multiple options for stems, offsets, and augments.



Poster #97

Why Are Total Knees Being Revised: A Review of 872 Consecutive Cases

David F. Dalury, MD, Robert Gorab, Danielle M. Chapman, Donald L. Pomeroy, MD

Introduction: Despite wide spread agreement that total knee replacements (TKR) are an effective and durable procedure, and despite improvements in implants, instruments and techniques, revision rates for this procedure remain stubbornly high. We retrospectively reviewed a large series of revisions TKRs to identify the causes for revision.

Methods: We retrospectively reviewed data from our clinical database and identified a total of 872 consecutive revisions TKRs (RTKR) from 3 centers. Surgeries were performed between 2000 and 2012. We documented the reason for their revision. Some patients had more than one cause for revision but the reason for surgery (based on X-rays, laboratory results and intra-operative observation) was recorded by the surgeon as the primary reason for the revision surgery.

Results: The mean age of the patients studied was 69 (19 – 94). Mean time to revision from index surgery was 5 yrs. (range 0.1 yrs. to 30 yrs.). Diagnosis for the revision surgery was: Infection 21.8%, Aseptic loosening 21.5 %, Poly wear 16.7%, Instability 16%, Pain/stiffness 8.7%, Osteolysis 4.2%, Malposition/malalignment 2.7%, Perisprosthetic fracture 1.2%, Dislocation/subluxation 1% and Other 4.3%.

Conclusion: Comparing this recent, large, multicentered series with other previous reports (1, 2) of causes of TKR failure, several differences are apparent. Fewer revisions are being performed for polyethylene wear and osteolysis and fewer revisions are performed for instability and malalignment. The reason for these changes are multifactorial but may represent improvements in surgical technique as well as in implants. However, this data shows that there continues to be room for improvement in these areas. Infection unfortunately continues to be a major challenge.

1. Sharkey PF, Hozack WJ, Rothman RH, et al. Why are total knee arthroplasties failing today? Clin Orthop. 404: 7-13, 2002
2. Fehring TK, Odum, S, Griffin WL, et al. Early Failures in total knee arthroplasty. Clin Orthop 392: 315-318, 2001

Poster #98

Osteointegration of Non-cemented Metaphyseal Sleeves in Revision Total Knee Arthroplasty in Active Patients

Morteza Meftah, MD, Danyal H. Nawabi, MD, FRCS,
Amar S. Ranawat, MD, Chitranjan S. Ranawat, MD

Introduction: Non-cemented, porous-coated metaphyseal sleeves have been designed to improve biologic fixation and long-term stability in revision total knee arthroplasty (TKA). However, safety and efficacy of these sleeves in major bone defects has not been investigated. The aim of this study was to evaluate the clinical results and assess the osteointegration of non-cemented metaphyseal sleeves in active patients with major bone loss.

Methods: Between 2008 and 2011, 25 revision TKAs with major bone loss were reconstructed using non-cemented metaphyseal sleeve (DePuy, Warsaw, IN) in both femur and tibia: 14 cases for aseptic loosening and 10 cases for second stage revision of periprosthetic infection. Indications for use of sleeves were major metaphyseal tibial and femoral bone loss, younger age, and/or higher activity level. The mean University of California Los Angeles (UCLA) activity score prior to TKA failure was 5 ± 2 (range 3 - 8). All patients were prospectively followed for a minimum of 2 years.

Results: The mean age at the time of surgery was 64.1 ± 11.4 years (43 - 87). The average range of motion and Knee Society Scores at final follow-up were 108 ± 24 degrees, and 84 ± 13, respectively. There was no malalignment, subsidence or re-revision. The joint line was restored in all cases within 2 mm, with a mean Insall-Salvati ratio of 1.0 ± 0.2. Osteointegration around the sleeves were classified as:
Grade 1: Complete osteointegration in all views without any demarcation (84%)
Grade 2: Sleeves that are not completely osteointegrated but they are stable (16%)
Grade 2A: Demarcation $<$ 2 mm on any view (14%)
Grade 2B: Demarcation $\geq$ 2mm on any view 3 (2%)
Grade 3: Sleeves that are unstable with evidence of subsidence (0%)
Grade 3A: Subsidence $<$ 2 mm on any view
Grade 3B: Subsidence $\geq$ 2 mm on any view

Discussion and conclusion: Short-term results of non-cemented metaphyseal sleeves in active patients with major bone loss for loosening or infection demonstrated excellent osteointegration.

Poster #99

Autoclaving an Infected Component for use in an Articulating Spacer: Confirming Sterility and Biofilm Evaluation

Melissa Levering, BS, **Coy A. Wright, MD,** Christina N. Krute, BS, Frances E. Rivera, MS, Ronan Carroll, Lindsey Shaw, PhD, Steven Lyons

Introduction: This study tests the hypothesis that immediate use "flash" steam sterilization can render a contaminated femoral component sterile. Multiple antibiotic spacer designs have proven effective at eradicating infection during a two-stage revision knee arthroplasty. Multiple authors describe temporary reuse of the "flash" steam sterilized femoral component and a new all poly tibia component as an effective articulating antibiotic spacer. Concern over sterility of the autoclaved femoral component has prevented widespread adoption.

Methods: Two explanted cobalt chrome femoral components from patients infected with Methicillin resistant Staphylococcus aureus (MRSA) and Staphylococcus epidermidis underwent sterility testing after exposure to a standard gravity-displacement autoclave "flash" cycle. In addition, six stock femoral components where inoculated with six different species of bacteria and then underwent sterility testing after exposure to a standard gravity-displacement autoclave "flash" cycle (132 °C at 27 pSIG for 10 min). The six components were also tested at a cycle setting of 121 °C at 15 pSIG for 45 min. In order to quantify remaining biofilm, three cobalt chrome fragments contaminated with MRSA biofilm underwent "flash" steam sterilization and were compared to controls under a scanning electron microscope and a multi-mode micro-plate spectrophotometer.

Results: The explanted femoral components returned zero colony forming units per milliliter (CFU/ml) after autoclave exposure. The six stock femoral components at both autoclave settings demonstrated zero CFU/ml; each control femoral component not exposed to the autoclave "flash" cycle demonstrated greater than 100, 000 CFU/ml. The autoclave significantly reduced the biofilm burden on the three cobalt chrome fragments when compared to controls ($p=<0.05$).

Discussion/Conclusion: This study confirmed sterility of the femoral component after a standard gravity-displacement "flash" cycle (132 °C, 27 PSIG, 10 min).

Poster #100

Modes of Failure and Outcomes of Revision of Non-Modular Total Knee Replacements

Lucas Pugh, MD, FRCSC, Geoffrey H. Westrich, MD, Allision Ruel, BA, Douglas E. Padgett, MD

Non-modular constrained (NMC) total knee arthroplasty (TKA) provides additional constraint without a stem on the femoral component. Three outcome measures were assessed: 1) Modes of failure analysis of NMC prostheses; 2) Survivorship analysis of revisions of these failures; 3) Revised patients' clinical outcome scores analysis. 50 patients with failed primary NMC TKAs and their SF-36/12, KOOS, and WOMAC scores were analyzed. 40 (80%) of the failures were due to aseptic loosening which is significantly higher than the rate expected ($p<0.0001$). 7 have required repeat revision at a mean time of 3.8 years. The clinical outcome scores were fair at 2 years from revision. There is a higher rate of aseptic loosening in NMC TKA and the revisions have inferior survivorship and clinical outcomes.

Poster #101

Porous Tantalum Tibial Cones in Revision Total Knee Arthroplasty: Minimum 5-Year Follow-up

Atul F. Kamath, MD, Arlen D. Hanssen, MD, David, Lewallen, MD

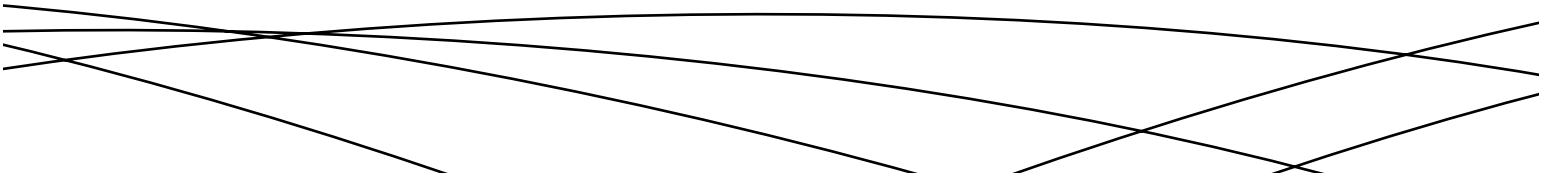
Introduction: Severe metaphyseal and meta-diaphyseal bone loss challenges the reconstructive algorithm in revision total knee arthroplasty. The best strategy for addressing massive tibial bone loss has not been determined.

Methods: 65 porous tantalum tibial cones (62 patients) were reviewed at an average of 70 months of follow-up (range, 60-105 months). According to the Anderson Orthopaedic Research Institute bone defect classification, 24 knees had a Type-3 defect, 25 knees had a Type-2B defect, and 16 knees had a Type-2A defect. All patients were followed clinically and radiographically beyond 5 years postoperatively.

Results: The average age was 67 years (range, 41-81). The average ASA status was 2.5, and the average BMI was 33. The patients had had an average of 3.1 prior knee surgeries (range, 1-20), and 34% of patients had a history of peri-prosthetic infection. 15 patients were on immunosuppressant medications, and 8 patients were smokers. The average Knee Society Scores improved from 58 points preoperatively to 79 points at final follow-up ($p<0.05$). In radiographic analysis, there was one patient with evidence of progressive radiolucencies about the tibial stem and cone; there was one patient with complete radiolucency about the tibial cone, concerning for fibrous ingrowth. Three tibial cone-related re-operations were performed: one for infection, one for aseptic loosening, and one for peri-prosthetic fracture.

Conclusions: Porous tantalum tibial cones offer a promising management option for severe tibial bone loss. At mid-term follow-up, porous tantalum tibial cones demonstrate durable clinical results and radiographic fixation. Revision-free survival of the tibial cone component was 95.4%. The biologic ingrowth of these implants offers the potential for successful long-term structural support in complex knee reconstruction for both septic and aseptic etiologies.

Summary sentence: At 5-9 year follow-up, porous tantalum cones for severe tibial bone loss demonstrate durable clinical results and radiographic fixation. Revision-free survival of the tibial cone component was 95.4%.



Poster #102

Mortality following Revision Total Knee Arthroplasty: A Matched Cohort Study of Septic versus Aseptic Revision

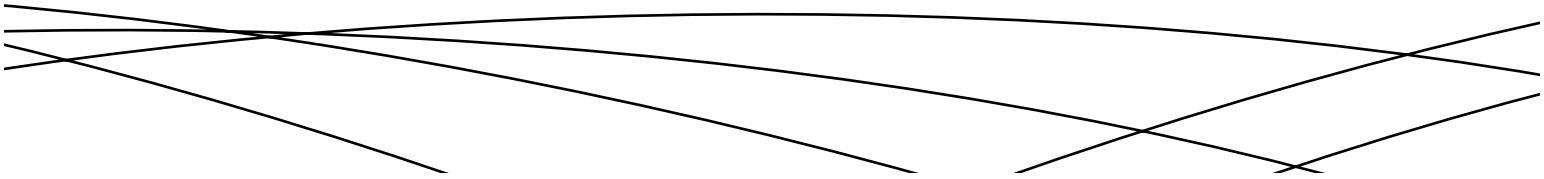
Ho-Rim Choi, MD, Hany Bedair, MD

Introduction: While studies have investigated the perioperative mortality rates for revision TKA, little information is available regarding longer-term rates of mortality, specifically in the setting of revision for sepsis. The purpose of this study was to (1) investigate the mortality rate for revision TKA beyond the perioperative period, (2) assess whether revision surgery for septic failures increases mortality rates compared to those for aseptic failures, and (3) identify independent predictors of mortality after revision TKA.

Methods: Eighty-eight patients undergoing revision TKA for sepsis by component removal and planned staged re-implantation (two-stage) procedures ('septic group') were individually matched with 88 patients who underwent revision for aseptic failures ('aseptic group') by age at the time of surgery (+/- 3 years) and year of revision surgery. Each patient's mortality status was identified through the Social Security Death Index. Multivariate logistic regression was performed to identify independent predictors of mortality.

Results: Overall mortality after revision TKA was 10.7% (19/176) at a median follow-up of 4 years (IQ range: 2-7 years). The mortality was 18% (16/88) in the septic group and 3% (3/88) in the aseptic group ($p=0.003$). Multivariate logistic regression analysis demonstrated that in addition to an increased age at the time of revision surgery ($p<0.001$, OR 1.13; CI 1.05-1.21), revision for septic failure ($p<0.001$, OR 7.7; CI 2.0-32.1) and ASA Class III or IV ($p=0.002$, OR 6.6; CI 1.7-25.7) were independent predictors of mortality among the entire cohort.

Conclusion: Overall mortality after revision TKA was comparable to that of primary surgery at a median of 4 years after surgery. Revision for sepsis correlated with an approximate six fold increase in the rate of mortality compared to revisions for aseptic failures and was identified as an independent risk factor for increased mortality with an odds ratio of 7.7.



Poster #103

Periprosthetic Hip and Knee Joint Infections Treated with Two-Stage Revision over a 14-year Period: An Evolving Microbiology Profile

Benjamin T. Bjerke-Kroll, MD, MS, Alexander B. Christ, MD, Alexander S. McLawhorn, MD, MBA, Peter K. Sculco, MD, Dorothy Marcello, MD, Barry D. Brause, MD, Kethy M. Jules-Elysee, MD, Thomas P. Sculco, MD

Introduction: Late periprosthetic joint infection (PJI) occurs in 0.3-1.7% of total hip replacement (THR) and 0.8-1.9% of total knee replacement (TKR). Surgical debridement, explant, and appropriate antibiotics are imperative for successful treatment. Epidemiologic studies guide empiric antibiotic choice. We analyzed organisms from PJIs at one institution for incidence trends over 14 years.

Methods: 395 THRs and 390 TKRs that underwent two-stage revision for late PJI between 1998 and 2011 were retrospectively reviewed. All patients had culture data. The primary pathogen was identified for each PJI by frequency in cultures and/or growth abundance. Differences in proportions of THR and TKR infected with each organism were compared using Chi-square tests corrected via False Discovery Rate estimation. Annual rates (%) of PJI for each organism were analyzed via Poisson regression modeling.

Results: 72.6% of primary pathogens were Gram-positive, 7.1% Gram-negative, and 0.6% fungi. 21.3% of cases were culture-negative. 12.1% were polymicrobial. Primary MRSA (incidence rate ratio [IRR]=1.11, p=0.019), S. viridans (IRR=1.18, p=0.002), and P. acnes (IRR=1.21, p=0.024), PJI increased over our study period. Poisson regression model demonstrated a linear increase in infection rate for all three bacteria over the time period.

Discussion: Increased incidence of MRSA, S. Viridans and P. acnes PJIs may inform prevention and treatment of late PJI. MRSA PJIs are associated with higher rates of treatment failure. Our results support empiric antibiotic regimens for PJI that cover MRSA, and pre-surgical screening and treatment should be further investigated. Significance of P. acnes in lower extremity PJI is unclear, but prolonged incubation for suspected PJI should be considered, given the increased isolation of this organism in our cohort. Current AAOS guidelines have limited evidence to recommend discontinuing dental prophylaxis for patients with joint replacements. With 12% of our PJI caused by S. viridans in 2011, re-evaluation of this recommendation is advised.

Poster #104

Caution! High Rate of Positive Cultures in Referred Patients with Antibiotic Spacers

Thomas K. Fehring, MD, Arlen D. Hanssen, MD, MD, Robert Sproul, MD,
Rafael J. Sierra, MD, **Kevin I. Perry, MD**

Introduction: A two-staged exchange for infected TKA has become the standard of care. Not infrequently, patients with an infected TKA are referred to another facility for persistent infection after an initial resection and antibiotic spacer have been placed. Little literature exists reporting outcomes to suggest how these patients should be managed. The purpose of this study is to report outcomes of patients with infected TKAs treated with initial debridement/resection referred to another center for definitive management.

Materials and Methods: We identified all patients treated for an infected TKA from 2000-2012 whose initial surgical treatments were performed somewhere other than the definitive treatment center. Fifty-four patients (average age 64) were retrospectively reviewed and followed for at least 6 months after their definitive treatment. Primary outcome measures were rates of re-debridement, positive cultures at the time of re-debridement, rates of re-implantation, and re-infection after re-implantation.

Results: The most common (25/54 knees) organism identified at the time of presentation was Staphylococcus (15 MSSA, 11 MRSA). All knees were re-debrided with antibiotic spacer exchange. Twenty-seven of these 54 knees had retained cement from their index arthroplasty identified at the time of re-debridement. Of the 54 knees, 22 (41%) grew an organism from a culture taken at the time of re-debridement. Forty-nine out of 54 (91%) knees were ultimately re-implanted with a TKA. Of the 49 knees re-implanted, only 1 (2.0%) had positive cultures at the time of re-implantation.

Conclusion: Patients referred for persistent infection after initial debridement and resection of their TKA have favorable results using re-infection after re-implantation as an endpoint. Re-debridement with removal of retained cement and antibiotic spacer exchange was performed in all patients. The high rate of positive cultures (41%) at the time of re-debridement strongly suggests that additional debridement and spacer exchange prior to proceeding with TKA re-implantation should be considered in this group.

Poster #105

Does Malnutrition Correlate with Septic Failure of Hip and Knee Arthroplasties?

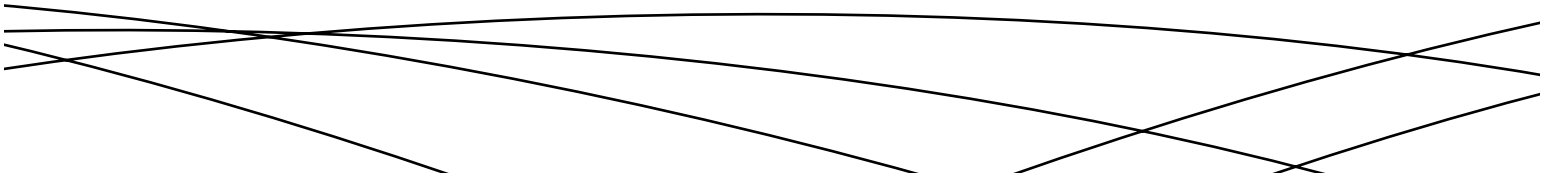
Elliott Vann, MD, Paul H. Yi, BA, Rachel M. Frank, MD,
Mario Moric, Craig J. Della Valle, MD

Introduction: Malnutrition has been hypothesized to increase the risk of periprosthetic joint infection (PJI), however strong evidence linking the two is lacking. The purpose of this study was to assess the prevalence of malnutrition in patients undergoing revision knee and hip arthroplasty. We hypothesized that 1) patients undergoing revision for chronic PJI would have a higher rate of malnutrition than revisions performed for other causes and 2) malnutrition would increase the risk of acute postoperative infection in those patients undergoing aseptic revision.

Methods: A consecutive series of 501 revisions (375 aseptic, 126 septic) were screened for malnutrition (defined as total lymphocyte count < 1500/mm3, serum albumin < 3.5 g/dL, or serum transferrin less than 200 mg/dL). Age, sex, insurance type, race, Charlson Comorbidity Index (CCI), and body mass index (BMI) were compared between aseptic and septic groups using Fisher's Exact Test and Student's t-test, as appropriate. The 375 aseptic revision cases were then assessed for the incidence of acute postoperative infection (within the first 90 days postoperatively). Multivariate regression analysis was performed to identify independent risk factors for 1) septic as opposed to an aseptic mode of failure, and 2) acute postoperative infection following an aseptic revision.

Results: 67 of 126 Patients (53.2%) undergoing revision for PJI were malnourished compared to 123 of 375 (32.8%) undergoing revision for a non-infectious etiology ($p < 0.0001$). Patients undergoing septic revision were also significantly more likely to be male (65% vs. 53%, $p = 0.03$) and to have non-private insurance (81.4% vs. 65.6%, $p = 0.03$). Normal weight patients had the highest prevalence of malnutrition (50.6%), although malnutrition was common in obese patients (31.9%). Of the 375 aseptic revisions,12 developed an acute postoperative infection (3.2%). The prevalence of infection was 9 of 123 in the malnourished group and 3 of 252 in the adequately nourished group (7.3% vs 1.2%; $p= 0.003$). Multivariate regression revealed that malnutrition is both an independent risk factor for septic revision ($p=0.0030$, Odds Ratio = 2.1) and for acute post-operative infection after aseptic revision arthroplasty ($p = 0.02$, Odds Ratio=5.9).

Conclusion: Pre-operative malnutrition is extremely common among patients undergoing revision arthroplasty and is an independent risk factor for both chronic septic failure and acute post-operative infection following revisions performed for a non-infectious etiology. Malnutrition was paradoxically more common in normal weight patients. Surgeons should consider screening patients preoperatively for malnutrition, even if they appear to be of normal weight.



Poster #106

Diagnosis of Periprosthetic Joint Infection in Medicare Patients: The Role of Multicriteria Decision Analysis

Claudio A. Diaz-Ledezma, MD, Paul M. Lichstein, MD, MS,
James Dolan, MD, Javad Parvizi, MD, FRCS

Introduction: In the setting of finite healthcare resources, developing cost-efficient strategies for diagnosis of periprosthetic joint infection (PJI) is paramount. The aim of this study is to determine the best diagnostic strategy for knee and hip PJI among Medicare patients, considering benefits, opportunities, costs and risks (BOCR) through multicriteria decision analysis (MCDA).

Methods: The Musculoskeletal Infection Society (MSIS) definition of PJI was employed for our study. Four diagnostic strategies comprising eight different tests were evaluated. MCDA was conducted in two stages: creation of a balance sheet followed by an analytic hierarchy process (AHP) that involved only the efficient diagnostic strategies. They were compared in terms of BOCR utilizing a preclinical model that involved a Medicare patient seen in the ambulatory setting.

Results: The efficient strategies for the diagnosis of PJI in both hip and knee models were: 1) Screening with serum markers (ESR/CRP) followed by arthrocentesis in those positive cases, 2) immediate arthrocentesis, and 3) serum markers requested simultaneously with arthrocentesis. The AHP model showed that screening strategy with serum markers followed by arthrocentesis in those positive cases is the best diagnostic strategy in hip (normalized priority value: 0.487) and knee (normalized priority value: 0.490).

Conclusion: Sensitivity analysis revealed that regardless of the importance allocated to the criterion benefits, opportunities or risks, the order in which the diagnostic strategies were ranked is not affected. However, if the priority allocated to costs is > 55% in knees or >54% in hips, the ranking is modified.The categorical PJI diagnostic criteria issued by the MSIS allow the use of MCDA to prioritize different diagnostic strategies. After considering the BOCR of the efficient strategies, our preclinical model supports the AAOS recommendations regarding the use of serum ESR/CRP before arthrocentesis as the best diagnostic strategy for PJI among Medicare patients.

Poster #107

Transfer of Patient Care Between Stages of a Two-Stage Exchange for Chronic Periprosthetic Joint Infection (PJI) Leads to Inferior Outcomes

Matthew J. Dietz, MD, Ho-Rim Choi, MD, Andrew A. Freiberg, MD, Hany Bedair, MD

Introduction: The two-stage exchange algorithm is the current gold standard for the management of chronic PJI in North America. This study evaluated the impact of having the first stage (resection arthroplasty +/- spacer) and second stage (re-implantation) performed at different institutions compared to having the entirety of care at one institution.

Methods: Patients having received initial resection for PJI at another hospital and then transferred to our institution for the remainder of their care were identified. These patients were then matched (2:1) with a similar cohort that had received their entire care for PJI at our institution. We compared patient characteristics, microorganism profile, total number of procedures performed, duration of treatment and final outcome between groups. Student's t-tests and chi-square tests were used for continuous and categorical variable, respectively, with a p-value < 0.05 considered as significant.

Results: Eighteen patients (6 THA, 12 TKA) (transferred group) were identified and compared to 36 matched controls that had received their entire care at our institution (continuous group). Age, comorbidities, BMI, infecting organisms and resistance patterns were not statistically different between groups. There were a significantly higher number of procedures in the transferred group compared to the continuous group (3.94 vs. 2.94, $p = 0.031$), with the largest difference seen in the number of procedures performed between stages. The overall treatment time to final procedure in the transferred group was nearly twice as long as in the continuous group (16.6 vs 8.41 months, $p = 0.021$). Substantially fewer patients in the transferred group had a re-implantation and successful retention of a functional arthroplasty compared to the continuous group (44% vs. 78%, $p = 0.014$).

Discussion and Conclusions: The management of chronic PJI is complex. Patients receiving all of their care for chronic PJI at a single institution led to fewer surgeries, shorter treatment times, and more favorable outcomes.

Poster #108

Leukocyte Esterase: Matched for MSIS Criteria

Eric H. Tischler, MD, Javad Parvizi, MD, FRCS

Introduction: Periprosthetic joint infection (PJI) is one of the most costly, challenging, and frequent complications following total joint arthroplasty with no single accepted test or diagnostic criteria to predict or categorize PJI. The Musculoskeletal Infection Society (MSIS) created an inclusive definition with the intention of creating a "gold standard" for categorizing PJI.

The use of leukocyte esterase (LE) enzyme has proven to be a strong indicator of infection; however, the sensitivity and specificity of LE has never been matched for the current, most inclusive MSIS criteria for PJI.

Methods: The presence of LE was evaluated in knee aspirates on a prospective basis from May 2007 to May 2013 with a cohort of 192 knees (78 septic, 114 aseptic). If the aspirate was bloody, a centrifuge was used to separate the bloody contaminant from the synovial fluid. A standard chemical test strip (graded as negative, trace, +, ++) tested the presence of LE. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the LE test was calculated when diagnosing PJI using two scenarios(++ as positive, +/++ as positive).

Results: Synovial fluid was obtained from 221 joints that underwent revision TKA for either mechanical failure or PJI. 29 joints were excluded due to lack of adequate criteria for MSIS classification. The LE test had a sensitivity, specificity, PPV, and NPV of 75.6% (95% CI 59.6-87.6), 94.3% (95% CI 87.4-98.2), 86% (95% CI 70.5 – 95.3), and 89.3% (95% CI 81.3-94.7) for diagnosis of PJI using MSIS criteria as the "gold standard".

Conclusion: Leukocyte Esterase, when matched to the current MSIS criteria is an accurate, simple, rapid, and valuable tool for physicians for diagnosis of PJI.

Poster #109

Diagnostic Thresholds for Synovial Fluid Analysis in Late Periprosthetic Infections Depends on Duration of Symptoms

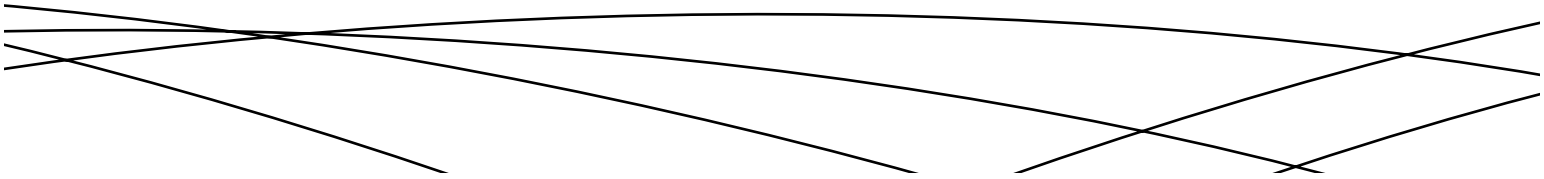
Kshitijkumar M. Agrawal, MD, Ho-Rim Choi, MD, Viktor J. Hansen, MD, Hany Bedair, MD

Introduction: Synovial white cell count(WBC) and differential have been shown to be excellent tests in diagnosing periprosthetic joint infection, albeit with a wide spread of diagnostic thresholds reported in the literature. It is unknown how the duration of a patient's symptoms in late infections may affect the diagnostic utility and threshold of this test.

Methods: Our institutional database was searched for all aspirations of THAs and TKAs in workup for infection from 2000-2010. Infection was diagnosed by positive cultures or gross purulence in 138 patients while 158 patients were considered not infected. Patients were divided into two groups based on symptom duration: ≤2 weeks and >2 weeks. We compared synovial WBC, % polymorphonuclear cells, C Reactive Protein(CRP) and Erythrocyte Sedimentation rate(ESR) values between the two groups and between infected and non-infected patients. Receiver operating characteristic(ROC) curves were constructed to determine the optimal cut off value for each test.

Results: Synovial WBC and CRP values were significantly greater in the infected patients with symptoms <2 weeks compared to those with symptoms >2 weeks. Values for synovial WBC and PMNs, and serum CRP and ESR were significantly elevated in the infected groups compared to the corresponding non-infected groups. The optimal cutoff for synovial WBC was 5800 cells/uL in the <2week group (sensitivity 97; specificity 100; Positive Predictive Value(PPV) 100%; Negative Predictive Value(NPV) 89%; Area Under Curve(AUC) 99%) compared to 1800 cells/uL (sensitivity 95; specificity 92; PPV 87% and NPV 97%; AUC 97%) in the >2week group.

Conclusion: The duration of symptoms is an important factor in evaluating the synovial fluid in suspected late periprosthetic infections. The cutoff for 5800 cell/uL in patients with acute symptoms is 3 times higher than in patients with more chronic symptoms. A single cutoff value for all late infections may lead to unnecessary operations in patients with different acuity of symptoms.



Poster #110

Periprosthetic Joint Infection: Should All Patients Undergoing Elective Arthroplasty be Screened for Urinary Tract Infection

Jeffrey Muenzer, Claudio Diaz-Ledezma, MD, Ari Brandsdorfer, BS, Glenn Kerr, MD, Javad Parvizi, MD, FRCS

Introduction: Although urinary tract infections have been proposed as a risk factor for periprosthetic joint infection (PJI), the evidence is still controversial. In this observational study, we sought to evaluate the possible link between detected bacterial colonization of the urinary tract and development of subsequent PJI.

Methods: Utilizing a cohort of 608 patients with PJI revised at our institution, we retrospectively analyzed urine cultures performed prior to index surgery as well as those performed in proximity to the diagnosis of PJI. Correspondence between the infecting bacteria was considered when the same organism strain was isolated both in the urine sample and in the periprosthetic tissues.

Results: None of the patients with positive urinary culture at the time of index arthropalsty developed PJI. Among 608 patients with PJI, 55 patients (9%)had urinary culture done at the time of diagnosis of PJI as well as cultures isolating the PJI causative organism from periarticular tissues. Among these 55 patients, six patients had developed PJI with the same organism as the one causing active UTI.

Conclusion: A multivariate analysis showed that female gender (OR: 4.7 [CI: 2.5-8.6], $p<0.01$) was the only factor found to be associated with colonization of the urinary tract that may have lead to subsequent PJI. Interestingly, none of the patientswith pathological urinary tract colonization before the primary arthroplasty had developed infection with the correspondening organsism as UTI. We found observational proof to propose urinary tract colonization as an additional factor that may contribute to development of PJI. Our data suggest that urinary tract colonization, when diagnosed in the proximity of diagnosis of PJI, may play a role in the development of culture-positive PJI in one over ten cases. Apparently, a positive urine culture prior to the primary arthroplasty does not have any role in the development of future PJI.

Poster #111

Chronic Renal Failure Patients have a Higher Infection Rate after Total Joint Arthroplasty

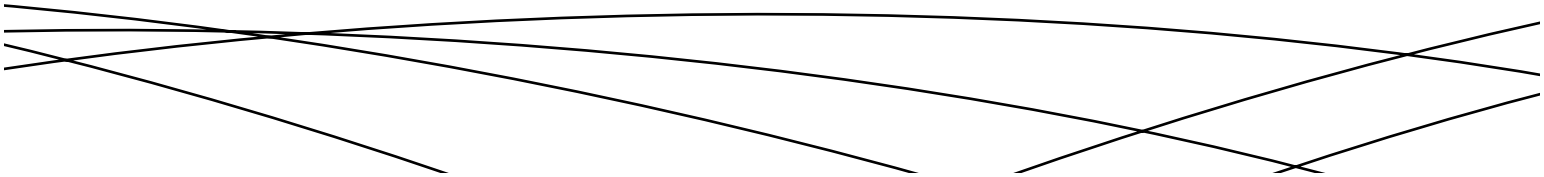
Omer F. Erkocak, MD, Joanne Lee, Camilo Restrepo, MD,
Mitchell Maltenfort, PhD, Javad Parvizi, MD, FRCS

Introduction: Patients with chronic renal failure (CRF) may require total joint arthroplasty (TJA) because of degenerative joint disease, fractures, osteonecrosis, amyloid arthropathy, or renal osteodystrophy. There has been conflicting results regarding the outcome of TJA in patients with renal disease. As far as we are aware none of these studies have evaluated the risk of these patients for infection following joint arthroplasty. The aim of this study was to determine the rates of infection and revision of TJA in patients with CRF.

Methods: Using ICD-9 codes, among 29,376 patients in our institutional TJA database, 359 patients were identified with CRF who had undergone TJA between January 2000 and June 2012. Of 359 patients with renal failure, 66 (18.4%) were receiving hemodialysis and 43 (12%) patients had received renal-transplant. Multivariate analysis was performed to evaluate the outcomes and rates of infection and revision for patients with CRF.

Results: The incidence of complications were markedly higher in patients with CRF, especially those undergoing hemodialysis. Of the 50 CRF patients receiving hemodialysis, 10 (20%) developed PJI. The incidence of PJI was also high at 4.53% (14/309) among other CRF patients. Using the multivariate analysis, the odds ratio for PJI in hemodialysis group was 7.54 (95 CI 2.83-20.12).

Conclusion: Patients with chronic renal failure, especially those requiring hemodialysis with high BMI, who receive TJA are at a higher risk of PJI. Although previous studies have reported a higher incidence of complication in CRF patients who undergo elective arthroplasty, few of them had demonstrated an increase in PJI. This study, using multivariate analysis, has confirmed that patients with CRF are indeed at high risk of infection following arthroplasty and should be counseled for this complication appropriately.



Poster #112

Is Regional Anesthesia Safe in Patients Undergoing Surgery for Treatment of Periprosthetic Joint Infection?

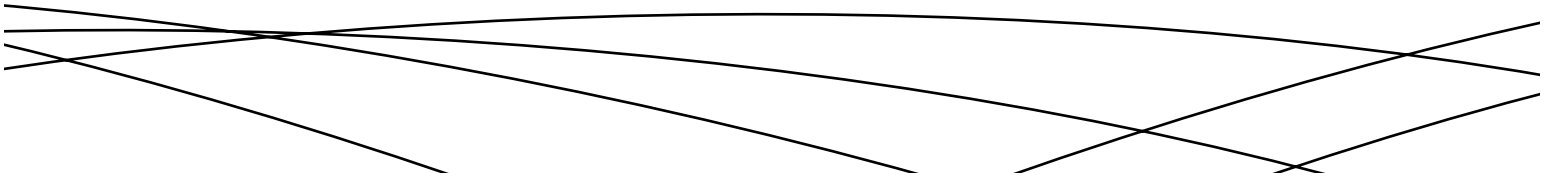
Mohammad R. Rasouli, MD, Hasan H. Ceylan, Camilo Restrepo, MD, Eugene R. Viscusi, MD, Javad Parvizi, MD, FRCS

Background: There is concern in the anesthesiology community that neuraxial (spinal, epidural) regional anesthesia in patients undergoing surgery for treatment of periprosthetic joint infection (PJI) may increase the risk of development of epidural abscess if there is blood-born bacteria. However, there is a paucity of literature in this regard. There is now substantial evidence that spinal anesthesia is superior to general anesthesia for joint replacement surgery. This study was designed to test the hypothesis whether regional anesthesia may result in development of epidural abscess in patients undergoing surgery for treatment of PJI.

Methods: All patients who underwent surgery for treatment of PJI under regional anesthesia from 2005 to June 2012 were included in this study. The diagnosis of PJI was made based on the Musculoskeletal Infection Society criteria. We used the Ninth Revision of the International Classification of Diseases (ICD-9) code of 324.1 to identify patients who developed intraspinal abscess. Patient's records were reviewed to ensure if the abscess developed shortly after the surgery for treatment of PJI which was performed under regional anesthesia.

Results: Of 1215 surgeries for treatment of PJI, 619 (51%) underwent under neuroaxial anesthesia. Patients underwent surgery with regional anesthesia had significantly shorter length of hospital stay (median: 4 versus 9 days, $p<0.001$) and smaller blood loss (296 mL versus 339.7 mL, $p=0.05$) compared to general anesthesia. However, there were not statistically significant differences between two groups regarding operative room time and allogenic blood transfusion ($p>0.05$). Only one epidural abscess occurred (0.08% of all patients and 0.16% of neuraxial anesthesia cases) in a patient who had received prior neuraxial anesthesia. The patient had 6 operations on his left hip during a 42-day period for instability and PJI. The last 2 hip operations had been performed under general anesthesia. The patient underwent spine surgery and epidural abscess resolved.

Conclusion: Based on this large case series, epidural abscess following neuraxial anesthesia during revision surgery for treatment of PJI is rare. Thus, the benefits of neuraxial anesthesia may outweigh the small risk of epidural abscess.



Poster #113

Diagnosis of Periprosthetic Joint Infection in Revision Hip Arthroplasty with a Metal-On-Metal Bearing or Corrosion

Paul H. Yi, BA, Michael B. Cross, MD, Mario Moric, Brett R. Levine, MD,
Scott M. Sporer, MD, MS, Wayne G. Paprosky, MD, Joshua J. Jacobs, MD, Craig J. Della Valle, MD

Introduction: Failed metal on metal (MOM) bearings and corrosion reactions are being increasingly encountered with little to guide evaluation for periprosthetic joint infection (PJI). Our purpose was to determine the utility of the erythrocyte sedimentation rate (ESR), C-Reactive Protein (CRP), synovial fluid white blood cell count (WBC) and differential (%PMN) in diagnosing PJI in failed hips with a MOM bearing or corrosion.

Methods: We identified 150 revision THA that included a MOM bearing (92, 61%), hip resurfacing (19, 13%) a metal-on-polyethylene bearing with corrosion (30, 20%) or full thickness polyethylene wear with metallosis (9, 6%). 19 Patients (13%) were diagnosed as infected using MSIS criteria. Mean laboratory values were compared between groups and receiver operating curves (ROC) generated with an area under the curve (AUC) to determine test performance and optimal cutoffs. Only synovial fluid samples with both a WBC and differential were included to ensure accuracy of the samples.

Results: The synovial fluid WBC was deemed inaccurate secondary to cellular debris in 47 patients (31.3%); 41 of these were not infected and initially reported with a mean synovial WBC of 16,157 cells/μL before being deemed inaccurate. Infected patients had significantly higher mean serum ESR (50 vs.18 mm/hr), CRP (65 vs. 13 mg/L), synovial fluid WBC (25,547 vs. 1720 cells/μL) and differential (89% vs. 52% PMN) [$p < 0.0001$, all]. The best tests for diagnosis of PJI were the synovial fluid WBC (AUC=98%, optimal cutoff 4,350 WBC/μL), and differential (AUC = 90%, optimal cutoff 85%PMN). The ESR and CRP both had good sensitivity.

Conclusions: The diagnosis of PJI is extremely difficult in patients with metallic bearings or corrosion and the synovial fluid WBC can frequently be falsely positive. It should only be relied upon if a manual count is done or if a differential can be performed on the sample.

Poster #114

Infection Risk Assessment in Patients Undergoing Primary Total Knee Arthroplasty

Lazaros A. Poultsides, MD, MSc, PhD, Vasileios Sakellariou, Peter K. Sculco, Huong Do, Stavros Memtsoudis, Thomas P. Sculco, MD

Introduction: Identification of patients at high risk for in-hospital or late periprosthetic infection after TKA is warranted and would allow establishing adequate measurements for prevention. The objectives of our study were to determine the incidence and identify potential risk factors for in-hospital and late infection following TKA.

Methods: Between 2000 and 2009, we analyzed a retrospective cohort of 17,959 TKA patients, 6,525 males and 11,434 females, with a mean age of 68.15 years (range, 12.6 to 96.8). The diagnosis of in-hospital or late infection was made based on well-established criteria. Potential patient-related risk factors for infection examined were: preoperative demographics and comorbidities. Surgery-related factors included procedure type (same-day bilateral, staged within a year or unilateral), procedure time, postoperative anemia, blood transfusion rates, and perioperative complications including local (hemorrhage, hematoma, seroma, wound dehiscence, non-healing wound) and minor or major systemic (sepsis, shock, MI, pneumonia, ileus, DVT, PE). Length of hospitalization, return to Post-Anaesthesia-Care-Unit, and patient discharge disposition were also evaluated. Patients were followed-up at a minimum of 1-year after the index procedure.

Results: The in-hospital TKA infection rate was 0.64%, of which 4% were deep infections. Younger age (OR 0.96; CI 0.93–1.00), allogenic blood transfusion (OR 1.54; CI 1.07–2.22), liver disease (OR 8.63; CI 1.03–72.43), and unilateral or staged bilateral surgery compared to same-day bilateral (OR 3.99; CI 1.35–11.83 and OR 3.76; CI 1.35–10.50, respectively) were identified as significant risk factors for in-hospital infection. The incidence of late TKA infection was 0.41%, with 82% of these infections classified as deep. Renal disease (OR 2.96; CI 1.04–8.47), pulmonary disease (OR 2.11; CI 1.20–3.70), UTI (OR 2.67; CI 1.26–5.68), wound dehiscence (OR 12.89; CI 1.61–102.95), and prior in-hospital infection (OR 6.33; CI 2.21–18.20) were found independent risk factors for late infection. Although a trend was shown, gender (male versus female: OR 1.53; CI 0.96–2.45) and history of metabolic syndrome (OR 1.75; CI 0.96–3.19) were not proven significant risk factors for late infection.

Conclusion: Future goals are to identify potential patients who present with an elevated infection risk and attempt to delineate appropriate interventions that may assist this at risk population in preventing perioperative complications.

Poster #115

Optimal Irrigation and Debridement of Infected Total Joint Implants with Chlorhexidine Gluconate

Daniel C. Smith, MD, Richard Maiman, Evan M. Schwechter, MD, Sun Jin Kim, MD, David Hirsh

Introduction: Acute periprosthetic joint infection (PJI) has been treated with irrigation and debridement (I+D) and polyethylene exchange with varying success. A previous study at our institution demonstrated that scrubbing an MRSA-coated titanium disk with chlorhexidine gluconate solution achieved superior biofilm eradication compared to scrubbing with alternative solutions. However, available literature suggests potential soft tissue damage using standard 4% chlorhexidine solution. The current study aimed to identify a minimum chlorhexidine gluconate concentration for effective bacteria eradication of an in vitro PJI model.

Methods: MRSA biofilms were grown on titanium disks using a clinically isolated MRSA strain in a liquid culture. Groups of disks underwent standardized irrigation with normal saline and scrubbing with either a control dry scrub brush or with a 4%, 2%, 1%, 0.5%, or 0.25% chlorhexidine solution-soaked brush. MRSA colonies were counted using the colony-forming units (CFU) remaining on the disks following simulated I+D. The procedure was repeated with a 24-hour reincubation period prior to CFU counting.

Results: A significant decrease in CFU was noted in all disks prior to reincubation when compared to the control group. After reincubation, a significant decrease in CFUs from the control group was found in the 4% and 2% groups only. The 2% concentration chlorhexidine gluconate solution was the lowest effective concentration to eradicate MRSA colonies prior to and following reincubation.

Conclusion: This study demonstrated that I+D of infected titanium disks simulating PJI with 4% chlorhexidine gluconate solution was more effective at treating MRSA biofilm than dry scrubbing alone. Moreover, we were able to decrease the chlorhexidine gluconate concentration to a 2% solution while still maintaining a significant decrease from the control group. The theoretical benefit of using a lower concentration chlorhexidine gluconate solution on local tissues favors progressing with further studies utilizing 2% chlorhexidine gluconate solution.

Poster #116

◊Local vs. Systemic vs. Combined Antibiotic Treatment for Implant Infection

Suman Medda, **Aaron Casp,** Daniel Del Gaizo, Laurence Dahners

Introduction: Periprosthetic infections are difficult to treat, often recurring despite long-term systemic antibiotics and prosthetic explantation. Because local antibiotics can be administered at high concentrations into the wound cavity without systemic toxicity, we hypothesized that a combination of local tobramycin and systemic ceftriaxone would yield better results against peri-implant infection than systemic antibiotics alone.

Methods: Sprague-Dawley rats had a HDPE, titanium wire and chrome cobalt wire implant attached to their lateral femur. The implants were inoculated with 1.0 x 106 CFU of Staphylococcus aureus. After forty-eight hours, four groups were established including a no treatment control (CTRL) and three once daily antibiotic therapy groups: systemic ceftriaxone only (SYST), local tobramycin only (LOCL), and combination systemic ceftriaxone and local tobramycin (COMB). The rats were sacrificed at seven days and quantitative culture was performed.

Results: The mean colony counts of all treatment groups were significantly different from each other. The count of the CTRL group was 1.8 x 107 CFU/mL, which differed from the SYST group (5.8 x 105, $p = 0.002$), LOCL group (6.8 x 104, $p = 0.001$) and COMB group (489, $p = 0.002$). There were no complete eradications of bacteria. The lowest count was 60 CFU/mL in one rat in the COMB group.

Conclusions: The group receiving both local tobramycin and systemic ceftriaxone yielded the best results. The high concentration of local antibiotic and the synergistic effect between aminoglycosides and cephalosporins may have contributed. The three orders of magnitude improvement over systemic antibiotics suggests that further study of these methodologies is warranted, and may demonstrate a less invasive technique to manage these infections.

◊The FDA has not cleared the pharmaceutical and/or medical devices for the use described in this presentation (Pfizer, Tobramycin-approved for IV, used locally)

Poster #117

Establishing a Role for Vancomycin Powder Application in Total Joint Arthroplasty for Infection Prevention: A Wear Simulation Study

Rabah Qadir, MD, John Ochsner, Joseph Zavatsky

Introduction: The utility of surgical site vancomycin powder application has recently shown efficacy in decreasing infection rate after spine surgery. The effects on polyethylene wear after intraoperative placement of vancomycin powder at the surgical site in total joint replacements has not been determined. The purpose of this study is to compare wear behavior of material couples of Cobalt Chromium Alloy (CoCr) on ultra-high molecular weight polyethylene (UHMWPE) to identical wear couples with vancomycin powder added prior to the start of wear simulation.

Methods: A six-station wear simulator was used to establish in vitro wear characteristics of CoCr on UHMWPE on test articles fabricated from materials identical to total knee implants. Three test simulators each included 250 mg of vancomycin powder added to 100 cc of 36% bovine calf serum solution. The three control simulators included bovine serum alone. Cyclic articulation simulations were run for 10 million cycles (Mc) at 4 ± 0.3 Hz under a constant axial load of 89N over 25^{0} of flexion-extension. UHMWPE wear was measured using photography, stereomicroscopic examination, and gravimetric measurements at the end of 0.5, 1, 2.5, 5, and 10 Mc.

Results: Photographic and stereomicroscopic evaluation of test groups revealed no significant differences in UHMWPE wear mark length ($p=0.85$), width ($p=0.34$), or area ($p=0.27$) at any time interval. There was no detectable difference in gravimetric wear between test groups at 2.5 Mc ($p=0.95$), 5 Mc ($p=0.80$), or 10 Mc ($p=.98$). After 10 Mc, the vancomycin and control groups lost an average of 0.32 and 0.33 mg, respectively ($p=0.98$).

Discussion: The addition of vancomycin powder to CoCr on UHMWPE wear simulator demonstrated no detrimental effects on the prostheses in vitro. Topical vancomycin powder may have a role in infection prevention during total joint arthroplasty. A well designed clinical study is needed to further elucidate this role.

Poster #118

Converting between High and Low Sensitivity CRP in the Assessment of Peri-Prosthetic Joint Infection

Michael Milone, Atul F. Kamath, MD, **Craig L. Israelite, MD**

Introduction: Many hospitals are transitioning to high-sensitivity CRP (Hs-CRP) as a marker of cardiovascular inflammation. Although low sensitivity CRP (Ls-CRP) is an important tool for evaluating PJI, no studies have evaluated whether Hs-CRP is correlated to Ls-CRP in this setting. The purpose of this study was to 1) evaluate the correlation between serum Hs-CRP and Ls-CRP (2) compare the sensitivity, specificity, and ROC curves of these markers, and (3) determine if unit reconciliation via a 10x conversion factor is a reliable method of converting between CRP tests.

Methods: We retrospectively reviewed the serum laboratory data of 98 TJA patients with suspected PJI (65 knees, 33 hips) from January 2011 to May 2013. Infection was diagnosed by tissue culture.

Results: Hs-CRP was highly correlated with Ls-CRP (R=0.93). ROC curves generated 100% sensitivity and 97% specificity for both Hs-CRP and Ls-CRP with optimal cut offs of 28.6 mg/L and 2.6 mg/dL, respectively. Hs-CRP was no different from Ls-CRP after converting Hs-CRP to Ls-CRP units by dividing by 10 and regression analyses revealed conversion factors that were no different from 10.

Discussion/Conclusion: This is the first clinical study to show that Hs-CRP is highly correlated with Ls-CRP. The identical ROC curves for Hs-CRP and Ls-CRP support the hypothesis that the two tests are not only highly correlated but also may be interchangeable in the work up of PJI. Hs-CRP and Ls-CRP were no different after reconciling the units reported for the two tests: Hs-CRP values reported in mg/L were 10x greater than Ls-CRP values reported in mg/dL. If an order for Ls-CRP is returned with a Hs-CRP result, physicians should now be more comfortable converting mg/L to the more familiar mg/dL of Ls-CRP, which we believe will be paramount as hospitals implement new Hs-CRP systems at the expense of orthopaedic proven Ls-CRP systems.

Poster #119

Mid-term Outcome and Survivorship of Two Stage Revision for Infected Total Hip Arthroplasty

Richard McCalden, Eran Avivi, **Edward M. Vasarhelyi, MD**, Lyndsay Somerville, Douglas D. Naudie, James Howard, Steven MacDonald

Infection remains a major cause of failure in total hip arthroplasty (THA). The standard of care for chronic infection is a two-stage revision arthroplasty. The purpose of this study is to report the mid- to long-term clinical outcomes and survivorship of patients undergoing two-stage THA for infection at our institution. We retrospectively reviewed 162 patients who underwent two-stage revision THAs for deep infection. There were 91 men and 71 women, with a mean age of 67.26 ± 10.4 and a mean BMI of 29.33 ± 9.67 kg/m(2). Mean follow up was 3.58 years (range 1.0 to 15.0 years). Harris Hip Clinical Rating Scores as well as serial radiographs were obtained. This cohort demonstrated a success rate of 89.5% eradication of infection post two-stage revision at their most recent clinical follow up. Of the 19 patients (11.7%) who failed two-stage revision arthroplasty, 3 died prior to completing the second stage, 11 underwent an excisional arthroplasty for failed eradication of infection and 5 underwent a repeat two-stage revision. Staph Aureus (22.6%) and Staph Epidermidis (21.2%) were the most common organisms identified. An infecting organism was not identified in 25.5% of cases. MRSA infections represented 10.6% of cases, while multiple organisms were cultured in 10 patients (7 %). MRSA patients in this series had an eradication rate of 80%. Conversely, those with multiple organisms that were isolated during their course of treatment demonstrated an eradication rate of only 40%. Two-stage revision for infected THA is an effective treatment with an 89.5% success rate in eradicating the infection at mid-term follow up. MRSA cure rates in this series were comparable to cure rates of infections caused by other single bacteria types. However, patients who had multiple organisms isolated on cultures had a significantly reduced chance of eradicating the infection with a two-stage revision.

Poster #120

Is Periacetabular Osteotomy Better than Total Hip Arthroplasty for Sports Participation in Middle-Aged Patients with Symptomatic Acetabular Dysplasia?

Niraj V. Kalore, MD, Naga Suresh Cheppalli, William Daner, William A. Jiranek, MD, FACS

Introduction: Symptomatic acetabular dysplasia in middle-aged patients is a difficult problem because of long life span, high activity level and sports participation. Treatment by PAO or THA provides pain relief and improves function. Improvement in sports participation has not been compared for these procedures. We compared the two procedures in terms of sports participation, function scores and duration of postoperative pain and rehabilitation.

Methods: After IRB approval, we retrospectively compared patients in 30-50 years age group with symptomatic acetabular dysplasia with CE angle $< 16°$ who underwent PAO (n=14) or THA (n=14) and had minimum 4 years followup. Patients in PAO group had Tonnis grade 1-2 osteoarthritis while those in THA group had grade 3-4. Sports participation was assessed by Tegner and University of California Los Angeles (UCLA) activity scores. Modified Harris Hip Score, High Activity Arthroplasty Score and modified Merle d'Aubigné-Postel Score was assessed at last follow-up. Durations of postoperative pain and rehabilitation were assessed. We used Student's t-test to compare scores and duration of postoperative pain and rehabilitation.

Results: Mean follow-up was 98 months in PAO and 90 months in THA group. In PAO group, mean Tegner score improved from 2.4 to 4.6 and UCLA score improved from 3.5 to 7.4. In THA group, mean Tegner score improved from 1.8 to 4.3 and UCLA score improved from 3.3 to 6.9. PAO patients tend to have higher sports participation ($p>0.05$) than THA patients. Three patients in PAO group and 2 in THA group could play high impact sports. There was no significant difference in function scores. Patients in PAO group had significantly longer duration of pain and rehabilitation ($p<0.05$).

Conclusions: In middle-aged patients, PAO and THA both produced comparable decrease in pain and improvement in sports participation and function in patients with symptomatic acetabular dysplasia. However, PAO has significantly longer postoperative pain and prolonged rehabilitation. This may be helpful in decision making process in middle aged patients with symptomatic acetabular dysplasia.

Poster #121

Does Pain Chronicity in Patients with Symptomatic Acetabular Dysplasia Correlate with Intra-Articular Disease?

Geneva Baca, **John C. Clohisy, MD,** Michael Millis, Daniel Sucato, Perry Schoenecker, Rafael J. Sierra, MD, Ernest Sink, Christopher Peters, ANCHOR Group

Introduction: Bernese periacetabular osteotomy (PAO) has become a common treatment for symptomatic acetabular dysplasia (DDH). More advanced intra-articular disease is thought to be associated with suboptimal clinical results. Identifying risk factors for advanced intra-articular disease is important in patient selection for surgery. This study analyzed the association between duration of hip symptoms and intra-articular disease severity in patients with acetabular dysplasia.

Methods: We reviewed a prospective multicenter database of patients that underwent PAO for DDH. Preoperative symptom chronicity, Modified Harris Hip Score (MHHS), UCLA activity scores, and intra articular finding were recorded prospectively. Statistical analyses were performed to determine differences in intra-articular disease findings relative to the chronicity of symptoms.

Results: 794 hips in 794 patients were analyzed. Pain chronicity was present < 6 months at 5%, 6-12 months in 23%, and >1 year in 72%. MHHS and UCLA did not differ by duration of symptoms. Hips with 6-12 months of pain had labral damage with degeneration at 26% compared to 47% with pain 12-36 months and 54% $\geq$5 years (p 0.024). Labral morphology was also significantly different (p 0.005) between $\leq$6 months (12.5% hypertrophic), 12-32 months (35% hypertrophic) and $\geq$ 60 months (57%). Hips with 6-12 months of pain had chondromalacia in 26.9%, 12-36 months of pain 27.9% and $\geq$60 months of pain 57% (p 0.001). No significant difference in acetabular labral, articular cartilage and head-neck junction abnormalities when analyzed with gender, age, BMI or activity level.

Conclusions: Chronicity of hip pain was significantly associated with the presence and severity of acetabular labral pathology and chondromalacia at the femoral head-neck junction. Pain chronicity was not associated with increased acetabular articular cartilage degeneration. In patients being considered for PAO correction of acetabular dysplasia, prolonged symptoms are associated with an increased risk of labral tears and head neck junction chondromalacia.

Poster #122

Arthroscopic Capsular Plication and Labral Preservation in Borderline Hip Dysplasia: Two-Year Clinical Outcomes of a Surgical Approach to a Challenging Problem

Benjamin G. Domb, MD, Timothy Jackson, Jennifer Stone, Dror Lindner

Background: The role of hip arthroscopy in the treatment of patients with dysplasia is unclear. Patients with borderline dysplasia are generally not candidates for periacetabular osteotomy (PAO). However, arthroscopy in dysplasia has had mixed results, and can exacerbate instability. In order to treat this challenging problem, we have defined a surgical approach which includes arthroscopic labral repair, augmented by capsular plication with inferior shift. The purpose of this study is to evaluate the clinical results of this surgical approach and hypothesize patients will demonstrate postoperative clinical improvement.

Methods: During the study period, April 2008 to November 2010, we included patients less than 40 years old, with a lateral center-edge (CE) angle $\geq$18 and $\leq$25, who underwent hip arthroscopy. Patients with Tonnis grade $\geq$ 2 and severe hip dysplasia (CE $\leq$17) were excluded. Patient reported outcome (PRO) scores, including the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score - Sport Specific Subscale (HOS - SSS), Hip Outcome Score - Activity of Daily Living (HOS - ADL), and visual analog scale (VAS) were obtained in all patients pre-operatively and postoperatively at multiple time points. Revision surgery and complications were recorded.

Results: Twenty-six patients met the inclusion criteria and 22 (85%) patients were available for follow-up. The mean length of follow-up for this cohort was 27.5 $\pm$ 5.5 months (17-39 months) and average age was 20 (14-39). The average CE angle was 22.2° (18°-25°) and Tonnis angle was 5.8° (0°-17°). There was significant improvement in all PRO and VAS scores ($p<0.0001$). Overall patient satisfaction was 8.4 and seventeen patients reported good/excellent results (77%). Two patients required revision arthroscopy.

Conclusions: Patients with borderline dysplasia have minimal treatment options. Ourstudy demonstrates favorable results at two-year follow-up for an arthroscopic approach including labral repair augmented by capsular plication with inferior shift.

Poster #123

Are Clinical Results of Periacetabular Osteotomy Generalizable? A Large, Prospective, Multicenter Cohort Study

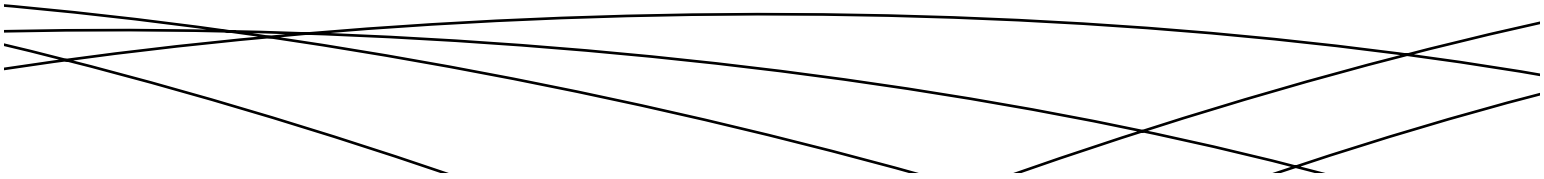
John C. Clohisy, MD, Meghan Gottlieb, MSW, Geneva Baca, BA, Perry L. Schoenecker, MD, Paul Beaule, MD, Rafael J. Sierra, MD, Daniel Sucato, Michael Millis, ANCHOR Group

Introduction: The majority of reports on the clinical outcomes of the periacetabular osteotomy (PAO) have been single surgeon, retrospective case series. There is a need for large prospective cohort studies to better define the clinical outcomes, predictors of treatment results and generalizability of the procedure. The purpose of this prospective, multicenter, longitudinal cohort study was to analyze the early clinical and radiographic results obtained with the Bernese periacetabular osteotomy in the treatment of acetabular dysplasia in adolescents and young adults.

Methods: 473 hips were enrolled in this prospective PAO cohort between 2008 and 2010. Preoperative baseline data were compared to follow-up at an average of 27 months postoperatively. Preoperatively, all patients had hip pain and sufficient hip joint congruency for the PAO. Prospective clinical data including patient demographics, radiographic measurements, and patient-rated outcome scores [MHHS, HOOS, WOMAC, and UCLA scores] were collected.

Results: Average age at surgery was 24.8 years. 76% female, 24% male with an average BMI of 25 kg/m². Comparison of preoperative and follow-up radiographs demonstrated an average improvement of 20.5° ($p < 0.001$) in the lateral center-edge angle, 23.7° (<0.001) in the anterior center-edge angle, and 16.2° ($p<0.001$) in Tönnis angle. The MHHS score improved 23.1 points ($p<0.001$). The UCLA score improved 1 point ($p<0.001$). The HOOS Pain score improved 27.8 points ($p<0.001$). The HOOS Symptoms score improved 20.4 points ($p<0.001$).The WOMAC Total score improved 21.6 points ($p<0.001$). At the time of the most recent follow-up, five (1.1%) of the hips had required conversion to total hip arthroplasty.

Conclusion: These prospective, multicenter data indicate that at early follow-up the PAO provides reliable pain relief and improved function in the treatment of symptomatic acetabular dysplasia. The procedure has a low early conversion rate to total hip replacement and achieves generalizable results in the hands of trained surgeons.



Poster #124

Does Labral Takedown Affect Results of Arthroscopic Acetabuloplasty and Labral Repair?

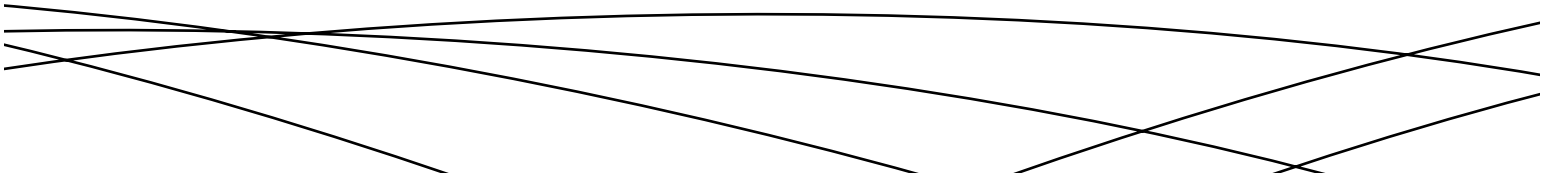
John M. Redmond, MD, Benjamin G. Domb, MD, Youssef El Bitar, Christine Stake

Objective: Arthroscopic acetabuloplasty was initially described with detachment of the labrum to access the acetabular rim for resection, followed by labral refixation. More recently technique refinements have made possible acetabuloplasty and labral refixation, without labral detachment. The purpose of this retrospective study is to report outcomes for patients undergoing arthroscopic acetabuloplasty and labral refixation without labral detachment (study group); and to compare this to a similar group of patients who underwent acetabuloplasty with labral detachment and refixation (control group) with a minimum two year follow-up.

Materials and Methods: During the study period, between February 2008 and February 2011, data was prospectively collected on all patients treated with hip arthroscopy. Inclusion criteria for the study group were acetabuloplasty and labral refixation without detachment, performed in cases with an intact chondro-labral junction. Patients were then matched to a control group of patients who had acetabuloplasty with labral detachment and refixation. All patients were assessed pre- and post-operatively using four patient-reported outcome (PRO) measures and a visual analogue score (VAS).

Results: Both groups demonstrated significant improvement from pre-operative to two-year follow-up for all four PRO scores ($p<.05$). There was no statistically significant difference in the change in PRO scores between groups. There was a significant decrease in VAS for both groups ($p<.05$). There was no statistically significant difference in the change in VAS between groups.

Conclusions: Treatment of pincer- and combined-type impingement with arthroscopic acetabuloplasty and labral refixation without detachment resulted in improved clinical outcomes and pain scores two years from surgery. In addition, these outcomes were equivalent to a control group of patients undergoing labral refixation after detachment. We may conclude that in cases where the chondro-labral junction remains intact, acetabuloplasty and labral refixation without detachment is a viable option.



Changing Trends in Level of Evidence (LoE) of Podium Presentations at AAHKS Annual Meetings (2004-12)

Nanjundappa S. Harshavardhana, MD, MS, Andrew Chappell

Introduction: AAHKS annual meeting(AM) is a global scientific platform for dissemination of research amongst arthroplasty professionals. Levels of Evidence(LoE) are rating systems introduced by AAOS in 2003 that reflect the quality of studies. POSNA and Federation of spinal associations have made it mandatory to report LoE for all abstract submissions to their AM unlike AAHKS. The objectives of this study were to report the LoE of all AAHKS AM podium presentations and analyze changing trends in LoE.

Methods: All AM proceedings & Journal of Arthroplasty supplements of the AAHKS from 2004 to 2012 were retrieved and divided into two groups (GrI: 2004-06 & GrII: 2010-12). Two orthopaedic surgeons (Fellow & Attending arthroplasty surgeon) independently graded the LoE of each abstract and its full-text article counterpart as per the AAOS LoE classification system. Intra-class correlation coefficient(ICC) for agreement between the two raters for LoE was calculated using SPSS v16.

Results: 273 abstracts from six annual meetings were reviewed (Hips 126;Knees101;&Misc.46). Two-thirds of the studies were of LoE III & IV. LoE I & II constituted less than 1/5th of all presentations. There was no change in number of LoE I & II studies presented between Groups I & II. However there has been a statistically significant decline in LoE IV presentations (44 to 28) with proportional increase in LoE III studies (37 to 72) with time ($p<0.0005$). The detailed analysis with year-wise breakdown and LoE are summarized in Table1. The ICC for inter-observer agreement between the two reviewers was excellent (ICC=0.81).

Conclusion: The LoE of research shared at AAHKS AM over the past decade is steadily improving. This signifies the commitment of AAHKS leadership for continuing improvement to quality and excellence in research. This study serves as a tool for comparison and monitor changing trends in LoE for future AAHKS AMs.

Poster #126

Does Tranexamic Acid Reduce Blood Loss and Transfusion Requirements Associated with The Periacetabular Osteotomy?

Scott Wingerter, Angela Keith, Geneva Baca, BS,
Gail Pashos, Perry L. Schoenecker, MD, **John C. Clohisy, MD**

Introduction: Tranexamic acid (TXA) has shown safety and efficacy in reducing blood loss associated with various surgical procedures. However, there is a paucity of information regarding the impact of TXA on blood loss and transfusion requirements associated with the periacetabular osteotomy (PAO). Minimizing blood loss in young active patients undergoing pelvic osteotomy surgery facilitates recovery and avoids the risk of complications associated with transfusions. The purpose of this study is to determine whether TXA reduces blood loss and transfusion rates associated with the PAO. Secondly we analyzed whether TXA was associated with an increased risk of thromboembolic events.

Methods: A consecutive series of 100 PAO procedures performed by a single surgeon was reviewed to compare the groups immediately prior to and following the implementation of the routine use of tranexamic acid (two prospective longitudinal cohorts). TXA dosing followed an established protocol based on risk with a standard dose of 1g IV infused over 10 minutes prior to skin incision and an additional 1g IV at wound closure, Outcome measures include estimated blood loss intraoperatively (EBL), intraoperative cell saver utilization, postoperative drain output, and transfusion rate.

Results: The average estimated blood loss intraoperatively (675.4mL vs. 391.0mL, $p<0.001$) and total blood loss including postoperative drain output (1020.6mL vs. 706.16mL, $p=0.001$) were significantly less in the patients receiving TXA. The transfusion rate during the hospital course decreased from 58% to 24% with a decrease in average number of units transfused per patient dropping from 1.02 to 0.28 ($p=0.013$). No cases of postoperative deep vein thrombosis (DVT) or pulmonary embolus (PE) were identified in either group.

Conclusion: TXA reduces transfusion rates and blood utilization without any increase in thromboembolic events when used in association with the periacetabular osteotomy for the treatment of acetabular dysplasia.

Poster #127

Outcomes of Hip Arthroscopy in Patients Aged 50 Years or Older Compared to a Matched Control Cohort of Patients Aged 30 Years or Younger: Minimum of Two-Year Follow-Up

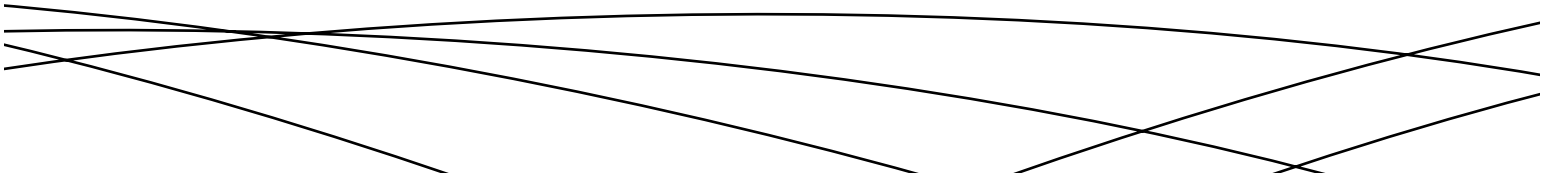
Dror Lindner, MD, **Benjamin G. Domb, MD,** Timothy J. Jackson,
Youssef El Bitar, Austin Chen, MD, Christine E. Stake, MD

Introduction: Few studies have addressed the issue of hip arthroscopy in the aging population, and none has compared it directly to a younger cohort. The purpose of this study was to compare the outcomes and patient characteristics of hip arthroscopy procedures in patients 50 years and over with a matched control group of patients 30 years and younger, at a minimum post-operative follow-up of two years.

Methods: Between September 2008 and March 2010, data was prospectively collected on all patients 50 years and over undergoing primary hip arthroscopy. Sixty-four cases met our inclusion/exclusion criteria, of which 57 (89%) were available for follow-up at a minimum of two years. A gender-matched control group of 57 patients 30 years and younger was created. All patients were assessed pre- and postoperatively, using four patient-reported outcome (PRO) measures: the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score Activity of Daily Living (HOS-ADL) and Sport-Specific Subscales (HOS-SSS). Pain was estimated on the visual analog scale (VAS) and satisfaction was recorded.

Results: The mean age of our study group was 55.68 (50-76), and the control group was 21 (14-30). The groups were gender-matched, including 17 (30%) male and 40 (70%) females in each group. The two-year survivorship for the study group was 82%. The mean time from arthroscopy to joint replacement was 18.4 months (range 3.5-38.5 months). At latest follow-up, survivorship was 6 of 12 (50%) for patients with Tonnis 2 arthritic grade, versus 32 of 45 (71%) for patients graded Tonnis 0 or 1. All postoperative improvements in both groups were statistically significant ($p<0.05$). There were no significant differences seen between the groups in score improvements for mHHS, NAHS or HOS-ADL. However, the improvement in the HOS-SSS was greater in the control group ($p=0.03$). The post-operative VAS and satisfaction was similar between the groups.

Conclusion: Overall, survivors 50 and over years of age experienced similar improvement to patients 30 and younger after hip arthroscopy regarding pain, functional scores, and patient satisfaction. Patients 50 and over with Tonnis grade 0 or 1 have higher survivorship than those with Tonnis grade 2.



Poster #128

Descriptive Epidemiology of Symptomatic Acetabular Dysplasia: A North American Cohort

John C. Clohisy, MD, Geneva Baca, BA, Paul Beaule, MD, Robert T. Trousdale, MD, Michael B. Millis, MD, Ira Zaltz, MD, Young-Jo Kim, Daniel Sucato, MD, MS, ANCHOR Group

Introduction: Symptomatic acetabular dysplasia is associated with hip pain, functional limitations and secondary osteoarthritis. Delays in diagnosis, inaccurate diagnoses and ineffective treatments are common in affected patients. Large patient cohorts are needed to define characteristics of "at risk" patients. The purpose of this study is to report the descriptive epidemiology and contemporary surgical treatment trends for patients undergoing a PAO for acetabular dysplasia.

Methods: Nine surgeons enrolled patients undergoing PAO for acetabular dysplasia from 2008-2013. Patient demographics, physical exam, radiographic data, diagnoses, operative data, and standardized patient reported outcome measures are collected. The first 848 cases are analyzed.

Results: 821 consecutive patients (848 hips) are enrolled. 84% female, 16% male, with average age of 25 years and average BMI of 24.4 and were predominantly Caucasian (86%). Pre operative outcome averages for this cohort are: Harris Hip Score, 62; UCLA 7; and WOMAC's pain 7.7, function 21.1 and total 31.9; SF12 physical component 39.5 and mental component 51.9. Of the 848 cases 16% (132 hips) had failed previous surgery with hip arthroscopy (44%) being the most common followed by a pelvic osteotomy (24%) and proximal femoral osteotomy (18%). 25% reported a family history of hip surgery. 82% full-time employment or student, 4% were disabled. All hips were treated with PAO; variability in surgical techniques was noted. 45% of hips had an osteochondroplasty of the femoral head-neck junction, 18% a combined hip arthroscopy, 7% a labral refixation/debridement, and 2% a combined femoral osteotomy.

Conclusion: This multicenter, prospective, longitudinal cohort is one of the largest PAO cohorts to date. These data indicate that symptomatic acetabular dysplasia (treated with PAO) occurs predominantly in young, female, Caucasian patients with normal BMI and is associated with major hip dysfunction and physical limitations. Contemporary treatment commonly includes an adjunctive femoral osteochondroplasty to prevent secondary femoroacetabular impingement.

Poster #129

Does Body Mass Index Affect the Clinical Outcomes of Hip Arthroscopy at a Minimum of Two Year Follow-Up?

Dror Lindner, MD, **Benjamin G. Domb, MD,** Adam Sadik, Christine E. Stake, MD, Timothy Jackson

Objective: The adverse effect high body mass index (BMI) has on the cartilage of weight bearing joints has been well described. Whether elevated BMI negatively affects the clinical outcomes of hip arthroscopy is yet to be determined. The purpose of this study is to examine the effect of BMI on hip arthroscopy outcomes, with minimum two-year follow-up.

Methods: Data was prospectively collected on all patients undergoing hip arthroscopy between August 2008 and April 2011. Exclusion criteria included any previous hip conditions (Fracture, Avascular Necrosis, LCPD, Dysplasia, PVNS, Ehlers-Danlos syndrome) and revision surgeries. Outcomes were assessed with visual analog scale (VAS) and four hip-specific scores. Any subsequent revision surgeries or conversions to total hip arthroplasty (THA) were noted. Patients were divided into to three groups: group 1 (BMI<25 – healthy weight); group 2 (25<BMI<30 – overweight); and group 3 (BMI>35 – obese).

Results: A total of 555 cases met our inclusion exclusion criteria of which 461 (83%) were available for two-year follow-up. Mean follow-up was 29 months (range 24-50). Pre-operative scores were significantly decreased in the obese and the overweight groups compared to the healthy group and VAS was significantly increased ($p<0.01$). All groups showed improvement in the hip-specific scores and the VAS. All improvements were statistically significant ($p<0.01$), and the obese group demonstrated the highest average amount of change.

Conclusion: Obesity is known to be associated with increased risk of osteoarthritis, and increased technical difficulty of an operation. Our results demonstrated lower pre-operative scores in patients with higher BMI, but these patients experienced improvement in outcome scores, pain and reported high satisfaction. Improving pain may give overweight and obese patients increased opportunities to become physically active, reduce their BMI and improve overall health. Based on our results, obesity should not be a barrier to hip arthroscopy.

Poster #130

The Incidence of Ankle Symptoms following Hip Arthroscopy

John V. Tiberi, MD, Maureen Dwyer, Jo Ann Lee, **Joseph C. McCarthy, MD**

Introduction: Complications associated with hip arthroscopy are rare, with many complications attributed to traction-related neuropraxias. The prevalence of ankle symptoms following this procedure is unknown. Our purpose was to explore the incidence of ankle symptoms following hip arthroscopy and determine if the change in tibiotalar joint space during traction was related to the presence of ankle symptoms.

Methods: One hundred consecutive patients who underwent hip arthroscopy were prospectively assessed. Fluoroscopic images of the ankle with a marker ball were obtained before and after applying traction. The tibiotalar joint space was measured at the mid-portion of the plafond. During the first postoperative visit, patients were asked if they had experienced any ankle symptoms, and a complete neurovascular examination was performed. Change in tibiotalar joint space was compared between patients with and without ankle symptoms using an independent t-test. Potential patient and surgical factors associated with the presence of ankle symptoms were assessed using multiple linear regression analysis.

Results: Twenty one patients (21%) reported ankle symptoms, including pain (15%), decreased sensation (5%), and both (1%). All symptoms spontaneously resolved within three weeks. Change in tibiotalar joint space did not differ between patients with and without symptoms (P=0.24) with the numbers available for study. There were no significant predictors (age, gender, laterality, height, weight, BMI, surgical time) of ankle symptoms (R2=0.07; P=0.60).

Conclusions: The occurrence of ankle symptoms following hip arthroscopy was high. Despite no relationship between ankle symptoms and the parameters investigated, an "at risk" group, including patients with a history of ankle sprains, ligamentous laxity, and a poor fit within the distraction boot may exist. Distraction with the ankle rotated may also place added stress on ligamentous structures. A preoperative discussion of the risk ankle symptoms and a comprehensive lower extremity examination are important.

Poster #131

Combined Surgical Hip Dislocation and Proximal Femoral Osteotomy for Severe Hip Deformities

Stephen T. Duncan, MD, Geneva Baca, BA, Angela Keith,
Perry Schoenecker, John C. Clohisy, MD, Meghan Gottlieb

Purpose: In patients with severe proximal femoral deformities, the combined surgical hip dislocation (SHD) and proximal femoral osteotomy (PFO) can be performed to optimize deformity correction while also addressing intra-articular pathologies. There is a paucity of data regarding the details of the surgical technique and the clinical efficacy of the procedure. The purpose of this study was to analyze the early clinical and radiographic results of combined SHD/PFO in treating complex proximal femoral deformities and provide updated refinements on surgical technique.

Methods: Retrospective review of patients who underwent combined SHD/PFO was performed. Clinical data including patient demographics, radiographic measurements, and patient-rated outcome scores were collected.

Results: 17 patients (17 hips) with 8 females and 9 males were identified. Previous history of SCFE and complex FAI were the most common etiologies for the deformity (41.2%). The average age was 17.6 years (range, 11-31), and average follow-up was 2.1 years. Conversion to total hip arthroplasty was performed in 2 patients (11.8%). In the remaining patients, the Harris Hip score improved significantly by 20.0 points ($p<0.05$). No change in radiographic OA occurred. The average neck-shaft angle was increased 135.1° to 139.7° ($p=0.2$). The trochanteric height improved from -14.4 mm to -6.1 mm ($p<0.05$). The head/neck offset ratio improved from -0.09 to 0.05 ($p<.05$). The frog lateral alpha angle (79.9° to 63.9°, $p<.05$) and the cross-table alpha angle (70.9° to 44.1°, $p<.05$) also improved.

Conclusion: Treatment of severe hip deformities with combined SHD/PFO demonstrated consistent radiographic deformity correction with improved head/neck offset and height of the trochanter in relation to the femoral head. The clinical data indicates combined SHD/PFO is associated with improved hip function and improved outcome scores in most patients with an acceptable rate of conversion to total hip arthroplasty. Recent refinements in the technique have facilitated surgical precision.

Poster #132

Do Surgeons and Third Party Payors Agree on the Criteria to Diagnose Femoroacetabular Impingement?

John C. Clohisy, MD, Ira Zaltz, Geneva Baca, BA, David Podeszwa, Perry Schoenecker, Daniel Sucato, Robert T. Trousdale, MD, Christopher Larson, James Ross

Introduction: Femoroacetabular impingement (FAI) is characterized by abnormal, repetitive contact between the femoral head and the acetabular rim leading to articular cartilage delamination, labral tears and secondary osteoarthritis. Disagreement between third party payor policies and clinical diagnoses can delay or prevent treatment. The purpose of this study was to compare the clinical diagnoses of FAI with third party payor policies to determine the level of agreement/disagreement.

Methods: 1085 hips undergoing surgery for FAI were identified from a prospective, multi-center database of over 2250 hip preservation procedures. The coverage policies of 3 insurance companies with strict criteria for the surgical treatment of FAI were applied to this patient population to determine if the treating surgeon's evaluation met the criteria of FAI diagnosis. Criteria included various combinations of symptom duration, age, positive impingement test, radiographic osteoarthritis, radiographic signs of cam and/or pincer impingement, and intra-operative Outerbridge classification.

Results: 1085 patients (1085 hips) underwent FAI surgery between May 2007 and April 2012. The patient demographics included 55% females, average age 28 years and average BMI 26.5 kg/m2. Acetabular and femoral head chondral disease was noted at surgery in 82.8% and 24.0% of hips respectively. 98.3% of hips demonstrated labral and/or chondral disease. Application of the three different insurance policies to this group of patients resulted in 39%, 57%, and 81% being defined as having appropriate criteria for surgical treatment of FAI. Inclusion increased from 39 to 66% and 57 to 76% for the 2 policies when the intra-operative Outerbridge classification was excluded from the inclusion criteria for FAI.

Conclusion: 19 to 61% of FAI diagnoses made by treating surgeons do not meet the criteria of third party payors. These data indicate a major need for improved consensus regarding the diagnosis of FAI and the indications for surgical intervention.

Poster #133

A Clinical Decision Support Tool to Predict the Risk of Failure in Patients with Femoroacetabular Impingement Undergoing Hip Preservation Surgery

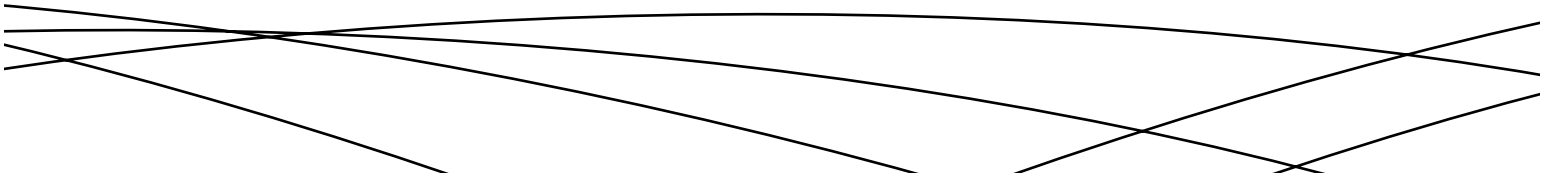
Claudio Diaz-Ledezma, Mitchell Maltenfort, Lesley Walinchus,
Benjamin Hendy, Thomas Novack, **Javad Parvizi, MD, FRCS**

Introduction: In modern Orthopaedics, risk prediction scores can help discriminate between ideal and poor candidates for a specific therapeutic intervention. We consider these tools useful during the process of shared medical decision-making. To our knowledge, such a strategy has never been explored in the field of hip preservation surgery. The aim of our study is to generate a clinical decision support tool to predict risk of failure after hip preservation surgery among patients with femoroacetabular impingement (FAI).

Methods: Data from 269 patients with clinical and radiological diagnosis of FAI (as evaluated by two independent observers) and no evidence of radiographic osteoarthritis was analyzed. At a mean follow-up of 1.9 years (6 months to 6.6 years), we categorized the outcome of surgery as success (modified Harris hip score >80 and patient satisfaction), or failure (modified Harris hip score<80, conversion to THA, or revision hip-preserving procedures). A regression analysis model including 23 preoperative variables was used to identify the independent predictors of failure, which were then combined to produce a risk prediction score that generates case-specific guidance during shared decision-making.

Results: Age, body mass index, characteristics of hip pain (intermittent versus constant), duration of symptoms (less or more than 12 months), and the use of any walking assistance were predictors of failure in our logistic regression model. A scoring system for predicting the occurrence of failure was created combining these 5 variables, which is able to stratify the risk of failure ranging from 10 to 80%. The goodness of fit of our predictive score was evaluated
using C-statistics, presenting a value of 0.729.

Conclusion: Because of its reasonable predictive capacities, our scoring system can be helpful in assessing individual risks of failure during the short and mid-term among patients with FAI undergoing hip preservation surgery. Consequently, it can be applicable during the process of preoperative shared medical decision-making in this fast-growing field of orthopaedics. We believe that the usefulness of our tool relies on its simplicity and anamnestic nature.



Poster #134

Intermediate Results of the Bernese Periacetabular Osteotomy for the Treatment of Perthes-like Hip Deformities

Stephen Duncan, Angela Keith, Geneva Baca, BA, Gail Pashos, Perry Schoenecker, **John C. Clohisy, MD**

Introduction: Perthes-like hip deformities are complex and variably encompass characteristic femoral deformities and secondary acetabular dysplasia. The need for acetabular correction in these hips is controversial and the intermediate results of these procedures are extremely limited. The purpose of this study was to analyze the intermediate clinical and radiographic results obtained with periacetabular osteotomy (PAO) for the treatment of acetabular dysplasia in hips with residual Perthes-like deformities.

Methods: Retrospective review for patients who underwent PAO for symptomatic Perthes disease was performed. 34 hips (31 patients) were treated with periacetabular osteotomy from March 1997 through April 2008 with 8 patients having bilateral PAOs performed, 17 having an concomitant proximal femoral osteotomy, 7 having a surgical dislocation to allow access to treat intra-articular pathology, and 5 having relative femoral neck lengthening. The average follow-up was 5 years. Clinical data including patient demographics, radiographic measurements, and patient-rated outcome scores were collected.

Results: 13 females (42%) and 18 males (58%) with average age of the patient at the time of surgery was 22 years (range, 12-44). Average improvements of 27.6° ($p < 0.001$) in the lateral center-edge angle, 33.1° ($p < 0.001$) in the anterior center-edge angle, and 16.5° ($p < 0.001$) in Tönnis angle occurred. The hip center was translated medially an average of 6.3 mm ($p < 0.001$). The Harris Hip score improved 20.3 points (from 59.2 to 79.5, $p < 0.001$). At the time of the most recent follow-up, four (11.8%) of the hips had required conversion to total hip arthroplasty.

Conclusion: The treatment for residual Perthes deformities in patients with acetabular dysplasia requires careful surgical planning. At intermediate term follow-up, patients with Perthes-like deformity following periacetabular osteotomy demonstrated good clinical results and an acceptable conversion rate to total hip arthroplasty.

Poster #135

Prospective, Randomized Single Blinded Trial of Standard of Care versus TENS for Knee Osteoarthritis

Mark McElroy, Casey Haddaway, Joseph Heinemann, Bhaveen Kapadia, Samik Banerjee, Kimona Issa, Robert Pivec, Anil Bhave, **Michael A. Mont, MD**

Introduction: The purpose of this study was to compare clinical and patient-reported outcomes following treatment for osteoarthritis using transcutaneous electrical nerve stimulation (TENS) versus using standard non-operative therapy (physical therapy, NSAIDs, and/or a corticosteroid injection).

Methods: This prospective, randomized, single blinded trial evaluated 34 patients (18 randomized to TENS, 16 randomized to control) with osteoarthritis. The TENS unit was incorporated in a neoprene brace and wearable for all activities except bathing/swimming. Patient reported outcomes and functional performance were evaluated initially and at three months.

Results: Decreases on a visual analog pain scale were significantly greater in the TENS group than in the matching group (mean 2 versus 1 point, respectively; $p = 0.018$). TENS treatment also led to greater improvements than standard treatment in the Knee Society objective score (mean 24 versus 8 points, respectively; $p=0.001$) and Knee Society functional score (mean 15 versus 9 points, respectively; $p = 0.139$). This physical improvement was also reflected in the LEFS score, which increased significantly more in the TENS group than the matching group (mean 20 points versus 7 points, respectively; $p = 0.007$). Both the SF-36 physical and mental scores improved more in the TENS group than in the matching group (mean of 7 versus 3 points ($p=0.058$) and 5 versus 1 point ($p= 0.140$), respectively).

Patients in the TENS group also achieved significantly larger gains in several functional tests, including a timed up and go test ($p=0.004$), a timed stair climb test ($p = 0.023$), and in isokinetic quadriceps muscle strength deficit as compared to the unaffected side ($p = 0.003$).

Conclusion: In our trial, patients who used TENS for 3 months had significantly greater improvements in multiple clinical and patient reported outcomes when compared to patients who received standard non-operative therapy.

Poster #136

Does Natural FAI Damage Affect the Sealing Function of the Acetabular Labrum?

Maureen Dwyer, Hugh Jones, Richard Field, Joseph C. McCarthy, MD, **Philip C. Noble, PhD**

Objectives: Experimental disruption of the acetabular labrum has been shown to compromise its ability to retain fluid within the central compartment. However, it is not known whether natural damage from femoro-acetabular impingement (FAI) affects its sealing function. This study quantifies the effect of natural pathology on labral function.

Methods: Ten hips, six normal and four with cam-FAI, were obtained from donors (47.8±1.5 years) and dissected free of muscle leaving the capsules intact. Pressure sensors were inserted via catheters into both the central and peripheral compartments and potted in resin. Prior to mounting to a loading apparatus, CT navigated portals were created in the iliac plate that extended through to the acetabular floor. Tubing was then inserted and attached to a syringe pump. During testing, the specimens were placed in positions simulating gait, pivoting, and stooping while fluid was introduced into the central compartment at a constant rate. The sealing capacity of the labrum was quantified by the peak pressure recorded within the central compartment before fluid transport into capsule was detected.

Results: Open dissection revealed that each FAI specimen exhibited damage to the labrum and adjacent chondral surface. These specimens exhibited reduced pressure resistance during pivoting when compared to intact specimens (15.2±2.6, 42.3±7.7kPa; P=0.007). No differences in pressure resistance was detected between specimens with and without labral damage during simulated gait (21.1±6.0, 22.0±4.2kPA; P=0.9) and stooping (8.6±2.4, 7.5±2.6kPa; P=0.78).

Conclusions: Labrum function was affected by impingement damage. Reduction in pressure resistance occurred during pivoting, however, the seal was maintained during gait and stooping. These results are in contrast to studies employing experimental tears. Labral degeneration is progressive with FAI and seal compromise was seen during pivoting, but at this time point (50 years), the function of the labrum remains largely intact. Our study highlights the importance of using relevant models.

Poster #137

Improved Immediate Postoperative Pain and Mobilization with a Rectus Sparing Periacetabular Osteotomy

Christopher L. Peters, MD, Jill A. Erickson, PA-C, Mike Anderson, MS, ATC, Christopher E. Pelt, MD, Lucas A. Anderson, MD

Introduction: Periacetabular osteotomy has become a mainstay the in the surgical treatment of developmental dysplasia of the hip (DDH). However, the recovery for patients early on can be limited by pain and activity restrictions. We hypothesized that a rectus-sparing modification of the Bernese PAO may accelerate the early postoperative recovery.

Methods: We retrospectively reviewed 75 patients who underwent periacetabular osteotomy (PAO) for DDH between January 2010 and May 2013. Group 1 was a consecutive series of 48 patients (49 hips) with a standard Bernese PAO. Group 2 was a subsequent consecutive series of 26 patients (26 hips) with a rectus-sparing PAO which permits an arthrotomy lateral to the rectus. An epidural was used in all patients for pain control until the morning of postop day 2 and all patients received a multimodal medication regimen. Demographics, ASA score, estimated blood loss, ambulation distance, pain scores during postop days 1-3, and length of stay were recorded. Correction was measured by anterior and lateral center edge angles (CEA).

Results: The mean age was 25 years (min-max, 13-43). Group 1 had significantly greater EBL (549 mL vs 414 mL; $p=0.06$), more females ($p=0.05$) and greater LOS (5.2 vs. 4.52 total days respectively, $p=0.001$) than Group 2. There was no difference in Age and ASA scores or correction of anterior or lateral CEA. Group 2 was able to ambulate significantly more on postop day 1 ($p=0.05$), no difference for postop day 2 or 3, but an overall trend to greater total ambulation distances in Group 2 ($p=0.06$). Additionally, Group 2 had less overall pain (3.1 vs. 4.0) on postop days 1-3 ($p=0.02$).

Discussion: A rectus-sparing modification of the Bernese PAO demonstrated shorter length of stay, lower pain scores and greater distances for inpatient ambulation without compromising radiographic correction of dysplasia. Longer-term functional results and patient outcomes will be helpful to determine any lasting benefits to this modification.

Poster #138

Do Patients with Income-based Insurance have Access to Total Hip Arthroplasty?

Ran Schwarzkopf, MD, MSc, Duy Phan, MD, Melinda T. Hoang, Dana Mukamel, Steven D. Ross, MD

Introduction: The Patient Protection and Affordable Care Act (PPACA) is expected to increase health care availability through Medicaid expansion. The objective of this study was to evaluate the effect of the PPACA by examining access to total hip arthroplasty for patients residing in Southern California. Our hypothesis is that patients with income-based insurance have a lower rate of access as determined by insurance acceptance and surgeon availability.

Methods: The offices of 39 orthopaedic surgeons in Southern California were called to schedule a total hip arthroplasty. Insurances used included a Preferred Provider Organization plan (PPO), Medicare, and three income-based insurances: Medi-Cal, CalOptima, and Medical Services Initiative (MSI). Data obtained included the number of accepting offices, the time period to the first available appointment, and if the surgeon had completed fellowship training. Fisher Exact tests were used to compare insurance acceptance rates and acceptance based on fellowship training. T-tests were used to compare appointment times.

Results: There was a significant difference in the rate of acceptance when comparing PPO patients and Medicare patients with Medi-Cal ($p<0.001$), CalOptima ($p<0.001$), and MSI ($p<0.001$) patients. There was no difference in the average time to appointment for PPO and Medicare patients. The income-based insurances required prior authorization and specific appointment dates could not be obtained. Finally, there was no difference in the proportion of acceptance based on the fellowship training of the surgeon.

Conclusions: This study showed that in Southern California, there is a significant difference for access to total hip arthroplasty. Patients with income-based insurances are very limited in the number of surgeons from whom they can receive care. These findings raise concerns that the PPACA objectives of providing access through Medicaid expansion will not be achieved. Although the PPACA will increase the number of insured patients, it may not similarly increase access to providers.

Poster #139

Charges and Reimbursements for Joint Reconstruction from the 2011 Medicare Database: What Variation Exists between American Hospitals?

Eric M. Padegimas, MD, Kushagra Verma, MD, MS, James J. Purtill, MD

Introduction: Significant variability in hospital charges exists for similar procedures. To increase billing transparency, the Centers for Medicare Services released charge and reimbursement data by Diagnosis Related Group (DRG) from 2011. The hypothesis of this study is that a significant charge to reimbursement disparity exists for major joint replacement (MJR) and that charges vary significantly with geography.

Methods: This study is a retrospective examination of Medicare billing. Hospital charge (C), Medicare reimbursement (R), and the ratio of C to R (CRR) were analyzed for two DRGs: 469, MJR with major complication/comorbidity (MCC) and 470, MJR without MCC. Distribution for C and CRR was calculated. Geographic variation of C and CRR was analyzed by grouping hospitals by state and city to calculate distinct within-group standard deviations (SD), means, and coefficients of variability (CV, ratio of SD to mean).

Results: For MJR with MCC, means (thousands$\pm$1SD) were: C:\$81.7$\pm$40.2, R:\$22.5$\pm$5.7, and CRR: 3.67$\pm$1.60. Skewness of CRR was 1.248 ($p<0.01$). States with the highest CRR (highest to lowest) were NV, CA, NJ, FL, AL (4.62-5.84). Cities that exhibited the highest within-group variability of CRR (CV) were San Antonio, Houston, and Dallas (0.430-0.520). National CV: 0.435.

For MJR without MCC (C:\$52.0$\pm$24.6, R:\$14.6$\pm$3.2, CRR:3.64$\pm$1.63). Skewness CRR: 1.405 ($p<0.01$). States with the highest CRR: NV, NJ, FL, CA, TX (4.53-5.15). Cities with the highest CV: Dallas, Jacksonville, San Antonio (0.417-0.439). National CV: 0.447.

Conclusion: Nationally, hospitals charge 3-4 times reimbursed value of a procedure, though significant interstate geographic variability exists with NV, NJ, and CA having the highest CRR. Significant charge variability also exists at the local level, though even the most variable cities remain consistent with the national average. Healthcare policy makers should closely consider geographic factors, patient factors, and surgical complexity to better understand charge to reimbursement disparity and variability of charges for joint reconstruction.

Poster #140

Positive Outcome Bias in the Total Joint Arthroplasty Literature: The Effect of the Department of Justice Agreements with Implant Manufacturers

Carola F. van Eck, MD, PhD, Antonia F. Chen, MD, MBA, Adolph Yates, MD

Introduction: In 2007, the Department of Justice (DOJ) reached settlements with the 5 largest orthopedic implant makers requiring each company to publicly disclose consulting arrangements with surgeons and establishing new limits on such relationships. Positive outcome bias in the literature is multifactorial. This study was designed to determine the incidence of positive outcome bias before and after 2007.

Methods: A systematic review of three orthopedic journals was conducted using the Journal of Arthroplasty and both the American and British Journal of Bone and Joint Surgery between October 2002 and October 2012. All studies reporting on outcomes or comparisons of arthroplasty implants were included. The reporting of conflict of interest (COI) and positive outcomes was compared for the five years before and after October 2007.

Results: 486 studies were included in this study (149,276 patients). The authors of 213 studies (43.8%) declared a COI. In 182 of those 213 (85.4%) studies, there was a direct relationship between the reported COI and the study's topic. There was no significant change in the reporting of the COI ($p=0.534$) or in the reporting of positive outcomes ($p=0.580$) before and after October of 2007. There was a significant relationship between the presence of a COI and the reporting of positive outcomes. Of the studies that reported a COI, 158 out of 213 studies (74.1%) reported on a positive outcome, whereas only 170 out of 273 (62.2%) were positive outcomes in studies without a COI ($p=0.05$).

Conclusion: This study shows no decrease in the rate of positive outcomes bias in the total joint literature since the DOJ agreements in 2007. The higher rate of positive outcomes reporting from surgeons with a self-reported COI remains steady since the agreement. A reported conflict of interest is associated with a bias towards a higher percentage of positive outcomes reporting.

Poster #141

The Influence of Comorbidities on Hospital Costs and Length of Stay Following Total Knee Arthroplasty

Andrew J. Pugely, MD, Yubo Gao, PhD, Christopher T. Martin, MD, John J. Callaghan, MD

Introduction: Total knee arthroplasty (TKA) is one of most common orthopaedic procedures performed. The purpose of this study was to examine the influence individual patient characteristics has on hospital charges and length of stay (LOS).

Methods: The 2009 National Inpatient Sample (HCUP-NIS) dataset was queried using ICD-9-CM codes to identify patients between ages 40 and 95 and undergoing elective TKA. We used weighted estimates of national procedure volume and patient comorbidities defined by the AHRQ and identified them using standard methods described by Elixhauser. Generalized linear models, based on Poisson regression analysis, were used to estimate the influence of individual patient characteristics on hospital charges and (LOS).

Results: In 2009, 621,029 patients underwent TKA. Of these, 12.7% of TKA patients had no comorbidities while 32.5% had three or more. The most common conditions included hypertension (67.6%), diabetes (20.0%), and obesity (19.9%). Mean hospital costs were $47,370 and mean hospital LOS was 3.4 days. With incremental comorbidities, both hospital charges and length of stay increased ($p < 0.01$). Both marginal charges and LOS rose with inpatient mortality (+$29,876, 1.9 days), patients with metastatic disease (+$20,526, 1.8 days), minority race (+$10,958, 0.3 days), pulmonary-circulatory disorders (+$10,665, 1.4 days), electrolyte disturbances (+$6,014, 0.7 days). Patients treated in the Midwest had lower hospital charges and LOS (-$498, -0.04 days).

Discussion: Hospital charges and length of stay after TKA rise dramatically with the multiply-comorbid patient. As the payments for arthroplasty continue to decline, policy makers must focus on providing fair compensation and quality metrics to hospitals and surgeons treating the comorbid; otherwise, significant restrictions in access to care may occur.

Poster #142

Has Best Available Evidence Changed the Treatment of Femoral Neck Fractures? A Look at ABOS Part 2 Examinees

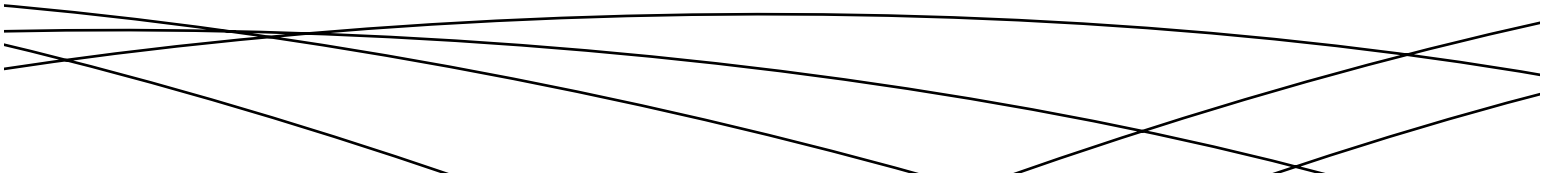
Benjamin J. Miller, MD, MS, **Nicolas O. Noiseux, MD**, Matthew Karam,
John L. Marsh, MD, John J. Callaghan, MD

Introduction: A substantial number of recent trials and reviews have suggested an advantage of arthroplasty over internal fixation and of total hip arthroplasty over hemiarthroplasty in the treatment of femoral neck fractures. Our goal was to investigate the trends in operative management by orthopaedic surgeons applying for board certification.

Methods: We queried the American Board of Orthopaedic Surgery (ABOS) database to determine all femoral neck fractures reported by candidates taking Part 2 of the licensing examination from 1999-2011 to determine the utilization of internal fixation, hemiarthroplasty, and total hip arthroplasty. The longitudinal trends were then stratified by patient age and declared subspecialty of the candidate (adult reconstruction, trauma, other). We used bivariate methods for statistical analysis.

Results: There were 19,541 cases (13,081 hemiarthroplasty, 5,990 internal fixation, and 470 total hip arthroplasty) treated by 4,450 candidates. The use of total hip arthroplasty increased tenfold (0.7% in 1999, 7.7% in 2011 [$p<0.001$]) while hemiarthroplasty (67.1% in 1999, 63.1% in 2011 [$p=0.020$]) and internal fixation (32.2% in 1999, 29.2% in 2011 [$p=0.064$]) demonstrated less significant changes. The proportion of patients <65 managed with total hip arthroplasty increased from 1.4% to 13.1% ($p<0.001$). The use of internal fixation was generally stable in all age groups and was the predominant form of fixation in patients <65 years. Candidates with a declared subspecialty of adult reconstruction showed a strong trend toward the use of total hip arthroplasty (4.3% in 1999 vs. 21.1% in 2011 [$p<0.001$]), while trauma examinees demonstrated decreasing utilization of internal fixation (40.9% in 1999 vs. 32.9% in 2011 [$p=0.012$]).

Discussion: The most substantial changes in treatment of femoral neck fractures were seen in younger patients, with hemiarthroplasty remaining the treatment of choice in the elderly. Longitudinal trend variations of adult reconstruction and trauma examinees suggest that recent literature has had a measurable effect on clinical practice.



Poster #143

Patient Attitudes Towards Resident and Fellow Participation In Orthopaedic Surgery

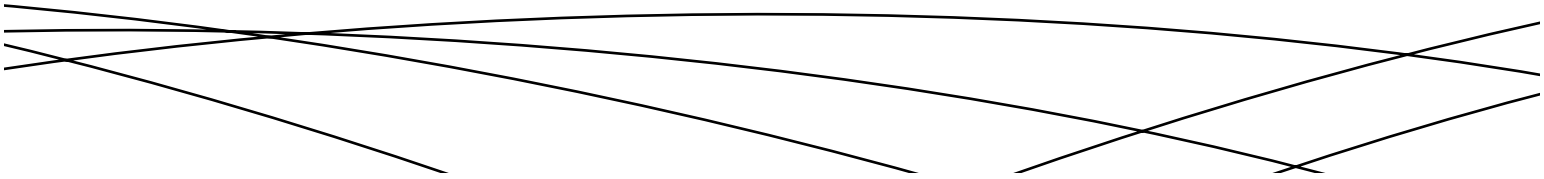
Paul H. Yi, BA, Michael B. Cross, MD, Sina Akhavan, BA, Paul M. Lichstein, MD, MS, Mario Moric, Javad Parvizi, MD, FRCS, Kevin J. Bozic, MD, MBA, Craig J. Della Valle, MD

Introduction: Residents and fellows' participation in orthopaedic surgery is a potential source of patient anxiety. The purpose of this study was to determine patients' attitudes towards residents and fellows' assisting an attending orthopaedic surgeon during surgery.

Methods: We prospectively surveyed 212 consecutive patients at two academic centers using an anonymous, self-administered written questionnaire. The questionnaire was developed in consultation with an expert in survey design using cognitive interviewing to ensure patient comprehension. Potential resident or fellow involvement in performing a total knee arthroplasty at various levels of training was presented and attitudes towards these scenarios were assessed. Differences between patient attitudes towards resident and fellow involvement at different levels of training were compared using Fisher's Exact Test.

Results: 135 patients completed the questionnaire (response rate 64%). While only 50% of patients were willing to have a PGY-2 perform some or most of their surgery, 75% would allow a PGY-5 ($p < 0.001$) and 84% a fellow ($p < 0.0001$). A minority of patients were willing to postpone their surgery by > 1 month if it meant that no resident (37%) or fellow (26%) would assist. Interestingly, > 90% of patients believed that it is important for patients to help in the education of future surgeons. Patients almost universally agreed that resident or fellow involvement should be disclosed to patients (99% for both). Attitudes towards orthopaedic surgeons who teach residents and fellows were favorable, with 80% agreeing that such surgeons are more likely to stay up-to-date on the latest techniques.

Conclusions: Patients desire disclosure of resident/fellow involvement in surgery and have a favorable view of surgeons who teach. While over 90% of patients believed that training residents and fellows was important, only half were comfortable having junior residents participate in their own surgery, but were more amenable to more experienced trainees.



Poster #144

Day of Surgery Determines Length of Stay in Total Joint Arthroplasty

Antonia F. Chen, MD, MBA, Susannah Cafardi, Brian A. Klatt, MD, Peter Z. Cohen

Introduction: As the number of surgeries increase, There is a greater demand for improved quality in total hip (THA) and total knee arthroplasty (TKA). Previous studies have demonstrated that decreasing hospital length of stay (LOS) increases quality of life and reduces costs. The purpose of our study was to determine if there was a difference in hospital LOS and complications based on the day of surgery for total joint arthroplasties (TJAs).

Methods: A retrospective cohort study of TJA Medicare patients from 2009-10 was conducted using a 20% nationally representative sample of Medicare claims data. Procedures were identified using CPT4 codes in Medicare claims and data was collected using encrypted beneficiary identification. Aggregate patient data on day of surgery, age, race, gender, comorbidities, socioeconomic class, length of stay, and complications (30-day readmissions, emergency department revisits within 30-days, death, infection, and DVT/PE) were collected. Results were analyzed using standard descriptive statistics and a Poisson regression model to compare LOS between the various days of the week, controlling for demographic predictors and comorbidities.

Results: There were 47,337 TKAs and the average LOS was 3.50 days. Patients that received a TKA on Monday stayed 6.4% shorter (95%CI 4.5-8.3%) than TKAs performed on Friday and 9.5% shorter (95%CI 7.9%-11.1%) than TKAs performed on Thursday.

For the 42,192 THAs, the average LOS was 3.57 days and patients that underwent THA on Friday stayed 9.7% longer (95%CI 7.8-11.6%) than Monday. Patients that underwent THA on Thursday stayed 10.4% longer (95% CI 8.7%-12.0%) compared to Monday. The findings were similar for TJAs performed on Tuesdays compared to TJAs performed on Thursday and Friday. There was no difference in LOS for TJAs performed on Monday versus Tuesday.

Conclusion: This large Medicare population study demonstrates that performing a TJA on Monday or Tuesday has a shorter LOS compared to Thursday and Friday, while controlling for other variables. Therefore, it is desirable to perform TJAs earlier in the week compared to later.

Poster #145

Economic Impact of Orthopaedic Adult Reconstruction Office Practice: The Implications of Hospital Employment Models on Local Economies

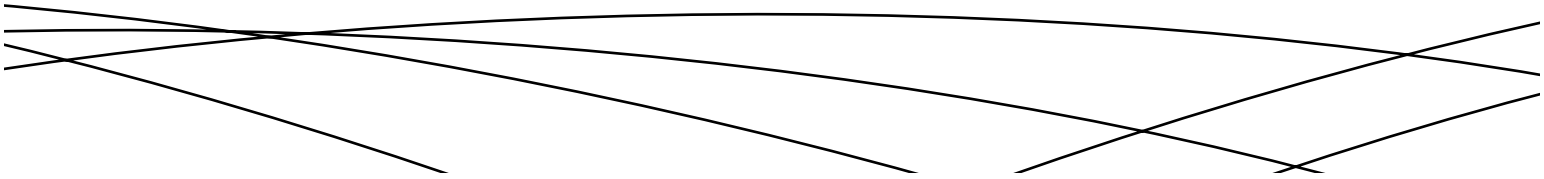
Richard Iorio, MD, Thomas K. Fehring, MD, Sally York, MN, RN, Mark I. Froimson, MD, David A. Halsey, MD, Charles M. Davis, MD, PhD, Richard F. Santore, MD, Louis F. McIntyre, MD

Introduction: The implications of hospital employment for in-patient based orthopaedic surgeons such as Adult Reconstructive (AR) Specialists is significant on the local economy. Due to health care reform, independent, private physician practices may be largely eliminated. Most physicians will be compelled to consolidate with other practitioners, become hospital employees, or align themselves with large hospitals or health systems. However, private practice orthopaedic surgery has an enormous economic impact on local economies which is lost with hospital employment.

Methods: The Research Committee of AAHKS performed a survey to evaluate the impact of AR office practice on local economies. Data were collected with a 26-question survey of the AAHKS Membership, which categorized the practice type, number of employees, budget, payment mix volume, and Medicare policy.

Results: 298 (65%) of 458 members are in private practice (fee for service, non-salaried, non-employed adult reconstruction surgeons). Currently in private practice, approached concerning hospital employment in the past 2 years: 43% yes, 57% no; Currently in private practice, sought hospital employment in the past 2 years: 11% yes, 89% no; Currently employed, in a different practice model than 2 years ago: 16% yes, 84% no. The average orthopaedic private group employs 13.4 orthopaedic surgeons (3.4 AR specialists), and 105 other employees. The average total budget is $12.5 million per year with $4 million in salaries, and $238,000 in tax revenue generated.

Conclusion: AR office practice generates economic activity for the state and local community by providing employment and benefits, purchasing goods and services, and supporting local and state government by creating tax revenue which would be significantly less if their practice was provided by a hospital. Co-management models appear to be a more well-rounded approach for aligning surgeons and hospitals while realizing the cost effectiveness and quality improvements necessary to realize the goals of PPACA and AARA.



Poster #146

Early Results of CMS Bundled Payment Initiative for a 90 day Total Joint Replacement Episode of Care

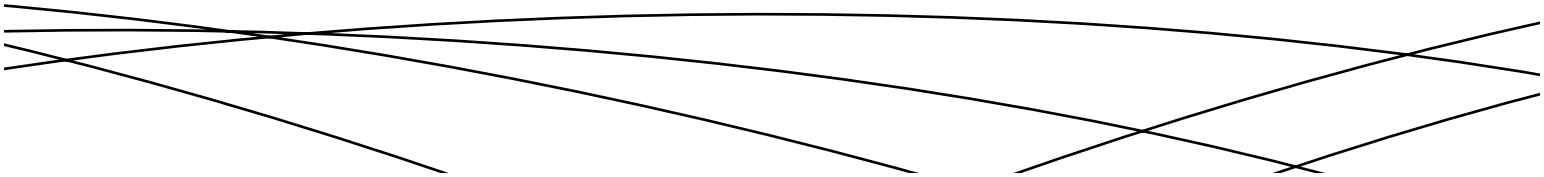
Richard Iorio, MD, James D. Slover, MD, Andrew J. Clair, BA, Joseph D. Zuckerman, MD

Introduction: In 2011 CMS initiated a new bundled payment project. The goal for this program is "to improve patient care through payment innovation that fosters improved coordination and quality through a patient-centered approach."

Methods: A large, tertiary, academic medical center with a hybrid compensation system was approved by CMS to implement a bundled payment initiative for TJA which will include the inpatient and post-acute care and all costs through 90 days following discharge.

Results: 271 patients were available for analysis at the time of submission. Average of length of stay was decreased to 3.5 days from 4.4 days (Median LOS 3 days). Discharge to inpatient facilities has decreased from 71% to 50%. Readmissions have occurred in 19 patients (7%) which is comparable to before the implementation of the BPI. The hospital has seen significant cost reduction in the inpatient component year over year. It is too early to determine the financial merits of the full 90 day episode of care.

Conclusions: Initiatives which enable physicians, health care systems and payers to control costs, improve quality and efficiency, and increase patient satisfaction will be enabled in the new health care paradigm. Early results from this CMS bundled payment initiative at an urban, tertiary, academic medical center demonstrate decreased length of stay and increased discharge to home, with stable readmissions, suggesting significant cost-savings with no loss of quality of care. Physicians, health care systems, and payers who are able to align their interests in a way which benefits patients while controlling costs will be rewarded in the near future.



Poster #147

Short-Term Outcomes and Cost of Fast-Track Surgery for Total Hip and Knee Arthroplasty at a Tertiary Hospital

Viktor J. Hansen, MD, Lauren Lebrun, Elizabeth Jacob, Robert Dorman, Greg Pauly, Henrik Malchau, Robert Peloquin, Andrew Freiberg

Introduction: A fast-track joint replacement program was designed in response to cost pressures. Patients were selected for fast- and standard tracks using the Risk Assessment and Prediction Tool. Anesthetic dosing, medical orders, mobilization, rehabilitation and patient communication were modified. This study assesses short term outcomes and costs of the program.

Methods: From 01/01/11 - 10/31/12, 2287 patients underwent primary total hip or knee arthroplasty. 30- and 90-day rates of reoperation, revision, readmission, transfusion, medical and orthopaedic complications were assessed along with demographics, BMI, ASA-score, length of stay (LOS) and recovery, turnover and surgical times. Total direct medical costs were assessed from FY2011. Outcomes were compared prior to and after implementation. Variables were analyzed using Chi-square and t-test.

Results: Overall outcomes showed decreased 30-day transfusion (15.10%-11.51%; $p=0.023$), LOS (3.69-3.32 days; $p<0.001$), recovery time (248-228 min; $p=0.025$), turnover time (close-cut) (92-87 min; $p=<0.001$), and surgical time (95-87 min; $p<0.001$). Total direct medical costs decreased by 1.9%. Outcomes of fast-track patients revealed increased ischemic stroke at 30 and 90 days (0.13%-0.91%; $p=0.044$) and decreased LOS (3.49-2.95 days; $p<0.001$), turnover time (close-cut) (91-86 min; $p<0.01$), and surgical time (94-83 min; <0.001). Costs decreased by 4.02%.

No differences were found in demographics, BMI or ASA-score.

Conclusions: the program decreased LOS, recovery, turnover and surgical times. Most outcomes remained consistent, but a decrease in reoperations, readmissions, DVT, PE and VTE was observed that may reach statistical significance with increased patient numbers. Costs were marginally reduced. While the increased stroke rate is unusual, it represents merely three additional cases and is likely related to patient risk factors, however careful monitoring is needed for conclusions regarding possible correlation to the program.

The program has implications for use in other hospitals and was designed around constraints experienced by many programs.

Poster #148

Prevalence and Costs of Rehabilitation and Physical Therapy after Primary TJA

Kevin L. Ong, PhD, Paul Lotke, Edmund Lau, Michael Manley, Steve Kurtz

This study was designed to define the patterns of post-hospital care after TJA together with the corresponding prevalence and costs of post-discharge physical therapy (PT). We asked: 1) have the trends in discharge pathways changed for primary TJA patients over the last ten years; 2) what is the prevalence of post-discharge PT; and 3) what is the cost of post-discharge PT?

The 5% Medicare database (1997-2010) was used to identify primary TJA patients and their post-discharge PT. The discharge status for 50,886 primary THA and 107,675 primary TKA patients was evaluated. The prevalence of PT post-discharge (using CPT codes) and the associated costs were evaluated within 12 months post-operatively.

More than 50% of patients were discharged to an inpatient facility. Over the last six years of the study, there was increasing use of skilled nursing units and a precipitous reduction in discharge to rehabilitation facilities. Independent of discharge status, PT was almost universally utilized. In 2009, the total aggregate cost of PT was $648 million. The average annual PT cost per patient rose by an order of magnitude over the twelve year study period, in contrast to reported reductions in hospital, surgeon reimbursement, and implant costs. Approximately 25% of the PT cost was expended on a variety of less common modalities such as electrical stimulation or hydrotherapy, for which there is sparse data to document their effectiveness.

In summary, more than half of primary TJA patients are discharged to skilled nursing or rehabilitation facilities. Physical therapy is utilized extensively, and in aggregate, costs Medicare more than $648 million a year. Many of the PT modalities utilized remain without substantive outcome data. With the increased pressure to control costs for primary TJA, the effectiveness of various PT modalities and the need for various aspects of post operative care deserves evaluation.

Poster #149

The Institutional Burden of Emergent Hip Arthroplasty

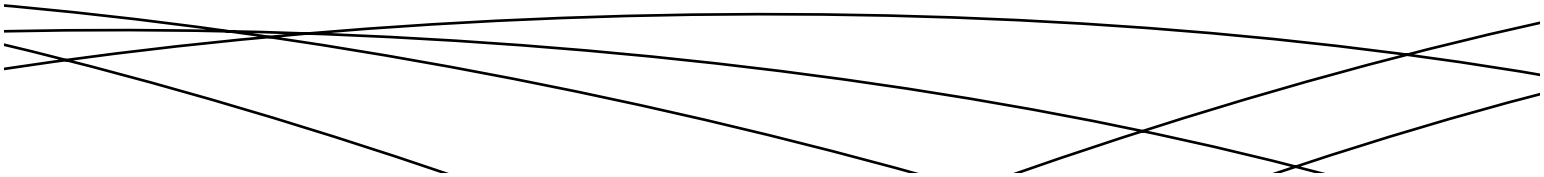
Atul F. Kamath, MD, Daniel C. Austin, BA, Peter B. Derman, MD, MBA, Craig L. Israelite, MD

Introduction: Emergent surgery has been shown to be a risk factor for poor patient outcomes. Studies suggest that patient morbidity is greater with emergent hip arthroplasty, although controversy exists regarding the impact of these procedures on mortality. The financial impact of emergent arthroplasty has not been studied previously.

Methods: From a cohort of 419 consecutive hip arthroplasty patients, we compared 57 patients who were treated emergently to 362 who underwent arthroplasty during an elective admission. This retrospective cohort study examined the characteristics of these groups using the mann-whitney test to compare quantitative data and chi-squared analysis to compare qualitative metrics. Demographics, admission diagnoses, complications, and costs were recorded and compared between the cohorts.

Results: Patients treated emergently were older ($p=0.04$), more likely to be transferred to our institution for treatment ($p<0.0001$), and more likely to be undergoing a revision procedure ($p<0.0001$). Femoral fracture ($p<0.0001$), peri-prosthetic fracture ($p=0.01$), prosthetic infection ($p=0.005$), and prosthetic dislocation ($p<0.0001$) were observed at higher rates within the emergent cohort. Peri-operative complications including intensive care unit time (0.02) and blood transfusion requirements (0.001) were greater in emergent patients, although in-hospital mortality was similar between groups ($p=1.0$). Emergent patients had a median length of inpatient stay 67% longer than those in the elective cohort ($p<0.0001$). All cost metrics, including a 24% higher median total cost ($p<0.0001$), were greater in the emergent group.

Conclusion: The well-known risks of emergent surgery also apply to emergent hip arthroplasty. Across most measures, including length of stay, morbidity, and costs, emergent arthroplasty carries a significant financial and clinical burden to treating institutions. This initial study prompts the need for further research to understand the indications for emergent procedures, and to develop treatment algorithms to effectively manage this subset of arthroplasty patients.



Poster #150

The Influence of Comorbidities on Hospital Costs and Lengths of Stay following Total Hip Arthroplasty

Andrew Pugely, MD, Yubo Gao, PhD, Christopher T. Martin, MD, John J. Callaghan, MD

Introduction: Total hip arthroplasty (THA) has been heralded as the operation of the century for its ability to reduce pain and restore function. Thus, the purpose of this study was to examine the influence patient characteristics have on hospital charges and length of stay (LOS).

Methods: The 2009 National Inpatient Sample (HCUP-NIS) dataset was queried using ICD-9-CM codes to identify patients undergoing elective THA. We used weighted estimates of national procedure volume and patient comorbidities defined by AHRQ and identified them using standard methods described by Elixhauser. Generalized linear models, based on Poisson regression analysis, were used to estimate the influence of individual patient characteristics on hospital charges and (LOS).

Results: In 2009, an estimated 277,564 patients underwent THA. Of these, 16.6% patients had no comorbidities while 28.2% had three or more. The most common conditions included hypertension (60.8%), diabetes (14.4%), and obesity (13.3%). Mental disorders were found in 10.2%, renal failure in 3.7% and AIDs in 0.13% of patients. Mean hospital charges were $49,740 and mean hospital LOS was 3.5 days. With incremental comorbidities, both hospital charges and length of stay increased ($p < 0.01$). Both marginal charges and LOS rose with inpatient mortality (+$24,165, 1.2 days), patients with recent weight loss (+$20,487, 2.3 days), metastatic disease (+$11,245, 1.8 days), minority race (+$13,098, 0.6 days), pulmonary-circulatory disorders (+$5,048, 1.0 days), AIDs (+$7,248, 0.3 days). Patients treated in the West region had higher marginal charges but a lower LOS (+$24,164, -0.2 days).

Discussion: Hospital charges and length of stay after THA rise dramatically with the multiply-comorbid patient. As the payments for arthroplasty continue to decline, policy makers should focus on providing fair compensation and quality metrics to hospitals and surgeons treating the comorbid; otherwise, significant restrictions in access to care may occur.

ACCREDITATION

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the American Academy of Orthopaedic Surgeons (AAOS) and the American Association of Hip and Knee Surgeons (AAHKS). The AAOS is accredited by the ACCME to provide continuing medical education for physicians.

CME CREDIT

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of ***15 AMA PRA Category 1 Credits™***. Physicians should only claim the credit commensurate with the extent of their participation in the activity.

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FDA STATEMENT

Some pharmaceuticals and/or medical devices demonstrated at the Annual Meeting have not been cleared by the US Food and Drug Administration (FDA) or have been cleared by the FDA for specific purposes only. The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each pharmaceuticals and/or medical device he or she wishes to use in clinical practice. AAHKS policy provides that "off label" status of the device or pharmaceutical is also specifically disclosed (i.e. that the FDA has not approved labeling the device for the described purpose). Any device or pharmaceutical is being used "off label" if the described use is not set forth on the product's approved label.

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Each participant in the Annual Meeting has been asked to disclose if he or she has received something of value from a commercial company or institution, which relates directly or indirectly to the subject of their presentation. The AAOS has identified the options to disclose as follows:

n = Respondent answered 'No' to all items indicating no conflicts;
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2 = Speakers Bureau (Speakers Bureau or Honorarium);
3 = Consultancies;
4 = Other Financial or Material Support;
5 = Stock or Stock Options;
6 = Research Support (Research or Institutional);
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An indication of the participant's disclosure appears after his or her name as well as the commercial company or institution that provided the support. The AAOS and the AAHKS do not view the existence of these disclosed interests or commitments as necessarily implying bias or decreasing the value of the author's participation in the course.

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Birmingham, MI

Paolo Adravanti, MD
International
Parma, Italy

Kshitij M. Agrawal, MD
Associate
Boston, MA

John W. Aldridge, MD
Fellow
Newport News, VA

Darin K. Allred, DO
Candidate
St. George, UT

David W. Anderson, MS, MD
Candidate
Kansas City, KS

Jared T. Armstrong, MD
Resident
Prospect, KY

John A. Avallone, DO
Fellow
Yardley, PA

John R. Ayres, MD
Fellow
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Resident
San Diego, CA

Lawrence S. Barnett, MD
Fellow
Orange, CA

Wael K. Barsoum, MD
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Michael D. Bates, MD
Resident
Charlotte, NC

Matthew S. Bernard, MD
Candidate
Chattanooga, TN

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Fellow
West Hills, CA

Puneet Bhatia, MD
Associate
Mayfield, KY

Christopher Blair, DO, MBA
Resident
Fort Lauderdale, FL

Henry J. Blum, MD
Fellow
Bellaire, TX

Michael W. Britt, MD
Fellow
Corpus Christi, TX

Justin G. Brothers, MD
Resident
Danville, PA

Chris D. Bryce, MD
Candidate
Gilbert, AZ

Joshua L. Carter, MD
Resident
South Burlington, KY

Shaun E. Chandran, MD
Candidate
San Pedro, CA

Jonathan J. Clabeaux, MD
Fellow
Seattle, WA

Wesley A. Clark, MD
Candidate
Metairie, LA

Todd Clarke, MD
Fellow
Beaumont, TX

H. John Cooper, MD
Candidate
New York, NY

Francis C. Cormier, MD
Fellow
Detroit Lakes, MN

Jonathan B. Courtney, MD
Candidate
New York, NY

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Resident
New Brunswick, NJ

Brock S. Cummings, MD
Fellow
Paradise, CA

Stephen H. Cummings, MD
Resident
Great Neck, NY

Anthony P. Czaplicki, MD
Resident
Columbus, OH

Jason G. Dalling, MD
Candidate
New York, NY

Alexander M. DeHaan, MD
Resident
Beaverton, OR

Gregory K. Deirmengian, MD
Fellow
Philadelphia, PA

Robert C. Detch, MD
Fellow
Burlingame, CA

John N. Diana, MD
Fellow
Napa, CA

Todd B. Dietrick, MD
Fellow
Pasadena, CA

Matthew J. Dietz, MD
Resident
Cambridge, MA

Robert E. Donnelly, MD
Fellow
Clearwater, FL

Justin N. Duke, MD
Resident
Birmingham, AL

John P. Dunleavy, MD
Fellow
Danbury, CT

Mark W. Dwyer, MD
Resident
Dearborn, MI

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Avram A. Edidin, PhD
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Portola Valley, CA

Karim A. Elsharkawy, MD
Resident
Lakewood, OH

Keith A. Fehring, MD
Resident
Richmond, VA

Gustav Fischer, MD
Resident
Wichita, KS

Michael J. Fracchia, MD
Fellow
Port Jefferson, NY

Marc J. Friedman, MD
Fellow
Van Nuys, CA

Todd L. Galdes, DO
Candidate
Decatur, GA

Gustavo A. Garcia, MD
International
Caracas, Venezuela

Dustin P. Gay, MD
Candidate
Dublin, GA

Tad L. Gerlinger, MD
Fellow
San Antonio, TX

Philip J. Glassner, MD
Fellow
Flemington, NJ

Gregory J. Golladay, MD
Fellow
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Felipe Gomez-Garcia, MD
International
Mexico City, Mexico

Christopher W. Grayson, MD
Resident
Gainesville, FL

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September 2012 through August 2013

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Lone Tree, CO

Francisco R. Grieco, MD
International
Caracas, Venezuela

Ray A. Grijalva, MD
Candidate
Salt Lake City, UT

Joseph R. Hanna, MD
Fellow
Woodbridge, VA

Dane C. Hansen, DO
Resident
Columbus, OH

Matthew S. Hepinstall, MD
Candidate
New York City, NY

Shane R. Hess, DO
Resident
Lansing, MI

Kurt C. Hirshorn, MD
Candidate
St. Petersburg, FL

Kirby D. Hitt, MD
Fellow
Temple, TX

Kathleen A. Hogan, MD
Fellow
Nashua, NH

Daniel J. Holtzman, MD
Resident
Seattle, WA

Charles A. Hope, MD
Fellow
Savannah, GA

Seth A. Jerabek, MD
Candidate
New York City, NY

Richard Johnston, MD
Fellow
St. Louis, MO

James Joseph, MD, MS
Resident
Yonkers, NY

AAHKS Welcomes New Members

September 2012 through August 2013

Michael E. Joyce, MD
Fellow
Glastonbury, CT

Niraj V. Kalore, MD
Associate
Blythewood, SC

Adam M. Katchky, MD
Resident
Toronto, Canada

Shin-Yoon Kim, MD
International
Daegu, South Korea

Kyung-Hoi Koo, MD
International
Seongnam-si, South Korea

Ryan C. Koonce, MD
Candidate
Alexandria, VA

Brian A. Krenzel, MD
Fellow
Hickory, NC

Anna A. Kulidjian, MD
Fellow
San Diego, CA

Stephen M. Kurtin, MD
Fellow
Milwaukee, WI

Satish Kutty, FRCS (Orth)
International
London, UK

Maxwell K. Langfitt, MD
Resident
Winston-Salem, NC

Bryan M. Lawless, MD
Candidate
Bedford, NH

Cameron K. Ledford, MD
Resident
Durham, NC

Jason H. Lee, MD
Resident
Chino, CA

Vincent J. Leone, MD
Fellow
Great Neck, NY

AAHKS Welcomes New Members

September 2012 through August 2013

Jun Li, MD, PhD
International
Xi'an, China

William J. Long, MD
Fellow
New York, NY

Stephen S. Louis, MD
Fellow
Hinsdale, IL

Phillip F. Ludkowski, MD
Fellow
Arlington Heights, IL

Trevor H. Magee, MD
Candidate
Salt Lake City, UT

Junaid A. Makda, MD
Candidate
Bloomingdale, IL

Joseph D. Maratt, MD
Resident
Ann Arbor, MI

Stacey K. Martin, MD
Candidate
Houston, TX

Leibnitz J. Martinez, MD
International
Santo Domingo,
Dominican Republic

David J. Mayman, MD
Fellow
New York City, NY

Allen P. McDonald III, MD
Fellow
Atlanta, GA

Robert P. McKinstry, MD
Candidate
Linthicum, MD

Morteza Meftah, MD
Candidate
Houston, TX

Jared L. Michalson, MD
Candidate
Denver, CO

Troy A. Miles, MD
Resident
Portland, OR

AAHKS Welcomes New Members

September 2012 through August 2013

Ryan G. Molli, DO
Candidate
Livonia, MI

Robert M. Molloy, MD
Fellow
Cleveland, OH

Matthew C. Morrey, MD
Fellow
San Antonio, TX

Bradley J. Morse, MD
Fellow
Oregon, OH

Richard D. Mulroy Jr., MD
Fellow
Milford, MA

Joseph E. Mumford, MD
Fellow
Topeka, KS

Trevor G. Murray, MD
Candidate
Cleveland, OH

Stephen M. Nagy III, MD
Fellow
Menlo Park, CA

Nader A. Nassif, MD
Resident
New York City, NY

Suresh Nayak, MD
Fellow
Cincinnati, OH

Michael J. O'Malley, MD
Resident
Allison Park, PA

Julius K. Oni, MD
Resident
Chicago, IL

Michael P. O'Reilly, MD
Fellow
La Plata, MD

Anjay R. Patel, MD
Resident
Chicago, IL

Preetesh D. Patel, MD
Fellow
Weston, FL

AAHKS Welcomes New Members

September 2012 through August 2013

Brian T. Perkinson, MD
Candidate
Nashville, TN

Jeffrey R. Petrie, MD
Resident
Orlando, FL

Kiel J. Pfefferle, MD
Resident
Akron, OH

Alberto Pinto, MD
International
Caracas, Venezuela

Edward J. Prince, MD
Fellow
St. George, UT

Andrew J. Pugely, MD
Resident
Iowa City, LA

Ricardo J. Reina, MD
Fellow
San Juan, PR

Keith R. Reinhardt, MD
Candidate
Bay Shore, NY

Benjamin F. Ricciardi, MD
Resident
New York, NY

Angel I. Robles, MD
International
Caracas, Venezuela

Ronald R. Romanelli, MD
Fellow
Springfield, IL

Seth D. Rosenzweig, MD
Fellow
New Iberia, LA

Randall J. Ruark, MD
Fellow
Augusta, GA

Christopher A. Samujh, MD
Candidate
Louisville, KY

Vineet K. Sarin, PhD
Affiliate
Camarillo, CA

AAHKS Welcomes New Members

September 2012 through August 2013

Arjun Saxena, MD
Candidate
Langhorne, PA

Emil H. Schemitsch, MD
Fellow
Toronto, Canada

Marco Schiraldi, MD
International
Savigliano, Italy

Evan M. Schwechter, MD
Candidate
Scarsdale, NY

William F. Scully III, MD
Resident
Lakewood, WA

Brian E. Seng, MD
Fellow
Hendersonville, NC

Seung-Suk Seo, MD
International
Busan, South Korea

Eric A. Silverstein, MD
Associate
Hartford, CT

Jordan B. Simpson, MD
Resident
Lubbock, TX

Gautam Siram, MD
Candidate
Chevy Chase, MD

Sang-Jun Song, MD, PhD
International
Seoul, South Korea

Lyle S. Sorenson, MD
Fellow
Seattle, WA

Robert C. Sproul, MD
Candidate
Charlotte, NC

Anand Srinivasan, MD
Candidate
Evanston, IL

Ajay Srivastava, MD
Fellow
Flint, MI

AAHKS Welcomes New Members

September 2012 through August 2013

William B. Stanfield, MD
Fellow
Sheffield Village, OH

Felix A. Stanziola, MD
Fellow
Miami, FL

Christopher M. Stewart, MD
Candidate
Little Rock, AR

Michael J. Stoesz, MD
Resident
Kalamazoo, MI

Aree Tanavalee, MD
International
Bangkok, Thailand

Louay Toma, MD
Fellow
Walnut Creek, CA

Ismail R. Tozan, MD
International
Istanbul, Turkey

Robert W. Tracey, MD
Resident
Bethesda, MD

Jon C. Uggen, DO
Candidate
Alexandria, VA

Slif D. Ulrich, MD
Resident
Baltimore, MD

Kenneth Urish, MD, PhD
Resident
Hershey, PA

Carola F. van Eck, MD
Resident
Pittsburgh, PA

James R. Van Horne, MD
Fellow
Grants Pass, OR

Shyam K. Vekaria, MD
Resident
Chicago, IL

Brad S. Waddell, MD
Resident
New Orleans, LA

AAHKS Welcomes New Members

September 2012 through August 2013

Timothy L. Walker, MD
Fellow
Sioux Falls, SD

Christopher N. Walton, MD
Fellow
Eugene, OR

Lucian C. Warth, MD
Resident
Iowa City, IA

Bradley J. Watters, MD
Fellow
Silverdale, WA

Ian C. Weber, MD
Fellow
Kearney, NE

Edward R. Westrick, MD
Candidate
Seattle, WA

Timothy M. Wright, PhD
Affiliate
New York, NY

Raj Yalamanchili, MD
Candidate
Bel Air, MD

Robert K. Yarbrough, MD
Fellow
Cumming, GA

Duke G. Yim, MD
Candidate
Honolulu, HI

Alejandro D. Zylberberg, MD
International
Providencia, Chile

AAHKS Welcomes New Members

(photos unavailable)

Jose A. Amundaray, MD
Fellow
Clearwater, FL

Scott B. Appell, MD
Fellow
Birmingham, AL

William A. Baione, MD
Resident
New Brunswick, NJ

William M. Browning III, DO
Resident
Erie, PA

M. Umar Burney, MD
Fellow
Rockwall, TX

James L. Cameron, MD
Resident
San Diego, CA

Darwin D. Chen, MD
Candidate
New York, NY

Frank Congiusta, MD
Fellow
Albany, NY

Sara J. Crookshank, PA-C
Affiliate
Cincinnati, OH

Justin M. Dunn, MD
Resident
Chattanooga, TN

Orry Erez, MD
Candidate
Brooklyn, NY

Matt C. Futvoye, MD
Candidate
Jackson, MS

Peter E. Guay, DO
Fellow
Falmouth, ME

Christopher R. Halphen, DO
Resident
Kansas City, MO

Matthew D. Higgins, MD
Resident
Chattanooga, TN

Robert E. Howell III, MD
Resident
Chattanooga, TN

Adeel Husain, MD
Resident
Redlands, CA

Dane A. Iams, MD
Resident
Gainesville, FL

James N. Irvine, MD
Resident
Pittsburgh, PA

Conrad B. Ivie, MD
Resident
Columbia, MO

Kenneth B. Jahng, MD
Resident
Loma Linda, CA

Christopher L. Jimenez, MD
Resident
Salt Lake City, UT

Charles L. Lupo, MD
Resident
Pittsburgh, PA

Wes Madsen, MD
Candidate
Layton, UT

David Rodriguez-Quintana, MD
Resident
San Juan, PR

Kamran N. Sadr, MD
Candidate
La Jolla, CA

David M. Shephard, MD
Fellow
Lubbock, TX

William F. Sherman, MD
Candidate
Metairie, LA

William S. Singer, MD
Fellow
Omaha, NE

William R. Sterba III, MD
Fellow
Warrenville, IL

Matthew D. Stover, DO
Resident
Sagamore Hills, OH

Ray C. Wasielewski, MD
Fellow
Columbus, OH

David F. Weiner, MD
Fellow
Denver, CO

Seann E. Willson, MD
Fellow
Flint, MI

Michael Zywiel, MD
Resident
Toronto, Canada

PROGRAM COMMITTEE:

Berend, Michael: 1,3B,5(BIOMET); 4(OrthAlign); 5(DePuy, wright, Stryker); 8(Joa); 8,.9(AAHKS, piedmont)

Clohisy, John: 3B(Pivot Medical); 5(Zimmer, Inc.)

Dalury, David: 1,2,3B,5(Depuy); 8(Journal of Arthroplasty)

Della Valle, Craig: 3B(Smith & Nephew, Convatec, Biomet); 4(CD Diagnostics); 5(Stryker, Smith & Nephew); 6(Zimmer: Institutional research support); 7(SLACK, Inc); 8(SLACK, Inc, Orthopaedics Today); 9(AAHKS, Chairman Eduation Committee, The Knee Society, Membership Committee Chairman, AAOS, Central Instructional Course Lecture Committeee Chairman)

Parvizi, Javad: 3B(Zimmer, Smith & Nephew, Convatech, TissueGene, Ceramtec, Emovi, 3M, Cadence, Medtronic, Pfizer) 5(Stryker, Zimmer, Smith and Nephew, Ceramtec, 3M); 7(Datatrace, Slack, Wolters Kluwer, Jaypee); 8(J Arthroplasty, JBJS-A, BJJ, Orthopedics Today); 9(AAHKS, EBJIS, MSIS, AOA)

Polkowski, Gregory: (n)

Sporer, Scott: 3B(Smith and Nephew); 3B,5(Zimmer); 7(Slack); 8(The Journal of Arthorplasty)

Springer, Bryan: 2(Depuy, Ceramtec); 3B(Stryker, Convatec Surgical); 8(Journal of Arthroplasty)

STAFF:

Zarski, Michael: 9 (American Association of Hip and Knee Surgeons)

Hall, Robert: (n)

Lusk, Eileen: (n)

Stewart, Krista: (n)

Creed, Sharon: (n)

Furlan, Jean: (n)

Rose, Patti: (n)

FACULTY:

Abbood, Emily: (n)

Abdeen, Ayesha: (n)

Abdel, Matthew: (n)

Abiola, Rasheed: (n)

Abolghasemian, Mansour: (n)

Abouk, Michael: (n)

Adam, Schwartz: 9(American Academy of Orthopaedic Surgeons Publications Committee)

Adams, Jake: (n)

Adams, Joanne: (n)

Adams. Kerri: (n)

Adelani, Muyibat: (n)

Adickes, Mark: (n)

Adluru, Hari Kishore: (n)

Agrawal, Kshitikumar: (n)

Ahn, Hye Sun: (n)

Ake. Christopher: (n)

Akhavan, Sina: (n)

Al khafaji, Abdul Radha kh: 6(stryker instruments);7(Hip,knee,andlocking nail);

Al Saied, Mohamed: 8,9(Medical director of the Libyan medical committee in Canada and secretary of the Libyan Canadian Medical Asdociation)

Al-Hamad, Mariam: (n)

Albrecht, Ryan: (n)

Albright, Lysha: (n)

Alexander, Jerry: (n)

Alexander III, Gerald: (n)

Alexiades, Michael: (n)

Allan, D Gordon: (n)

Allen, Bryce: (n)

Allen, Rachel: (n)

Allison, Jeroan: 3B(Pfizer Medical Education Review Panel)

Almand, Jeff: 3B,5(DePuy Orthopaedics, A Johnson & Johnson Company)

Alosh, Hassan: (n)

Alvarez, Andres: (n)

Alvi, Hasham: (n)

Amantullah, Derek: (n)

Ambrose, Catherine: (n)

Amendola, Annunziato: 1,4(arthrosurface inc, arthrex inc, 1,3C,4(MTP solutions);3B(arthrex); 5(moximed); 8(foot and ankle international; clinical journal of sports medicine; sports medicine and arthroscopy; AAOS; ABOS; AOSSM; ISAKOS)

Ammeen, Deborah: (n)

Ammerman, Michelle: (n)

Amott, Lindsay: (n)

Amrami, Kimberly: (n)

Amstutz, Harlan: 1(Conserve Plus hip resurfacing, wright Medical Technology, Inc.)

Anania, Andres: (n)

ANCHOR group: (n)

Anderson, Ashley: (n)

Anderson, Christopher: 3A(OrthoSensor, Inc.)

Anderson, David: (n)

Anderson Lucas: (n)

Anderson, Melissa: 3A(Smith & Nephew); 4(Smith & Nephew)

Anderson, Michael: (n)

Andersson, Gunnar: (n)

Ang, Chia-Liang: (n)

Anract, Philippe: (n)

Anseth, Scott: 3B(Stryker Performance Solutions, Biomet)

Anthony, Iain: 3B, 5(CORIN) 5(Zimmer, MAKO)

Anthony, Trenga: (n)

Anthony, Danielle: 3A(Stryker Orthopaedics, Integra LifeSciences)

Antoniak, Derrick: (n)

Aoki, Stephen: (n)

Appleton Jr., J Stephen: (n)

Archdeacon, Michael: 2(Stryker Orthopaedics); 3B(Stryker Orthopaedics); 8(JOT, JBJS, CORR, JOR, JAAOS)

Archibeck, Michael: (n)

Arnholt, Christina: 3A(Pfizer); 4(Pfizer)

Arsoy, Diren: (n)

Ashfaq, Kashif: (n)

Ast, Michael: (n)

Atrey, Amit: (n)

Attarian, David: 7(Royalties from Data Trace Publishing); 9(Board of Directors- OMEGA, AAOS Committee on Professionalism)

Au, Brigham: (n)

Aubin, Michelle: (n)

Aubin, Pierre Philippe: (n)

Auer, Ron: (n)

Austin, Daniel: (n)

Austin, Luke: 3B(Tornier); 5(Zimmer)

Austin, Matthew: 1,2,3B(Zimmer); 8(Journal of Arthroplasty); 9(AAHKS EBM Committee, AAOS CME Courses Committee)

Aversano, Francis: (n)

Avivi, Eran: 5(Institutional research support from S&N, DEPUY, STRIKER)

Ayers, David: 5(Aircast, Merck, DePuy, Pfizer, OTA, AAHKS, MTF, K2M, Mitek, NIH, AHRQ, DOD, RWJF, Worcester Foundation, Zimmer, Apatec,Medtronic, Synthes); 8(JBJS); 9(AAOS Hip Reconstruction Committee; Chair; AOA, Academic Leadership Committee)

Aynardi, Michael: (n)

Azad, Vikrant: (n)

Babatunde, Oladapo: (n)

Baca, Geneva: (n)

Backstein, David: 2,3B(Zimmer); 3B(Wright Medical); 3C(Avenir medical); 8(Journal of Arthroplasty)

Baek, Ji-Hoon: (n)

Baghdadi, Yaser: (n)

Bagsby, Deren: (n)

Baker, Kevin: 3B(Globus Medical); 5(Arthrex Inc., Globus Medical, Zimmer, Inc.)

Baldwin, Keith: 3B(Synthes trauma); 4(PfiZer); 7(JBJS); 8(Jbjs reviews); 9(Research and evidence based medicine committee POSNA)

Balkissoon, Rishi: (n)

Ball, Scott: 2,5(DePuy)

Band, Philip: 8(Bulletin of the Hospital for Joint Diseases)

Band, Marc: 3A, 4(Zimmer, GmbH)

Banerjee, Samik: (n)

Banka, Trevor: (n)

Banzhof, Jennifer: (n)

Barber, Thomas: (n)

Barbuto, Richard: (n)

Bargar, William: 2,3A(Curexo Technology Corporation (now: Think Surgical)); 4(Stryker, Biomet, J&J); 5(Depuy)

Barker, Elizabeth: (n)

Barnes, C Lowry: 2(Convatec); 3B(DJO, Wright Medical Technology, Inc.); 5(ConforMIS, DePuy, Johnson & Johnson Company, Wright Medical Technology, Inc.); 8(Orthopedic Knowledge Online (Peer Reviewer), Clinical Orthopaedics and Related Research, (Journal of Surgical Orthopaedic Advances, Journal of Arthroplasty); 9(Founder and Medical Driector of HipKnee Arkansas Foundation, Arkansas Orthopaedic Society)

Barnett, Steven: 2,3B(DePuy Orthopaedics)

Barnett, Clint: (n)

Barney, Jacob: (n)

Barr, Christopher: 6(Research support from Zimmer, Inc.)

Barrack, Robert: 1,3B,5,6(Stryker); 5(Biomet; Medical Compression Systems; Smith & Nephew; Wright Medical Technology, Inc.); 7(The McGraw-Hill Companies Inc; Wolters Kluwer Health - Lippincott Williams & Wilkins); 8(Journal of Bone and Joint Surgery - American; Journal of Bone and Joint Surgery - British); 9(Hip Society; Knee Society)

Barrett, Ian: (n)

Barrett, William: (n)

Barrington, John: 1,2,3B,5(Biomet); 2,3B(Angiotech, Pacira)

Barsoum, Wael: 1,2,3B,5(Stryker); 1(Exactech, Zimmer, Shukla Medical); 3A(KEF Healthcare); 4(Custom Orthopaedic Solutions, OtisMed Corporation, iVHR); 5(The Medicines Company, Active Implants,DJO, Zimmer, Orthovita)

Barton, Bruce: (n)

Barut, Nicolas: (n)

Bashti, Kave: (n)

Bassett, Nick: (n)

Bastian, Adam: 3A,(Stryker Orthopaedics); 4(Stryker)

Bates, Brittany: (n)

Bates, Michael: (n)

Battista, Christopher: (n)

Baumgartner, Carla: (n)

Baxi, Omkar: 3A(Merck (Father))

Bayer-Thering, Mary: (n)

Bayley, Nick: (n)

Beal, Matthew: 3B,3C(Zimmer); 3C(Mako Surgical, Stryker)

Beauchamp, Christopher: (n)

Beaule, Paul: 1,2,3B,4,5(Wright Medical Technology) 2(MEDACTA, CORIN, Smith-Nephew); 3B(CORIN, MEDACTA, Smith-Nephew); 5(Depuy-J&J, CORIN, MEDACTA)

Beaver, Walter: 1,2,3B,5(Stryker Orthopaedics); 5(DonJoy)

Bedair, Hany: 4(Amgen, Inc)

Bedard, Nicholas: (n)

Beebe, Michael: (n)

Behery, Omar: (n)

Behn, Anthony: (n)

Belkin, Mark: (n)

Belkoff, Stephen: (n)

Belkora, Jeffrey: (n)

Belyea, Christopher: (n)

Belzile, Etienne: (n)

Benazzo, Francesco: 3B,5(Limacorporate); 1,2,3B(Zimmer); 2(Fidia, Grunenthal); 9(Efort);

Berbari, Elie: (n)

Berend, Keith: 1,3B,5(Biomet, Inc); 5(Stryker, Inc.); 8(Clinical Orthopaedics and Related Research,Journal of Bone and Joint Surgery – American, The Journal of Arthroplasty, Orthopedics); 9(Board of Specialty Societies, American Association of Hip and Knee Surgeons)

Berend, Michael: 1,3B,5(BIOMET); 4(OrthAlign); 5(DePuy, wright, Stryker); 8(Joa); 8,.9(AAHKS, piedmont)

Berger, Richard: 1(zimmer)

Bernasek, Thomas: 1,2(DePuy Orthopedics); 4(Johnson & Johnson); 5(Eli Lilly, DePuy)

Bernasek, Thomas: (n)

Bernstein, Derek: (n)

Berry, Daniel: 1(DePuy for selected hip and knee implants); 3B,5(DePuy); 7(Wolters-Kluwer); 8(Journal of Bone and Joint Surgery); 9(Hip Society, Mayo Clinic Board of Governors, American Joint Replacement Registry)

Berwick, Don: (n)

Betzle, Chris: (n)

Bhargava, Tarun: 1(Innomed); 3B(Renovis); 4(New Era Orthopaedics, Midwest Surgical Alliance)

Bhave, Anil: 3B(DJO Global, Ongoing care collations); 8(World Journal of Orthopedics)

Bhimani, Samrath: (n)

Bhowmik-Stoker, Manoshi: 3A,4(Stryker)

Bible, Scott: (n)

Bichara, David: (n)

Billi, Fabrizio: (n)

Bindelglass, David: 4(Amedica, Bristol Myers Squibb, Novartis)

Bingham, Joshua: (n)

Bini, Stefano: 9(AAHKS)

Birnbaum, Jackie: (n)

Bisson, Alexander: (n)

Bjerke-Kroll, Benjamin: (n)

Blackwood, Clint: 3B,4(Mako Surgical)

Blaha, John: 1,3B(Wright Medical Technology); 7(Woodhead Publishing, UK); 8(J Arthroplasty, CORR (Reviewer), JBJS (Reviewer), The Knee (Reviewer), 9(Michigan Orthopaedic Society)

Bliden, Kevin: (n)

Blocher, Joshua: 3A(Sanofi Pasteur (employer of my wife))

Bloemke, Adam: (n)

Bloom, Kevin: (n)

Bloomfield, Michael: (n)

Blumenfeld, Thomas: 1,2,5(Depuy, a Johnson and Johnson Co); 8(Journal of Arthroplasty)

Blyth, Mark: 2(Zimmer, Convatec); 2,3B,5(Moximed); 5(Mako); 9(Vice Chairman Scottish Committee in Orthopaedica and Trauma)

Boe, Eric: (n)
Boettner, Friedrich: 2(DJ Ortho); 3B(OrthoDevelopment) 3B,5(Smith and Nephew)
Bogatch, Michael: (n)
Bogner, Eric: (n)
Bogunovic, Ljiljana: (n)
Bollier, Matthew: (n)
Bolognesi, Michael: 1,3B (Biomet); 1,2,3B(Zimmer); 3C,4(Amedica, TJO); 5(ERMI, DePuy, Wright Medical 8(JSOA); 8(AAHKS - Publications Committee Chair); 9(AAHKS- Publications Committee Chair, Easter Orthopaedic Association- Board of Directors)
Bono, James: 3B(Stryker); 7(Springer)
Boquin, Luis: (n)
Born, Christopher: 2,3B,5,6(Stryker Orthopaedics);); 3B(Illuminoss); 3C,4(Biointraface); 4(Illuminoss); 8(JAAOS, J Ortho Trauma); 9(Foundation for Orthopaedic Trauma, Orthopaedic Trauma Association, American Academy of Orthopaedic Surgeons)
Borque, Kyle: (n)
Borus, Todd: 3B(Mako Surgical, Medacta); 5(Mako Surgical)
Bosco, Joseph: 5(3M, Mako); 9(AAOS, OLC)
Bostrom, Mathias: 3B(Smith and Nephew); 8(HSS Journal); 9(Orthopaedic Research Society)
Botser, Itamar: (n)
Bou, Monsef Jad: (n)
Bouzarif, Ghita: (n)
Bowen, Thomas: (n)
Boydston-White, Susie: (n)
Boyla, Matthew: (n)
Bozic, Kevin: 9(AAOS (Council on Research and Quality), UCSF Medical Center, HTAP, OREF (Board of Trustees), American Joint Replacement Registry (Board of Directors), COA (President), AAHKS (Health Policy, EBPC)
Bracken, Colten: (n)
Bradbury, Thomas: (n)
Braddock III, Clarence: 8(Editorial Board, Annals of Internal Medicine); 9(Council, Society of General Internal Medicine, Ethics, Professionalism and Human Rights Committee, American College of Physicians, Ethics Committee, Society of General Internal Medicine)
Bradley, Gary: 1(Innomed); 3B(Medacta); 8(J. Arthroplasty - reviewer)
Bragdon, Charles: 1,5(Zimmer Inc), 5(DePuy, Biomet, MAKO
Bramlett, Kasey: (n)
Branam, Grant: (n)
Brandsdorfer, Ari: (n)
Brause, Barry: (n)
Bravo, Dalibel: (n)
Brekke, Adam: (n)
Briggs, Virginia: (n)
Briski, David: (n)
Broekstra, Chelsea: (n)
Bronson, Michael: 8(Editorial Board, The Journal of Arthroplasty);
Brooks, Larry: (n)
Brooks, Peter: 3B(Smith and Nephew, Stryker)
Brown, Kenneth: (n)
Brown, Thomas: 3B(Smith & Nephew, Winston & Strawn (attorneys), Zimmermann Reed (attorneys));5(Musculoskeletal Transplant Foundation); 8(Journal of Bone & Joint Surgery)
Browne, James: 3B(DePuy Synthes, DJO Surgical); 8(Journal of Arthroplasty)
Bruggers, Jennifer: (n)
Brusson, Adrian: (n)
Bucholz, Robert: (n)
Buechel, Jr Frederick: 3B(Mako Surgical Corp.: I am a consultant); 3B,4(Mako Surgical Corp.)
Buehler, Knute: 2,3B,4,5(Stryker, Medical Compression Systems); 4(Johnson and Johnson)
Bugbee, William: 1(Smith & Nephew, Zimmer Biologics, DePuy); 3B(Zimmer, DePuy, Smith & Nephew, Moximed, Joint Restoration Foundation); 4(Moximed, OrthoAlign, Alexandria Research Technologies); 5(OrthoAlign, Alter-G, Joint Restoration Foundation)
Bunn, Kevin: (n)
Burbano, Maria: (n)
Burgett, Michelle: (n)
Burkhart, Bob: (n)
Burko, Igor: (n)
Burnett, Stephen: (n)
Burns, Robert: (n)
Burton, Lucas: (n)
Bush, Jared: (n)
Bushmiaer, Marty: 4(stryker);
Butler, Robert: 8(Journal of Arthroplasty, Editorial Board)
B**ye, Angela:** (n)
Cabanela, Miguel: 9(International Hip society)
Caborn, David: (n)
Cafardi, Susannah: (n)
Cafri, Guy: (n)
Cahill, Palisch Catherine: (n)
Cai, Jenny: (n)
Cakmak, Selami: (n)
Callaghan, John: 1,3B(DePuy - for intellectual property transfer for hip and knee implant designs); 7(Lippincott, Williams & Wilkins - for books edited); 8(Journal of Arthroplasty); 9(OREF, International Hip Society)
Callan, Alexandra: (n)
Cameron, Alexander: 3A,4(CD Diagnostics)
Campbel,l Abigail: (n)
Caplan, Arnold: 2,3B(ORTHOFIX)
Cardone, Dennis: (n)
Carlso, Evan: (n)
Carnahan, Clay: (n)
Carothers, Joshua: 5(DJ Orthopaedics)
Carpenter, Dylan: (n)
Carrillo-Villamizar, Nazly: (n)
Carroll, Ronan: (n)
Carter, Aaron: (n)
Carter, Christopher: (n)
Casp, Aaron: (n)
Casper, David: (n)
Cass, Joseph: (n)
Casstevens, Christopher: (n)
Ceylan, Hasan: (n)
Cha, Thomas: 6(Institutional Fellowship Support: Globus, AO Spine, OREF);
Chakravertty, Rajesh: (n)
Chalmers, Peter: (n)
Chaloupka, Amie: (n)
Chan, Newton: (n)
Chan, Vanessa: (n)
Chang, Eric: (n)
Chapman, Danielle: (n)
Chappell, Andrew: (n)
Chaput,Christopher: 3B(Nuvasive); 5(Nuvasive, Medtronic, Globus, Baxano); 6(Facet-Link)
Charters, Michael: (n)
Cheal, Edward: 3A(OMNI life science, Inc.); 3B(Formae, Inc.); 4(Orthopaedic Synergy, Inc.)
Chen, Antonia: 3A(Novo Nordisk); 7(SLACK publishers)
Chen, Austin: (n)
Chen, Shaolong: (n)
Chen, Stephanie: 3A,4(Watson Pharmaceuticals, Inc. (now Actavis, Inc.))
Chen, Tian: (n)
Chen, Xiao-Dong: (n)
Cheng, Edward: (n)
Chenok, Kate: (n)
Cheppalli, Naga Suresh: (n)
Choi, Ho-Rim: (n)
Choi, Leera: (n)
Choi, Kwang-cheon: (n)
Chong, Alexander: (n)
Chrastil, Jesse: (n)
Christ, Alexander: (n)
Christensen, Christian: (n)
Christofilopoulos, Panayiotis: (n)
Christopher, Jennifer: 3A,4(MAKO Surgical Corp.)
Chung, Christine: 3B(Stryker); 9(ISMRM)
Cieply, Ryan: (n)
Cipriano, Cara: (n)
Clair, Andrew: 3B(Gore Medical, Covidien Medical, Bard Medical, Endologix, Medtronic, Boston Scientific Inc); 7(UpToDate); 8(Journal of Endovascular Therapy, Vascular Disease Management); 9(Society for Vascular Surgery Education Committee, Vascular Surgical Board of the American Board of Surgery)
Clark, Charles: 2(DePuy, Johnson & Johnson); 3B(DePuy, Johnson & Johnson; Zimmer; Merck); 5(DePuy, Johnson&Johnson; Smith&Nephew); 7(Deputy Editor, Journal of Bone and Joint Surgery); 8(Deputy Editor, Journal of Bone & Joint Surgery); 9(ABC Committee of the American Ortho Assn; Member, Hospital Advisory Committee, University of Iowa Hospitals and Clinics);
Clarke, Henry: 1,3C(Conformis); 3B(Biomet); 5(Stryker); 8(The Knee;Journal or Arthroplasty;American Journal of Orthopedics;The Journal of Knee Surgery); 9(AAOS;Knee Society;ICJR;BOS)
Clark, Wesley: (n)
Clarke, Ian: 3B(Depuy, Stryker, Wright Medical Technology); 5(DJ Orthopedics, MDT); 9(DARF, FARM, JISRF);
Cleary, Mark: (n)
Clem, William: (n)
Clendenen, Steven: (n)
Clohisy, John: 3B(Pivot Medical); 5(Zimmer, Inc.)
Clyburn, Terry: 1(Nimbic Systems, royalties for HIP VISE); 2,3B,4(ConforMIS); 4,7(Nimbic,); 9(ICL committee, AAOS: Membership Committee AAHKS);
Cochran, Adam: (n)
Codella, Stephen: (n)
Cody, Elizabeth: (n)
Cohen, Peter: (n)
Colacchio, Nicholas: (n)
Collier, Matthew: 6(Renovis Surgical Technologies)
Collopy, Dermot: 2,3B,5(Stryker)
Colwell Jr, Clifford: 3B(Medical Compression Systems); 5(Stryker, Medical Compression Systems; Norvartis; Isis); 8(Journal of Arthroplasty; Journal of Bone and Joint Surgery - American; Clinical Orthopaedics and Related Research)
Conditt, Michael: (n)
Connor, Emmalynn: 3A(Stryker)
Coon, Thomas: 1(Mako surgical corp; Synvasive, Inc; ortho circle; orthosensor); 2(Mako surgical; stryker); 3B(Mako surgical; Stryker surgical; orthosensor); 4(Mako surgical; orthosensor); 5(Mako surgical; Stryker;orthosensor)
Cooper, H. John: 3B(Smith & Nephew)
Cope, Robert: (n)
Copp, Steven: 4(Nuvasive); 8(Associate Editor Foot and Ankle International)
Cornell, Charles: (n)
Costanzo, James: (n)
Courpied, Jean Pierre: 9(International Orthopaedics); 9(SOFCOT); 9(SICOT)
Courtney, Paul: (n)
Cox, Nicole: (n)
Crockarell, John: (n)
Cross, Michael: (n)
Crowson, Cynthia: (n)
Culler, Steven: (n)
Currier, John: 2(DePuy)
Curry, Madelyn: (n)
Curry, Todd: (n)
Curtin, Brian: 9(AAHKS)
Cushner, Fred: 3B(Smithe and Nephew,Convatec, Allergan,Aperion,Zimmer,Medtronic); 2(Convatec. Smith and Nephew,Medtronic,); 1(Smith and Nephew); 7(Thieme,Elseviwer)
Czaplicki, Anthony: (n)
D'Apuzzo, Michele: (n)
d'Heurle Albert: (n)
D'Lima, Darryl: 3B(National Institutes of Health (NIAMS and NICHD), Mako Surgicals); 3C(Stryker, Zimmer, Orthocyte,Ossur, ConfirMIS); 5(Stryker,Zimmer,Smith & Nephew,Tornier, ConforMIS, OC Dynamics, 8(Open Orthopaedic Journal, Orthopaedics (Open Access Publishing)); 9(International Society for Technology in Arthroplasty (ISTA), Orthopaedic Research Society (ORS), Cochair Musculoskeletal Tissue Engineering Study Section (NIH)
Dabash, Sherif: (n)
Dahl, Brian: (n)
Dahners, Laurence: (n)
Dalal, Sam: (n)
Dalury, David: 1,2,3B,5(Depuy); 8(Journal of Arthroplasty)
Daner, William: 4(Vertex Pharmaceuticals)
Daniels, Alan: (n)
Dasa, Vinod: 2, 3B(Bioventus)
Daubert, Gail: (n)
Davenport, Patrick: (n)
Davis, Charles: 9(AAHKS research committee)
Davis, Erin: (n)
Davis, Jason: (n)
Davis, Mark Denis: (n)
Dayan, Alan: (n)
Dayton, Michael: 3B(Smith Nephew Orthopaedics); 8(Orthopedics); 9(Western Orthopaedic Association)
De La Rocha, Adriana: (n)
De Martinis Silvia: (n)
Dean, David: (n)
DeBattista, Jennifer: (n)
Deegan, Brian: (n)
DeHaan, Alexander: (n)
DeHart, Matthew: (n)
Deirmengian, Carl: 2,3B,5(Zimmer); 3B(Biomet); 4,5(CD Diagnostics, 4(Trice, Domain, Biostar Ventures); 7(JBJS)
Deirmengian, Gregory: (n)
Del Gaizo, Daniel: 2(cadence pharmaceuticals); 5(Stryker); 8(Journal of Arthroplasty);

Delanois, Eonald: (n)
Dell, Richard: (n)
Della Valle, Craig: 3B(Smith & Nephew, Convatec, Biomet); 4(CD Diagnostics); 5(Stryker, Smith & Nephew); 6(Zimmer: Institutional research support); 7(SLACK, Inc); 8(SLACK, Inc, Orthopaedics Today); 9(AAHKS, Chairman Eduation Committee, The Knee Society, Membership Committee Chairman, AAOS, Central Instructional Course Lecture Committeee Chairman)
DeMoss, Brian: (n)
Dennis, Douglas: 1(Innomed, DePuy, A Johnson & Johnson Company); 2,3B,5(DePuy, A Johnson & Johnson Company); 4(Joint Vue); 5(Porter Adventist Hospital); 8(Orthopedics Today, Journal of Arthroplasty, Clinical Orthopaedics and Related Research, Journal of Bone and Joint Surgery - American); 9(AAOS, Joint Vue, Hip Society, International Congress for Joint Reconstruction, Operation Walk USA)
Dennison, Taylor: 3A(Eisai oncology)
Deren, Matthew: (n)
Derman, Peter: (n)
Deshmane, Prashant: (n)
Deshmukh, Ajit: (n)
Dhand, Sabeen: (n)
Diaz, Alejandro: (n)
Diaz-Ledezma, Claudio: (n)
Dickerson, Shane: (n)
Diesfeld, Paul: (n)
Dietz, Matthew: (n)
DiGioia III, Anthony: 4(BlueBelt Technologies, Inc.); 8(Orthopedics Today); 9(AMD3 Foundation)
Dilisio, Matthew: (n)
Dimaio, Frank: 2,3B(Zimmer Inc); 4(Amedica, Inc & Total Joint Orthopaedics, Inc); 8(Journal of Arthroplasty)
Dines, Marshall: (n)
Dinh, Laurent: (n)
Dion, Neil: (n)
Diskin, Brian: (n)
Do, Huong: (n)
Doarn, Michael: (n)
Dobson, Christopher: (n)
Dolan, James: (n)
Domb, Benjamin: 3B(MAKO Surgical, Arthrex Inc.); 5(MAKO Surgical, MedWest, Arthrex Inc, Adventist Hinsdale Hospital); 9(American Hip Institute -- non-profit)
Donaldson, Thomas: 1,2,3B(biomet)
Donnell-Fink, Laurel: (n)
Donnelly, Michael: (n)
Donnelly, Brandon: (n)
Dorman, Robert: (n)
Dorr, Lawrence: 1,3B(Encore Medical); 3C(MAKO, Total Joint Orthopedics); 4 (Total joint orthopedics); 5 (MAKO ROBOTIC); 8 (Journal of Bone and Joint Surgery - American; Clinical Orthopaedics and Related Research; Journal of Arthroplasty); 9 (Hip Society)
Dorrwachter, Janet: (n)
Dossett, Harold: 8(Unpaid editorial board, Federal Practitioner)
Dounchis, Jon: 3B(Mako); 4(J&J, Mako)
Dowd, James: (n)
Drake, Lindsey: (n)
Dramis, Asterios: (n)
Drew, Jacob: (n)
Drexler, Michael: (n)
Dror, Lindner: (n)
Duarte, Robert: (n)
Duchman, Kyle: (n)
Duffy, Michael: (n)
Duggal, Naven: 8(Techniques in Foot and Ankle Surgery, Journal Orthopedics)
Dunbar, Michael: 1,3B,5(Stryker); 5(DePuy, Zimmer, Smith and Nephew); 8(Bone and Joint Journal, Journal of Knee Surgery); 9(Medical Advisory Committee Arthritis Society of Canada, halifax Biomedical Inc Advisory Board)
Duncan, Stephen: (n)
Dunlop, Douglas: 3C(JRI - uncemented cup design)
Dupaix, John: (n)
Duplantier, Neil: (n)
Duwelius, Paul: 1,2.3B,5(zimmer); 1(periarticular plates & screws and stem design); 2(Periprosthetic Fracture talk and OR efficiences talk); 3B(Accellero Health Partners); 5(Research support for staff member in charge of clinical affairs); 7(American Journal of Bone and Joint Surgery); 7(JBJS Adult Hip Newsletter); 9(Chairman, AAOS Adult Reconstruction ICL Subcommitte)
Dwyer, Maureen: (n)
Dwyer, Tim: (n)
Dyke, Jonathan: (n)
Dzaja, Ivan: (n)
Eberle, Robert: (n)
Economedes, Demetri: (n)
Edusei, Emmanuel: (n)
Edwards, Lindsey: (n)
Edwards, Max: (n)
Edwards, Danielle: (n)
Edwards, Paul: (n)
Eggman, Ashley: (n)
Eilers, Mark: (n)
Ekanem, Emmanuel: (n)
El Bitar,Youssef: (n)
El Hage, Samer: 8(Open Journal of Orthopedics)
El-Abbadi, Naglaa: 4(Amgen, Inc)
Elizabeth, Paxton: (n)
Elkins, Jacob: (n)
Elpers, Marcella: (n)
Elsharkawy, Karim: (n)
Elson, Leah: 3A(OrthoSensor Inc.)
Emerson, Roger: (n)
Empson, Jan: 3B,5(DePuy, A Johnson & Johnson Company)
Endo, Yashimi: (n)
Engel, Corey: (n)
Engeln, Kathleen: (n)
Engh, Jr. Charles: 1,3B,4,5,(DePuy); 5(Smith and Nephew); 9(BOS);
Engh, Gerard: 1(Innomed);1,2,3B,5(Smith & Nephew); 2,3B,5, (DePuy, A Johnson & Johnson Company); 3C(TGS Knee Innovations); 4(TGS Knee Innovations); 5(Inova Health Systems)
Erb, Samantha: (n)
Erdle, Nicholas: (n)
Eren,s Greg: 2(Pfiedler Enterprises); 4(Johnson and Johnson); 6(Stryker - research and institutional support)
Erez, Orry: (n)
Erickson, Jill: (n)
Erkocak, Omer: (n)
Eslam, Pour Aidin: (n)
Esposito, Christina: (n)
Estok Daniel: (n)
Estrada, Nicolette: (n)
Estrera Kenneth: (n)
Evangelista, Perry: (n)
Evans, David: (n)
Evans, Nate: (n)
Faizan, Ahmad: 3A(Stryker Orthopedics, Zimmer)
Falakassa Jonathan: (n)
Falls Thomas: (n)
Farias-Kovac, Mario: (n)
Faruqui, Sami: (n)
Fehring, Keith: 1,2,3B,5,6(DePuy – Family Member); 9(AAHKS- family member, Knee society - family member)
Fehring, Thomas: 1,2,3B,5(DePuy/J&J); 9(American Association of Hip and Knee Surgeons;The Knee Society; The Hip Society)
Fei, Jun: (n)
Feibel, Robert: (n)
Feldman, George: (n)
Fening, Stephen: (n)
Fernando, Navin: (n)
Field, Richard: 3B,5(Medacta, Stryker); 5(Medtronics, Smith & Nephew, MatOrtho, Corin); 8(Bone & Joint 360); 9(British Hip Society, International Society for Hip Arthroscopy)
Fields, Adam: (n)
Fields, Kara: 2, 3B(Savient, Takeda); 2(Pfizer); 8(Arthritis & Rheumatism)
Figgie, Mark: 2(medtronic); 4(mekanika); 5(ethicon)
Figueroa, Nathania: (n)
Fink, Leslie: (n)
Fitz, David: (n)
Flammer, Grant: (n)
Fletcher, James: (n)
Fokin, Alexander: (n)
Foltzer, Michael: (n)
Fook-Chong, Stephanie: (n)
Forde, Braxton: (n)
Foster, Scott: (n)
Fowler, Susan: (n)
Frank, Michael: (n)
Frank, Rachel: (n)
Franklin, Patricia: 5(Zimmer)
Fraser, Tyler: (n)
Fredrick Amy: 3A(EOS Imaging)
Freedhand, Adam: (n)
Freiberg, Andrew: 1,3B(Biomet, Zimmer); 3B(Medtronic); 4(ArthroSurface, Inc); 9(AAHKS)
Fricka, Kevin: 2,3B,5(Zimmer)
Friedman, Michael: (n)
Frisch, Nicholas: (n)
Froemke, Cecily: (n)
Froimson, Mark: (n)
Fruth, Kristin: (n)
Frye, Benjamin: (n)
Fu, Yang-Chieh: (n)
Fuchs, Christoph: (n)
Fuentes, Alexandre: 3A(Emovi inc.); 4(Emovi inc.)
Gad, Bishoy: 4(Advanced Cell Technology Company, DRIO, LabStyle Innovations Corp)
Gaffney, Christian: (n)
Gage, Mark: (n)
Gajewski, Timothy: (n)
Gao, Yubo: (n)
Garcia-Cimbrelo, Eduardo: 5(Biomet)
Garellick, Goran: (n)
Gargiulo, Jeanine: (n)
Garofolo, Garret: (n)
Garvin, Kevin: 1(Biomet); 5(Vanguard, Athrexx, CSSG Multi Center Retrospective and Observational Data Registry, Ortho Development, Gruppo Bioimplanti, Smith and Nephew); 8(The Knee); 9(The Hip Society, The Knee Society)
Gaughan, John: (n)
Gebuhr, Peter: 3A(Biomet); 4(Pfizer)
Geiser, Dana: (n)
Geller, Jeffrey: (n)
Gesell, Mark: (n)
Gettings, Justin: (n)
Ghanem, Elie: (n)
Gherke, Thorsten: (n)
Ghomrawi, Hassan: 5(Mako Surgical Co through an umbrella grant to the Hospital for Special Surgery)
Ghosh, Gaurav: (n)
Gibon, Emmanuel: (n)
Gil, Karen: (n)
Gilbert, Jeremy: (n)
Gilbert, Susannah: (n)
Gililland, Jeremy: 5(Angiotech)
Gioe, Terence: 4(Johnson & Johnson, Eli Lilly); 5(Depuy, Inc.); 9(American Joint Replacement Registry, MAOA, Knee Society)
Giordano, Brian: 3B(Arthrex; Carticept); 5(Arthrex)
Giori, Nicholas: (n)
Gladnick, Brian: (n)
Glait, Sergio: (n)
Godin, Jonathan: (n)
Goetz, Devon: (n)
Gold, Jonathan: (n)
Goldberg Timothy: (n)
Goldberg, Tyler: 1,2,3B,5(Medacta International)
Goldblum, Andrew: (n)
Goldstein, Zachary: (n)
Goldvasser, Dov: (n)
Golladay, Gregory: 3B,4,5(Orthosensor, Inc); 4(MAKO); 8(Journal of Arthroplasty); 9(Michigan Orthopaedic Society, MARCQI)
Gomes, Christopher: 3A(EOS imaging
Gondusky, Joseph: (n)
Gonzalez, Jose: (n)
Gonzalez, Della Valle Alejandro: 3B(Orthosensor)
Good, Robert: (n)
Goodman, Susan: 3B(Bruce N. Cronstein, MD, Bristol-Myers Squibb, Novartis, Regeneron, Endocyte, Takeda, Savient, Gismo Therapeutics, Antares Pharmaceuticals, Medivector, Consultant (within the past two years), 4(CanFite Biopharmaceuticals); 5(Takeda,Gilead,Celgene, Astra Zeneca, OSI); 8(Inflammation, Current Rheumatology Reports)
Goodman, Stuart: 3C(Biomimedica, Accelalox, Tibion); 5(Baxter); 7(Association of Bone and Jont Surgeons (CORR)); 8(J Arthoplasty, Clin Orthop, J Biomed Mater Res, Biomaterials, J Ortho Research); 9(Chairman AAOS Biological Implants Committee)
Goodman, Zachary: (n)
Gorab, Alexandra: (n)
Gorab, Robert: 3B,5(DePuy Synthes, A Johnson & Johnson Company)
Gorroochurn, Prakash: (n)
Gottlieb, Meghan: (n)
Gould, Elaine: (n)
Goulet, James: (n)
Goyal, Nitin: (n)
Gradisar, Ian: (n)
Graham, Jove: 5(Biogen Idec Inc.)
Graves, Stephen: (n)
Graves, Christopher: (n)
Gray, Chancellor: 8(University of Pennsylvania Orthopaedic Journal)
Greber, Eric: 3A(Stryker Medical Division - Employee (sister))
Green, David: (n)
Greene, Kenneth: 1,3B(Stryker Orthopedics); 8(Journal of Arthoplasty)
Greene, Meridith: 5(Biomet, Zimmer)

Greiner, Justin: (n)
Griffin, William: 1,2,3B,5(Depuy/J&J); 5(Wright Medical, Biomet, Zimmer, Cormet, Convatech); 8(Journal of Arthroplasty, CORR, JOAA,); 9(AAOS - Knee Committee, AAHKS - Finance committee, Match committee, Knee Society - Education committee)
Grijalva, Ray: (n)
Gross, Allan: 1,2,3B(Zimmer)
Gross, Thomas: (n)
Grosso, Paul: 3B,4(Avenir Medical); 5(Biomet Inc)
Group ANCHOR: (n)
Gruen, Thomas: 6(DePuy Synthes, Corin, Biomet, IlluminOss)
Guild III, George: (n)
Gulasarian, Amanda: (n)
Gunning, Paul: 3A,4(Smith & Nephew)
Gupta, Rishi: 4(MAKO)
Gurbel, Paul: (n)
Gustke, Kenneth: 2,3B,5(Zimmer, Orthosensor, Mako Surgical);4(Zimmer, Orthosensor); 8(Journal of Arthroplasty)
Gutsche, Jacob: (n)
Ha,Yong-Chan: (n)
Haas, Brian: 1,2,3A,5(Depuy Johnson and Johnson)
Haas, Steven: 1,2,3B,5Smith & Nephew); 8(The Knee); 9(Knee Society)
Habeish, Mark: (n)
Haddaway, Casey: (n)
Hage, Samer El: (n)
Hagemeister, Nicola: (n)
Haidukewych, George: (n)
Hale, Gregory: (n)
Haleem, Amgad: (n)
Halim, Thomas: (n)
Hall, Christine: (n)
Hall, Michael: 3A(Smith and Nephew)
Hallstrom, Brian: (n)
Halsey, David: 9(AAOS)
Hamadouche, Moussa: 3B(Aston, Smith & Nephew, Medacta, BBraun, Mathys)
Hamilton, William: 5(Biomet); 2,3B,5(Depuy); 9(AAHKS Patient Education Committee, Health Policy Committee)
Hamlin, Brian: 3B(Depuy, Johnson & Johnson); 3B(Biomet, Depuy, Johnson & Johnson); 3B,4(Blue Belt Technologies); 8(Transfusion, Journal of Arthroplasty); 9(AAOS Knee ICL Subcommittee)
Hamula, Mathew: (n)
Hannon, Daniel: (n)
Hansen, Erik: (n)
Hansen, Dane: 4(Shire pharmaceuticals)
Hansen, Viktor: (n)
Hanssen, Arlen: 1(Stryker Corp); 7(Elsevier)
Harrington, Melvyn: 3B(Zimmer Inc); 9(J. Robert Gladden Orthopaedic Society, Western Orthopaedic Association, Arthritis Foundation)
Harris, Adam: 2(Speaker for Baxter/FloSeal); 6(Sub Investigator for Smith & Nephew for a knee implant - not related to the implant in one submission); 8(Rush Arthroplasty Alumni Magazine); 9(American Association of Physicians and Surgeons (Board of Directors) Harrold, Leslie: 9(American College of Rheumatology)
Harshavardhana, Nanjundappa: (n)
Hartman, Curtis: 2,3B,5(Smith & Nephew)
Hartzband, Mark: 1,2, 3B(Zimmer)
Harwin, Steven: 1,2,3B,4(Stryker Orthopaedics); 3B(ConvaTec, Inc.); 7(Slack, Inc., Thieme, Inc.); 8(Journal of Arthroplasty, Journal of Knee Surgery, Orthopedics, Surgical Technology International);
Hasty, Karen: (n)
Hatten, Kyle: (n)
Haughom, Bryan: (n)
Haulsee, Zachary: (n)
He, Janice: (n)
Healy, William: (n)
Hebeish, Mark: (n)
Hedgecock, Jon: (n)
Hedlund, Hakan: (n)
Heekin, Richard: 3B(DePuy, Stryker); 5(Depuy, Stryker)
Heinemann, Joseph: (n)
Helfet, David:(n)
Hellman, Michael: (n)
Hendy, Benjamin: (n)
Hennessy, David: (n)
Hennigar, Allan: (n)
Hentz, Joseph: (n)
Herder, Lindsay: (n)
Hewitt, Brett: 3A(Stryker)
Hewlett, Angela: 9(Committee member, Society for Healthcare Epidemiology of America (SHEA)
Heyse, Thomas: 2,3B,5(Smith & Nephew)
Higuera, Carlos: (n)
Hillen, Travis: 2(dfine)
Hilliard, Christine: 4(Abbott)
Himden, Sam: 3A(DePuy Synthes, a Johnson & Johnson Company); 4(Johnson & Johnson);
Hirsh, David: (n)
Hitt, Kirby: (n)
Ho, Henry: (n)
Hoang, Melinda: (n)
Hochfelder, Jason: (n)
Hoedt, Christen: (n)
Hoffmeyer, Pierre: (n)
Hofmann, Kurt: (n)
Hogan, Craig: (n)
Hohman, Donald: (n)
Holman, Ashlee: (n)
Holt, David: (n)
Hoogeboom, Thomas: (n)
Hopkins, Ronald: (n)
Hopper Jr, Robert: 5(DePuy Orthopaedics, a Johnson & Johnson Company);
Houdek, Matthew: (n)
Housman, Lawrence: 5(Smith & Nephew, Genzyme, Arthrocare,); 9(Western Orthopaedic Association);
Howard, James: 2(Smith and Nephew); 2,3B,5(Stryker); 3B(Smith and Nephew, DePuy); 5(Smith and Nephew, DePuy)
Howard, Michael: 3A,4(Stryker Orthopaedics)
Howe, Benjamin: (n)
Howell, Stephen: 1,2,3B(Biomet Sports Medicine); 8(American Journal of Sports Medicine);
Hozack, William: 1,3B(Stryker Orthopedics); 8(Editor in chief of Journal of Arthroplasty)
Hsu, Albert: (n)
Hsu, Raymond: (n)
Huang, Eddie: (n)
Huang, Jiapeng: (n)
Huang, Mingqian: (n)
Huang, Wei-Ti: (n)
Huddleston, James: 1,2,3B(Zimmer, Exactech); 2,3B(Biomet, Stryker,); 3B(Smith and Nephew); 3C(Porosteon, Inc.); 4(Porosteon, Inc.); 5(Biomet, Robert Wood Johnson Foundation)
Huether, Todd: (n)
Huff, Thomas: 3B,5(Smith and Nephew; Etex); 5(Zimmer)
Hull, Brandon: (n)
Hull, Maury: 5,6(Stryker); 8(Journal of Biomechanics)
Hume, Eric: (n)
Hung, Man: (n)
Hungerford, David: (n)
Hunter, Katelyn: (n)
Huo, Michael: 2(Cadence, Janssen); 3B(Biomet, DePuy, IMDS); 8(Current Orthopedic Practice); 7(Journal of Bone and Joint Surgery)
Hupel, Thomas: (n)
Hurst, Jason: (n)
Hussein, Khalil: 4(Abbott Laboratories);
Hwang, Byoung Yoon: (n)
Hwang, Katherine: (n)
Hwang, Kevin: (n)
Iacobelli, David: (n)
Iannotti, Joseph: 1(DePuy Synthes, Zimmer, Biomet, Tornier, MTF); 2(DePuy Synthes, Zimmer); 3B(Tornier); 7(Elsivier, Lippincott); 8(Journal Shoulder and Elbow Surgery); 9(Journal Shoulder and Elbow Surgery)
Igboechi, Oduche: (n)
Illgen, Richard: 1,3B(Zimmer); 3B(MakoSurgical, Orthosensor)
Illical, Emmanuel: (n)
Imrie, Susanna: (n)
Inacio, Maria: (n)
Incavo, Stephen: 1(Innomed, Kyocera), Zimmer); 3B(Kyocera, Zimmer, MDS); 4(Nimbic Systems); 7(Journal of Arthorplasty - Board Member); 8(Journal of Arthroplasty); 9(AAHKS - Communications Committee, AAOS - Hip, Knee & Adult Reconstruction Evaluation Subcommittee)
Ingrassia, Rachel: (n)
Iorio, Justin: (n)
Iorio, Richard: 3B(IMDS, Kyocera); 8(JBJS, CORR, JOA, JBJS Reviews, JAAOS); 9(Knee Society, New England Orthopaedic Society)
Iori, Stefano: (n)
Irani, Mazyar: (n)
Ireland, Philip: 5(Stryker)
Irgit, Kaan: (n)
Irizarry, Andrea: (n)
Ishmael, Chad: (n)
Ismael, Salam: (n)
Ismaily, Sabir: (n)
Israelite, Craig: 3B(Zimmer)
Issa, Kimona: (n)
Jacks, Duncan: (n)
Jackson, Timothy: (n)
Jackups Jr, Ronald: (n)
Jacob, Elizabeth: (n)
Jacobs, Cale: 3B(ERMI); 5(Biomet, Zimmer)
Jacobs, Joshua: 4(Implant Protection); 5(Zimmer Inc, Medtronics, Nuvasive, Spinal Motion); 9(American Academy of Orthopaedic Surgeons)
Jacobson, Steven: 2(LifeCell); 3B(Lifecell)
Jacofsky, David: (n)
Jaffe, Fredrick: (n)
Jagadale, Vivek: (n)
Jagannathan, Sreenath: (n)
Jahangir, A Alex: 2(AO North America)
Jain, Deepak: (n)
Jamali, Amir: 3B(Isto Technologies.); 9(Board of Directors, California Orthopaedic Association)
James, Thomas: (n)
Jay, Patel: (n)
Jeffries, James: (n)
Jegier, Briana: (n)
Jenkins, Derek: (n)
Jennings, John: (n)
Jerry, Gerald: (n)
Jester, Jon: 2(Knee Creations)
Jevsevar, David: 2(Medacta USA); 4(Omni Life Sciences); 5(Medacta USA)
Ji, Hyung-Min: (n)
Jiang, Jin: (n)
Jimenez, Irene: (n)
Jiranek, William: 1,3B(Depuy orthopaedics); 4(Johnson and Johnson, Alexandria Research Technologies); 8(Orthopaedic Knowledge Online (OKO)); 9(AAHKS)
John, Alun: (n)
John, Thomas: (n)
Johnson, Beverly: 4(I own stock in Johnson and Johnson in excess of 10,000);
Johnson, Derek: 2,3B(DePuy Orthopedics); 3B,5(Medacta Inc)
Johnson, Skylar: (n)
Johnson, Staci: (n)
Johnston, Richard: (n)
Jones, Bryn: 2(Zimmer, Covidien, Moximed, convatec); 3B(moximed); 8(Injury)
Jones, Christopher: (n)
Jones, Hugh: (n)
Jones Jr., Kinzy: (n)
Jones, Lynne: (n)
Jones, Richard: 1(depuy, kinamed, mako surgical, innomed); 2(depuy, mako surgical); 4(J&J, Amedica, Omni Scientific, Total Joint Orthopedics, Kinamed)
Jones, Stephen: 1,2,3B(Smith and Nephew); 1,2,3B(Lima); 2,3B,5(Depuy); 2,3B(Zimmer), 3B(Biomet)
Jones, Robert: (n)
Jones, William Kinzy: (n)
Jordan, Matthew: (n)
Joseph, James: (n)
Josephs, Lee: (n)
Joyce, David: (n)
Judd, Dana: (n)
Jules-Elysee, Kethy: (n)
Jung, Kwang Am: (n)
Jupiter, Daniel: (n)
Kahan, David: (n)
Kahn, Timothy: (n)
Kakar, Rumit Singh: (n)
Kalamas, Alicia: (n)
Kalore, Niraj: (n)
Kamath, Atul: 8(BMC Musculoskeletal Disorders)
Kane, Patrick: (n)
Kannan, Arun: (n)
Kao, Ying-Ying: (n)
Kapadia, Bhaveen: 2,3B(Sage Products, Inc.)
Kaplan, Lige: (n)
Kaplin, Lisa: (n)
Kapron, Ashley: (n)
Kapu, April: (n)
Karam, Joseph: 2(speaking honorarium, Convatec);
Karam, Matthew: (n)
Kardos, Keith: 3A,4(CD Diagnostics)
Karia, Raj: (n)
Karthikeyan, Tharun: (n)
Kathrins, Richard: (n)
Kathrins, Bess: (n)
Katz, Jeffrey: (n)
Kaufman, Kenton: (n)
Kavanaugh, Aaron: (n)
Kawakita, Erick: (n)
Kaye, Ian: (n)
Kazam, Jonathan: (n)
Kazarian, Erick: (n)
Keating, E Michael: (n)

Keenan, Mary Ann: (n)
Keeney, James: 3B(OrthoSensor); 5(Stryker); 9(Society of Military Orthopedic Surgeons)
Keggi, John: 1,2,3B,4(OmniLife Science); 2,3B(Smith & Nephew, Medtronic); 8(Reconstructive Review)
Keith, Angela: (n)
Keith, Reinhardt: (n)
Kelley, Todd: (n)
Kelly, Sean: (n)
Kennon, Robert: (n)
Kerboull, Luc: (n)
Kerr, Glenn: (n)
Kester, Mark: 3A,4(Stryker)
Khakharia, Saurabh: (n)
Khalaf, Naila: (n)
Khamaisy, Saker: (n)
Khan, Habeeb: (n)
Khanuja, Harpal: 3B(Ehticon,Johnson & Johnson); 8(Journal of Arthroplasty); 9(AAOS; American Association of Hip and Knee Surgeons)
Khatib, Omar: (n)
Khatod, Monti: (n)
Kilmartin, Patrick: 3A,4(CD Diagnostics); 4(Johnson and Johnson)
Kim, Christopher: (n)
Kim, Hee Joong: 1,4(Corentec); 8(Clinics in Orthopedic Surgery); 9(Korean Orthopaedic Association)
Kim, Jae Won: 3A,4,5(Corentec)
Kim, John: (n)
Kim, Jong Won: (n)
Kim, JungSung: 3A,4(Corentec)
Kim, Paul: 3B(Stryker)
Kim, Raymond: 1(Innomed); 2(Depuy Johnson and Johnson, Convatec, Ceramtec); 2,3B(Stryker); 5(Depuy Johnson and Johnson)
Kim, SangHwan: (n)
Kim, Sun Jin: 5(Ferring Pharm)
Kim, Sunny: (n)
Kim, Tae-Young: (n)
Kim, Yong Sik: 4(Corentec)
Kim, Young-Jo: (n)
Kim, Weon-Yoo: (n)
Kinder, Jeremy: (n)
Kindsfater, Kirk: 2,3B,5(DePuy Orthopaedics)
King, Bryan: (n)
Kinsella, Stuart: (n)
Kinsey, Tracy: 6(Research support to my institution from Stryker Orthopaedics and Arthrex); 8(Journal of Arthroplasty)
Kirby, Kirby: (n)
Kirkness, Carmen: (n)
Klaassen, Alison: (n)
Klatt, Brian: 7(Slack, Elsevier); 8(Journal of Arthroplasty)
Klatt, Brooke: 5(Cempra); 7(Slack, Elsevier); 8(Journal of Arthroplasty)
Klein, Gregg: (n)
Kleiner, Matthew: (n)
Klifto, Christopher: (n)
Klika, Alison: (n)
Klinge, Steve: (n)
Klinger, Craig: (n)
Knabe, Jeffrey: (n)
Kneeland, Nicole: (n)
Knight, Vijaya: (n)
Knothe, Ulf: (n)
Ko, Young-Bong: (n)
Kocagoz, Sevi: (n)
Koehler, Steven: (n)
Koenig, Jan: 1,2,3B(OmniLifeScience); 2,3B(Medtronic)
Kolessar, David: (n)
Koli, Emmanuel: (n)
Konigsberg, Beau: (n)
Koo, Kyung-Hoi: (n)
Kopolovich, Daniel: (n)
Kops, Kathleen: (n)
Korczak, Abigail: (n)
Koroukian, Siran: 3A,4(American Renal Associates)
Korshunov, Yevgeniy: (n)
Koruprolu, Sarath: (n)
Kraay, Matthew: 3C(Zimmer)
Krackow, Kenneth: (n)
Kralovec, Michael: (n)
Kraus, Emily: (n)
Krebs, Viktor: 1(Shukla Medical(extract-all)); 2,3B(Stryker Orthopaedics); 7(Journal of Arthroplasty); 8(Journal of Arthroplasty)
Kreuzer, Stefan: 1,2,3B,4,5(MAKO); 1(Zimmer/ Synvasive,Corin, Smith and Nephew); 2,3B(Zimmer); 2,3B, 5,Corin); 3B(Stryker); 3C(Innovative Orthopedic Technologies); 4(IOT)
Krishnamurthy, Anil: (n)
Krishnan, Varun: (n)
Krummenacher, Tyler: (n)
Krute, Christina: (n)
Kuchinad, Raul: (n)
Kudrna, James: (n)
Kumar, Gunasekaran: (n)
Kunapuli, Sarat: (n)
Kurdziel, Michael: (n)
Kurt, Blasser: (n)
Kurtz, Steve: 5(SpinalMotion, Medtronic, DePuy Synthes, DJO, Invibio, Kyocera Medical, Stelkast, Stryker, Ticona, Wright Medical Technology, Smith and Nephew, Biomet, Zimmer, Ceramtec, Formae); 8(JOA editorial board)
Kusuma, Sharat: 2,3B,5(Zimmer Holdings); 2,3B,5(Smith & Nephew, Medtronic Advanced Energy)
Kuzyk, Paul: 5(Zimmer); 5(Stryker, Avenir Medical)
Kwasman, Bertram: (n)
Kwasny, Mary: (n)
Kwon, Young-Min: 5(Mako Surgical, Zimmer)
Kwong, Louis: 1,2,3B(Zimmer); 2(ConvaTec, Janssen); 3B(Osseous Technologies of America, Mallinckrodt); 3C(CIBOR); 5(Purdue); 8(Journal of Surgical Orthopaedic Advances
Labro, Eva: (n)
Lackey Wesley: (n)
Laende, Elise: (n)
Lahr, Brian: (n)
Laker, Michael: (n)
Lally, Lindsay: (n)
Lambrinos, George: (n)
Lamplot, Joseph: (n)
Landrum, Matthew: 4(Abbott)
Landry, Dale: (n)
Landry IV, Arthur: (n)
Lange, Jeffrey: (n)
Langlois, Jean: (n)
Lanting, Brent: (n)
Larson, A Noelle: 9(Scoliosis Research Society, POSNA)
Larson, Christopher: 3B(Smith and Nephew); 3B,4(A3 Surgical)
Larson, Dirk: (n)
Latham, Jeremy: 2,3B(DePuy); 3B(Zimmer, LIMA LTO); 9(CoChairman Metal Hips Research Group)
Lau, Edmund: 3B(As employee of Exponent with consulting work from Stryker, BIOMET, Medtroinc, Alcon)
Laursen, Mogens: (n)
Lavernia, Carlos: 1,3B,4,5(MAKO Surgical Corp); 4(Johnson & Johnson; Zimmer; Stryker; Wright; Symmetry Medical); 8(Journal of Arthroplasty); 9(American Association of Hip and Knee Surgeons; Florida Orthopedic Association)
Lavigne, Martin: (n)
Lawrence, Adam: (n)
Lawrie, Charles: (n)
Laz, Peter: 5(DePuy Synthes)
Lazaro, Lionel: (n)
Lazennec, Jean: (n)
Le, Theodore: (n)
Le Duff, Michel: (n)
Lebrun, Lauren: (n)
Ledford, Cameron: (n)
Lee, Young-Kyun: (n)
Lee, Gwo-Chin: 2(Depuy, Ceramtec); 3B(Stryker, Pacifira); 5(Zimmer, Smith and Nephew); 8(Journal of Arthroplasty, Clinical Orthopedics and Related Research, Journal of Bone and Joint Surgery, Orthopedics, Orthopedic Hyperguide - Knee Section Editor, The Knee); 9(AAOS Hip, Knee, Adult Reconstruction Evaluation Commitee)
Lee, Byungho: (n)
Lee, Jason (n)
Lee, Jo Ann: (n)
Lee, Joanne: (n)
Lee, John: (n)
Lee, Jonathan: (n)
Lee, Joong-Myung: 1,3B(Corentec)
Lee, Su Chan: (n)
Lee, Taehun: (n)
Lee, Thay: 3B(Conmed, Depuy, Corentec, Eleven Blade); 5(Arthrex, Corentec, Arthrocare, Accumed, Stryker, Tornier, B Braun, Cellcotec, U&I); 8(JSES, CIOS); 9(ASES)
Lee, Yuo-yu: (n)
LeFevre, George: (n)
Lehil, Mandeep: (n)
LeMarr, Angela: (n)
Lementowski, Peter: (n)
Lendhey, Matin: (n)
Lendway, Lisa: (n)
Lennon, Donald: (n)
Leo, Brian: 3B(Cayenne Medical, Inc)
Leonard, Evan: (n)
LePere, Darren: (n)
Les, Clifford: (n)
Lesko, James: 3A(DePuy Synthes); 4(Johnson & Johnson);
Levering, Melissa: (n)
Levin, Nachum: (n)
Levine, Brett: 3B, (Biomet, Zimmer); 3B(CONMED, Linvatec; DePuy, A Johnson & Johnson Company, Johnson & Johnson); 8 (Human kinetics; Orthopedics; SLACK Incorporated); 9 (AAOS)
Levison, Timothy: (n)
Lewallen, David: 1,3B(Zimmer); 3B,4(Ketai Medical Device Ltd.); 3B(Pipeline Biomedical Holdings); 8(Clinical Orthopaedics and Related Research); 9(The Hip Society, American Joint Replacement Registry); Association of Bone and Joint Surgeons); Orthopedic Research and Education Foundation)
Lewallen, Laura: 1,5(Zimmer (family member)); 2(Osteotech (family member)); 3B,4(Pipeline Biomedical (family member))
Lewandowski, Robert: (n)
Lewis, Courtland: 5(Biomet); 9(American Assn of Hip & Knee Surgeons, Connecticut State Medical Society)
Lewis, Peter: (n)
Lewis, Jamie: (n)
Li, Guoan: (n)
Li, Jia: (n)
Li, Jing-Sheng: (n)
Li, Jun: (n)
Li, Kai: (n)
Li Wenjun: (n)
Li, Zhongmin: (n)
Liabaud, Barthelemy: (n)
Lichstein, Paul: (n)
Licini, David: (n)
Lieberman, Jay: (n)
Lim, Moe: (n)
Lim, Seung-Jae: (n)
Limbird, Richard: 4(Baxter International,J&J, Pfizer,Abbott,Merck)
Lin, Cheryl: (n)
Lindner, Dror: (n)
Lindsey, Joshua: (n)
Lipman, Joseph: 1(OrthoDevelopment, Mathys); 3B(Ivy Sports Medicine)
Littleton, Tiffany: (n)
Liu, Fei: (n)
Liu, Jane: (n)
Liu, Steve: (n)
Loechler, Youlonda: (n)
Logterman, Stephanie: (n)
Lombardi, Adolph: 1(Innomed); 1,2,3B,5,7(Biomet, Inc.); 5(Stryker); 8(Surgical Technology International, Clinical Orthopaedics and Related Research, Journal of Arthroplasty, Journal of Bone and Joint Surgery - American), Journal of the American Academy of Orthopaedic Surgeons, Journal of Orthopaedics and Traumatology, The Knee, 9(The Knee Society, Operation Walk USA, New Albany Surgical Hospital Foundation, The Hip Society, Orthopaedic Research and Education Foundation (Trustee))
Lonner Jess: 1,2,3B(Zimmer; 1,3B,4(Blue Belt Technologies); 3B(Mako Surgical); 3B,4(CD Diagnostics); 4(Blue Belt Technologies); 7(Wolters Kluwer, Elsevier); 8(American Journal of Orthopedics; Journal of Arthroplasty; Seminars in Arthroplasty); 9(Knee Society)
Lorich, Dean: (n)
Losina, Elena: (n)
Lotke, Paul: 1(DePuy,innomed); 3B(Stryker); 7(lippincott.Springer); 8(CORR)
Lovecchio, Francis: (n)
Lovro, Luke: (n)
Lugade, Vipul: (n)
Luhm, Vigor Michele: (n)
Luo, Michael: (n)
Luther, Gaurav: (n)
Luu, Hue: (n)
Lübbeke, Anne: 8(BMC Musculoskeletal Disorders)
Lyman, Stephen: 8(American Journal of Orthopedics); 9(ISAKOS Scientific Committee)
Lyons, Steven: (n)
Mabry, Tad: 3B(Zimmer); 4(Pfizer, Novartis, Elan)
Macaulay, William: 3B(Johnson & Johnson);); 4(OrthAlgin); 5(Pfizer, WrightMedical Technologies); 8(Journal of Arthroplasty, Clinical Orthopaedics and Related Research); 9(American Association of Hip and Knee Surgeons)
MacDonald, Steven: 1,3B,5(Depuy); 1(Smith & Nephew, Stryker); 8(Knee Society)

MacDonald, Daniel: (n)
Mack, Andrew: (n)
MacLean, Angus: (n)
Madadi, Firooz: (n)
Madadi, Firoozeh: (n)
Madhusudhan, Yakkanti: (n)
Madoff, Samuel: (n)
Madsen, Wes: (n)
Maher, Patrick: (n)
Maheshwari, Aditya: (n)
Mahmoud, Samer: (n)
Mahmoud, Aatif: (n)
Mahoney, Craig: (n)
Mahoney, Ormonde: 3B,5(Stryker Orthopaedics); 5(Arthrex, Inc); 8(Journal of Arthroplasty, Orthopaedic Today)
Maiman, Richard: (n)
Maiti, Aparna: (n)
Malchau, Erik: 3B,5,7,9(family-Smith & Nephew, DePuy, Biomet, Zimmer)
Malchau, Henrik: 1,3B,5(MAKO); 1,3B,7(Smith and Nephew); 3C,5,9(Biomet); 4,9(RSA Biomedical Inc); 5(Zimmer,DePuy)
Malcolm, Tennison: (n)
Malek, Ibrahim: (n)
Malinzak, Robert: 3B(Biomet, Inc; Orthalign); 4(Orthalign); 5(Biomet, Inc; DePuy; Stryker; St Francis Hospital); 9(Knee Society)
Malkani, Arthur: 1,2,3B,5(Stryker); 5(Synthes)
Maloney, Brigid: (n)
Maloney, William: (n)
Maltenfort, Mitchell: (n)
Mandl, Lisa: (n)
Mangudi, Varadarajan Kartik: 3A,4(MERCK & CO)
Manley, Michael: 3A,4(Stryker)
Mannning, David: 1,3B(Biomet); 1,2(Medacta); 3B(Iconacy); 9(AAOS program subcommittee- adult hip)
Manthe, Megan: (n)
Maoz, Guy: (n)
Maradit-Kremers Hilal: (n)
Maratt, Joseph: 3A, 4(Merck, Alexion Pharmaceuticals, Momenta Pharmaceuticals); 4(Abbott Laboratories, Vertex Pharmaceuticals, Sanofi)
Marcantonio, Andrew: (n)
Marcello, Dorothy: (n)
Mardones, Rodrigo: (n)
Marecek, Geoffrey: (n)
Marega, Luca: 1,2,3B,5(stryker), 5(oref); 3B(De Puy, Smith&Nephew, Lima); 4(only as investment funds not as privately owned stocks)
Markel, David: 5(stryker, oref); 8(jbjs, joa,corr); 9(aahks, maoa, michigan ortho)
Marsh, John: 3B(BioMet); 7(Oxford Press); 9(ABOS, AOA, MAOA)
Marshall, Amanda: (n)
Martell, John: 3B(StelKast, Inc.)
Martin, Christopher: 9(Publications Committee, AAOS)
Martin, J Ryan: (n)
Martinez, Leibnitz: 1(Pharmatech, Orthobone, Traiber, Farmaconal.)
Martinez, Nichol: (n)
Marwin, Scott: 1,2,3B(Smith and Nephew)
Masch, Jessica: (n)
Masini, Michael: 1,2,5(Stryker, 1(DePuy, Smith and Nephew, Biomet)
Mason, J Bohannon: 1,3B,5(Depuy); 3BOrthoSensor); 7(Journal of Arthroplasty); 8(Journal of Arthroplasty)
Masonis, John: 1,3B(Smith & Nephew Inc); 5(Zimmer)
Massey, Paul: 5(CRADA from Celgene - Mother)
Mast, Logan: (n)
Mather, Richard: 3B, (KNG Health Consulting, Stryker, Pivot Medical); 4(for[MD])
Mathis, Kenneth: 1(Zimmer)
Matsen, Ko Laura: (n)
Matthews, Joshua: (n)
Mauerhan, David: 1,3B(Biomet Inc); 4(Astrazeneca, Phizer); 8(Journal of Arthroplasty); 9(Chairman, Quality Committee AAHKS)
Mayer, Ryan: (n)
Mayer, Annyce: (n))
Mayman, David: 2, 3B(Smith and Nephew); 2,3B,4,5OrthAlign); 3B(Mako)
Mayo, David: (n)
McArthur, Benjamin: (n)
McAsey, Craig: (n)
McAuley, James: 1,2,3B,5(DePuy Orthopaedics); 5(Smith & Nephew, Stryker)
McCalden, Richard: 2,3B,5(Smith & Nephew); 5(Stryker, J&J Depuy); 8(Journal of Arthroplasty);
McCarthy, Joseph: 1(Stryker,Innomed,Arthrex); 9(ISHA)
McCauley, Julie: (n)
McClure Philip: (n)
McCoy, Thomas: 1,3B,5(Zimmer); 3B(Corin)
McDonald, Douglas: 9(Musculoskeletal Tumor Society (MSTS) Executive Committee)
McDonald, Tyler: (n)
McElroy, Mark: (n)
McGarry, Michelle: 3A,4(Alphatec Spine, Inc)
McGonigle, Owen: (n)
Mcgrath, Mike: (n)
McGraw, Michael: (n)
McGrory, Brian Joseph: 8 (Journal of Arthroplasty; SLACK Incorporated); 9 (American Association of Hip and Knee Surgeons)
McInerney Vincent: (n)
McIntyre Louis: 2,5(DePuy Mitek); 4(Tornier Medical); 9(Westchester County Medical Asssociation, Advocacy for Improvement in Mobility, Arthroscopy Association North America);
McKee, Michael: (n)
McLaren, Alex: 4(Sonoran Bioscience); 5(Astrellas Pharma US Inc); 6(Synthes: resident education support, Stryker: resident education support, Research Recovery Institute: resident education support, Smith and Nephew)
McLaughlin, Dell: (n)
McLawhorn, Alexander: (n)
Mclemore, Ryan: 4(Sonoran Biosciences); 5(Astellas Pharmaceuticals)
McNabb, David: (n)
McQueen, David: (n)
McShane, Michael: (n)
McTighe, Timothy: (n)
Mears, Simon: 8(Arthritis and Rheumatism, Geriatric Orthopedic Surgery and Rehabilitation, 9(International Geriatric Fracture Society)
Medda, Suman: (n)
Meding, John: 1,5(Biomet, Warsaw, Indiana)
Mednick, Rachel: (n)
Meehan, John: 2(Depuy Orthopedics)
Meere, Patrick: 1,3B,4,5,7(OrthoSensor, Inc); 8(Bulletin for Joint Diseases); 9(Arthritis Foundation);
Meftah, Morteza: (n)
Mehle, Susan: (n)
Mehra, Akshay: (n)
Mehran, Nima: (n)
Mehrle, Robert: (n)
Mehta, Samir: 2(Synthes, Smith & Nephew, Zimmer); 5(Amgen, Synthes); 7(Wolters Kluwers); 8(Current Orthopaedic Practice); 9(Pennsylvania Orthopaedic Society)
Meijer, Karim: (n)
Mellano, Christen: (n)
Melvin, James: 4(Cadence)
Memtsoudis, Stavros: (n)
Mendelis, Joseph: (n)
Meneghini, Michael: 1,2,3B,5(Stryker); 8(Journal of Arthroplasty); 9(Knee Society Radiographic Score Committee)
Mercante, Donald: (n)
Merle, Christian: (n)
Meyer, Mark: (n)
Meyer, Maximilian: (n)
Meyers, Kathleen: (n)
Mihalko, William: 1,3B(Aesculap Inc); 3B(Medtronic Inc); 7(Elsevier Inc, Springer, Inc); 8(Journal of Arthroplasty, Reconstructive Review)
Mikhael, Bassem: (n)
Milillo, Ralph: (n)
Miller, Benjamin: (n)
Miller, Justin: (n)
Miller, Ryan: (n)
Millis, Michael: 7(Lippincott-Williams and Wilkins Editorail royalties for book)
Milone, Michael: (n)
Minas, Tom: 1,2,3B(ConforMIS Inc.); 3B(Sanofi Biosurgery); 4(ConforMIS Inc.); 7(ELSEVIER)
Miner, Todd: (n)
Mioton, Lauren: (n)
Miozzari, Hermes: (n)
Mishra, Kirtishri: (n)
Misra, Lopa: 2,3B,3C(Arthrex, Cayenne Medical, RTI biologics, Ossur Inc, SMith and Nephew, Tornier); 5(Canyenne Medical, Arthrex, Ossur Inc, Smith & nephew, Tornier); 7(Pathology Recall); 8(American Journal of Sports Medicine); 9(Council of Delegates Arizona Representatives)
Mittal, Yogesh: 2,3B(Stryker); 2(Cadence)
Mlodinow, Alexei: (n)
Mochizuki, Tomoharu: (n)
Moga, Iustin: (n)
Mokris, Jeffrey: 1(Biomet)
Moller, Hans: (n)
Molloy, Robert: 2,3B,5(Stryker); 5(Zimmer)
Mont, Michael: 9(AAOS OKO); 8(Journal of Bone & Joint Surgery - American); 8(Journal of Arthroplasty); 8(American Journal of Orthopaedics); 8(Surgical Techniques International); 5(DJ Orthopaedics); 5(Sage Products); 5(Stryker Orthopaedics); 8(Journal of Knee Surgery); 5(Tissue Gene); 5(Joint Active Systems); 5(Wright Medical Technology, Inc.); 5(National Institutes of HGealth (NIAMS and NICHD)); 3B(Joint Active Systems); 3B(DJ Orthopaedics); 3B(Sage Products, Inc.); 3B(Stryker Orthopaedics); 3B(Wright Medical Technology, Inc.); 3B(Tissue Gene); 3B(Biocomposites); 1(Stryker Orthopaedics); 3B(Medtronic); 3B(Janssen); 1(Wright Medical Technology, Inc.); 9(AAOS CME Committee);
Moore, Matthew: (n)
Moore, Ryan: (n)
Moore, Socorro: (n)
Moric, Mario: (n)
Morison, Zachary: (n)
Morris, Brandon: (n)
Morris, Kelly: (n)
Morris, Michael: 3B,5(Biomet, Inc.)
Morrison, Mark: 3,4(Smith & Nephew)
Morrison, Tiffany: (n)
Morrow, Melissa: (n)
Morton, Diane: (n)
Moseley, Jon: (n)
Moses, Michael: (n)
Moskal, Joseph: (n)
Moss, Garrett: (n)
Moss, Michael: (n)
Moucha, Calin: 2(3M), 4(Auxillium);
Mudd, Christopher: (n)
Muenzer, Jeffrey: (n)
Mukamel, Dana: (n)
Muratoglu, Orhun: 1(Zimmer, Biomet, Corin, Iconacy, Renovis, Conformis, Aston Medical, Meril Healthcare, Arthrex, Mako); 2(Biomet, Corin, Zimmer), 5(Biomet, Mako, Depuy);
Murayama, Takayuki: (n)
Murgo, Kenneth: (n)
Murphy, James: (n)
Murphy, Jefferey: 3A(DePuy Synthes, a Johnson & Johnson Company); 4(Johnson & Johnson)
Murphy, Joshua: (n)
Murphy, Robert: 9(AAOS)
Murray, Patrick: (n)
Murray, Trevor: 5(Stryker Orthopaedics)
Mushlin, Alvin: (n)
Mutnal, Amar: 4(Genentech)
Myers, Kevin: (n)
Myers, Thomas: (n)
Nagrare, Nupur: (n)
Nair, Rajesh: (n)
Nam, Denis: (n)
Namba, Robert: 1(Innomed)
Nambu, Satya: 3A, 4(Wright Medical Technology)
Nandi, Sumon: 8(Journal of Arthroplasty)
Naranje, Sameer: 7(Fellowship Salary support-Orthopaedic Research and Education Foundation)
Narzikul, Alexa: (n)
Naudie, Douglas D: 1,2,3B,6(Smith and Nephew); 2,3B,6(Stryker); 2,3B(Pfizer); 6(Depuy); 9(The Knee Society (Research committee)
Nawab, Akbar: 1(Arthrex); 3B(Linvatec, Zimmer)
Nawabi, Danyal: (n)
Nayfeh, Tariq: (n)
Nazarian, Ara: (n)
Naziri, Qais: (n)
Nebergall, Audrey: (n)
Neeld, Gregory: (n)
Nellans, Kate: (n)
Nelms, Nathaniel: (n)
Nelson, Charles: 9(Board of Directors, J. Robert Gladden Orthopaedic Society); 3B(Zimmer, Inc)
Nelson, Christopher: 3B(DePuy Mitek)
Nelson, Daniel: (n)
Nelson, Timothy: (n)
Nepple, Jeff: (n)
Nessler, Joseph: 1,2,3B.4,6(Stryker)
Nett, Michael: (n)
Neufeld, Michael: (n)
Newbern, David: (n)
Ng, Vincent: (n)
Nguyen, Joseph: (n)
Nho, Jae-Hwi: (n)
Nicholson, Lisa: (n)
Nicholson, James: 2(DePuy); 7(Kinamed)
Niedbala, Elizabeth: (n)
Niehaus, Richard: (n)
Nielsen, Poul: (n)
Nielsen, Evan Scott: (n)
Nikolaus, Oliver: (n)
Nishiwaki, Toru: (n)
Nistor, Vasile: (n)
Niu, Shun: (n)

Noble, John: 1,3B,5(Stryker); 1,3B,5(Smith&Nephew), 1(Zimmer, Omni Science Inc, Springer); 9(Louisiana Orthopaedic Association)
Noble, Philip: 3B(Zimmer, Omni Sciences Inc.); 4(J&J, Zimmer, Astra-Zeneca, Merck); 5(Synthes, Zimmer, Arthrex); 8(Journal of Arthroplasty); 9(International Society for Technology in Arthroplasty)
Nocera, Chris: 3A(Stryker)
Nodzo, Scott: (n)
Nogler, Michael: (n)
Noiseux, Nicolas: 3B(Wright Medical Technologies); 5(Zimmer)
Noori, Naudereh: (n)
North, W Trevor: (n)
Norton, Adam: (n)
Novack, Thomas: (n)
Novicoff, Wendy: 5(Stryker); 8(Case Reports in Orthopaedics)
Nunley, Ryan: 3B(Smith & Nephew; Wright Medical Technology, Inc.; Medtronic; CardioMEMS; Integra Sciences); 5(Biomet; Wright Medical Technology, Inc.; Stryker; Smith & Nephew; DePuy Synthes; Medical Compression Systems, Inc); 9(Missouri State Orthopaedic Association Board Member; Southern Orthopaedic Association Board Memeber)
Nyazee, Humaa: (n)
O'Connell, Robert: (n)
O'Connor, Mary: 3B(Stryker, Inc.; Zimmer, Inc.); 4(Accelalox, Inc.); 8(Clinical Orthopaedics and Related Research); 9(American Association of Bone and Joint Surgeons; Association of Bone and Joint Surgeons)
O'Gorman, Thomas: (n)
O'Guinn, Justin: (n)
O'Keefe, Regis: 4(LaGet); 5(Amgen); 9(Board of Directors of the ABOS; Board of Directors of the AOA)
Obzerova, Sona: (n)
Ochenjele, George: (n)
Ochsner, John: (n)
Odland, Andrew: (n)
Odum, Susan: 9(AAHKS Research Committee); 8(Journal of Arthroplasty)chen
Oh, Jennifer: (n)
Olcot,t Christopher: (n)
Oliver, Jeffrey: (n)
Olsen, Michael: (n)
Olson, Jessica: (n)
Ong, Alvin: 3B(Stryker); 3B(Smith and Nephew); 3B(Medtronic); 5(Zimmer); 8(Journal of arthroplasty);
Ong, Kevin: 8(J of Arthroplasty); 5(Medtronic); 5(Stryker); 5(Paradigm Spine); 5(Mako Surgical);
Orden, Michael: (n)
Orozco, Fabio: 8(Journal of Arthroplasty); 5(Stryker); 5(Zimmer); 3B(Stryker Orthopaedics); 3B(Medtronics);
Ortiguera, Cedric: (n)
Osmon, Douglas: (n)
Otero, Jesse: (n)
Owen, David: (n)
Pacheco, Karin: (n)
Paci, Gabrielle: (n)
Padegimas, Eric: (n)
Padgett, Douglas: 1,2,3B,4(mako surgical); 3B(stryker); 8(journal of arthroplasty); 9(The Hip Society, The Hospital for Special Surgery)
Pagnano, Mark: 1(Stryker, DePuy, Mako); 7(Clinical Orthopaedics); 8(Clinical Orthopaedics); 9(Knee Society)
Paller, David: (n)
Palmer, Pamela: (n)
Palumbo, Brian: (n))
Paprosky, Wayne: 1,2,3B(zimmer); 2,3B(Depuy, Stryker, Zimmer); 3B,4(Avenir); 3B,4(Medtronics); 7(Lippincott); 8(Journal of Arthoplasty)
Park, Youn-Soo: 3B(Johnson & Johnson)
Park, Andrew: (n)
Park, Brian: (n)
Park, Caroline: (n)
Park, Ha Young: (n)
Parker, Gillian: (n)
Parks, Christopher: (n)
Parks, Michael: 3B,4,5(Zimmer, Inc); 4(Johnson and Johnson, Merck, Pfizer); 9(AAHKS, OREF Board of Directors, New York State Society of Orthopaedic Surgeons Board of Directors)
Parks, Nancy: (n)
Parsley, Brian: (n)
Parsons, III Theodore: (n)
Parvizi, Javad: 3B(Zimmer, Smith & Nephew, Convatech, TissueGene, Ceramtec, Emovi, 3M, Cadence, Medtronic, Pfizer) 5(Stryker, Zimmer, Smith and Nephew, Ceramtec, 3M); 7(Datatrace, Slack, Wolters Kluwer, Jaypee); 8(J Arthroplasty, JBJS-A, BJJ, Orthopedics Today); 9(AAHKS, EBJIS, MSIS, AOA)
Pascual-Garrido Cecilia: (n)
Pashos, Gail: (n)
Patel, Anay: (n)
Patel, Jasmine: (n)
Patel, Jay: (n)
Patel, Kushal: (n)
Patel, Preetesh: 3B(Stryker); 4(OtisMed Corporation)
Patel, Raj: (n)
Patel, Rikin: (n)
Patel, Ronak: (n)
Patel, Rupal: (n)
Patil, Shantanu: (n)
Patil, Sunit: (n)
Patrick, David: (n)
Patterson, Andrew: (n)
Patterson, Christine: (n)
Patzakis, Michael: (n)
Paul,Sophia: (n)
Paulus, Megan: (n)
Pauly, Greg: (n)
Pavey, Emily: (n)
Pavlov, Helene: (n)
Paxton, Elizabeth: (n)
Pearle, Andrew: 3B(Pipeline Orthopedics, 3B(BlueBelt Technologies)
Pedersen, Douglas: (n)
Pellegrini, Vincent: 1(DePuy hip stem; royalties); 3B(DePuy hip stem); 9(AOA, past president on board, Hip Society, president elect, AAMC CAS board of directors, UMMC, President of Medical Staff)
Peloquin, Robert: (n)
Pelosi, Michael: 3A,4(Stryker)
Pelt, Christopher: 5(Biomet); 9(AAOS)
Penenberg, Brad: 1(Wright Medical); 3C,4(Radlink)
Pera, Samuel: (n)
Peralta, Juan-Vicente: (n)
Perkins, Robert: (n)
Perkinson, Brian: (n)
Perry, Kevin: (n)
Peter, Viju: 5(Zimmer)
Peters, Christopher: 1,3(Biomet); 8(Journal of Arthroplasty); 9(AAHKS)
Peters, John: (n)
Petis, Stephen: (n)
Petrus, Cara: (n)
Peyser, Katie: (n)
Pfefferle, Kiel: (n)
Phan, Duy: (n)
Phillips, Matthew: 3B(Stryker); 4(Ampio Pharmaceuticals)
Phillips, Michael: 3C(3M corporation)
Phisitkul, Phinit: (n)
Picard, Frederic: 1,3C,5(BBraun 1(Aesculap, CMU); 3B,4(Blue Belt Technology); 3C(Convatec); 5(Stryker, Mathys, Convatec)
Pickering, Trevor: (n)
Pierson, Jeff: 3B,5(Zimmer); 3B(Accelero Health); 4,6(Exactech)
Pillai, Aiswarya Chandran: (n)
Pivec, Robert: (n)
Plakseychuk, Anton: 3B(Blue Belt Inc)
Plaskos, Christopher: 3A(OMNIlife Science)
Plummer, Darren: (n)
Podeszwa, David: 9(Pediatric Orthopaedic Society of North America; American Academy of Orthopaedic Surgeons)
Poehling Monaghan, Kirsten: (n)
Politi, Joel: 2,3B,5(DePuy)
Polkowski, Gregory: (n)
Pomeroy, Donald: 3B,5(DePuy, A Johnson & Johnson Company)
Ponder, Corey: 2(Medtronic); 2,3B(Biomet, OMNI); : 2,3,4(MAKO, 4(TJO)
Porter, Anthony: 5(Zimmer Inc)
Porter, David: (n)
Porter, Susanne: (n)
Posey, Jennie: 3B(DePuy Synthes, Inc.)
Post, Zachary: (n)
Potter, Hollis: 3B(Regentis Biomaterials); 5(Institutional research support, General Electric Healthcare); 8(Editorial Board, Osteoarthritis and Cartilage, Editorial Board, Cartilage)
Poultsides, Lazaros: (n)
Pourmoghaddam, Amir: (n)
Pourtaheri, sina: (n)
Prieto-Saavedr,a Hernan: (n)
Pritzlaff, Scott: (n)
Pugely, Andrew: (n)
Pugh, Lucas: (n)
Pui, Christine: 9(AAHKS Health Policy Fellowship)
Pulido, Pamela: (n)
Pulido, Luis: (n)
Pulos, Nicholas: (n)
Puri, Lalit: 1(Innomed); 3B(Stryker, Medtronic, Kinamed); 9(AAHKS Payment Policy Subcommittee, AAOS Health Care Systems Committee)
Puri, Rajeev: (n)
Purtill, James: (n)
Puthiya, Veettil Manoj: (n)
Qadir, Rabah: (n)
Queen, Robin: 5(Stryker, Nike, DJO); 8(Foot and Ankle International)
Rachala,, Sridhar: (n)
Rader, Kevin: (n)
Ragsdale, Mary: (n)
Rahim, Arshad: 3A(Healthgrades, Inc.);
Rahnavardi, Mohammad: (n)
Rajesh, Krishnankutty: (n)
Rakel, Barbara: (n)
Ramakrishnan, Rama: 3A(Stryker Orthopaedics); 4(Stryker Orthopaedics)
Ramkumar, Prem: (n)
Ramsden Stein, Danielle: (n)
Ranawat, Amar: 1,2,3B(Depuy, 1(Mako, ConforMIS, Pipeline); 2,3B(Medtronic, Convatec); 3B(Nova); 4(ConforMIS); 5(Stryker, Ceramtec); 8(JOA, JBJS, CORR); 9(EOA)
Ranawat, Chitranjan: (n)
Rand, James Alan: 2,3B (Zimmer)
Rao, Biyyam: (n)
Raphael, Ibrahim: (n)
Rasinski, Kenneth: (n)
Rasouli, Mohammad: (n)
Rasquinha, Vijay: (n)
Raterman, Stephen: (n)
Rathod, Parthiv: (n)
Reader, Douglas: (n)
Ready, John: (n)
Rebal, Brett: (n)
Redmond, John: (n)
Reed, George: 3A(CORRONA, Inc)
Reedy, Mary: (n)
Ren, Jinma: (n)
Renaud, Alexandre: (n)
Rennie, Christopher: (n)
Replogle, William: (n)
Restrepo, Camilo: (n)
Restrepo, G Nicolas: 1,2,3B(Depuy Synthes); 2(Sanofi Aventis); 9(Colombian Orthopedic Society (SCCOT) Past President, Latin american Orthopedic Society (SLAOT) Past Secretary)
Restrepo, Santiago: (n)
Reyes, Christopher: (n)
Rice, Elizabeth: (n)
Richard, Raveesh: (n)
Richards, Lindsey: (n)
Richardson, Glen: 2(Stryker); 5(DePuy)
Riedel, Stefan: (n)
Rifai, Aiman: (n)
Riley, Michelle: (n)
Rimnac, Clare: 5(DePuy, Zimmer, Exponent); 7(Senior Associate Editor for Clinical Orthopaedics and Related Research); 8(Clinical Orthopaedics and Related Research); 9(Orthopaedic Research Society)
Ritter, Merrill: 3C,4(Iconacy)
Ritterman, Scott: 4(Pfizer, Bristol Myers Squibb)
Rivera, Frances: (n)
Rivera, Kelly: (n)
Rives, Terry: (n)
Rivlin, Michael: (n)
Robb, William: 1(Inomed); 3C(Smith and Nephew); 4(Stryker); 9(AAOS Patient Safety Committee, OREF Finance and Audit Committees)
Robbins, Claire: (n)
Robinson, Jonathan: (n)
Robinson, Kristin: 3A,4(Stryker)
Robinson, Le Don: (n)
Robinson, Luke: 4(Johnson and Johnson)
Robinson, Sean: (n)
Roc, Gilbert: (n)
Jeremy, Gilbert: (n)
Roche, Martin: 1,2,3B,4,5(makosurgical, 1(orthosensor); 4(J and J, Orthosensor); 5(Depuy)
Rodrigo, Juan: 8(Review articles for JBJS, CORR); 9(AAOS Adult Reconstruction Knee Program Committee)
Rodrigues, Danieli: (n)
Rodriguez, Jose: 3B,5(Smith Nephew, Depuy, Exactech); 3B(Medacta); 8(CORR, J Arthroplasty, HSS Journal); 9(Health Policy Committee AAHKS)
Rojas-Granados, Gustavo: (n)
Rolfson, Ola: (n)
Rose, Christine: (n)

Rose, Peter: 7(Journal of the American Academy of Orthopaedic Surgeons (Deputy Editor honorarium); 8(Yearkbook of Orthopedics, Journal of the American Academy of Orthopaedic Surgeons, 9(Minnesota Orthopaedic Society, Collaborative Spine Research Foundation)
Rosen, Adam: 1(Innomed); 4(Cadence Pharma)
Rosenbaum, Samuel: (n)
Rosenthal, Brett: 1(Musculoskeletal Physical Exam (smartphone application)
Ross, David: (n)
Ross, Hunter: (n)
Ross, James: (n)
Ross Matthew: (n)
Ross, Steven: (n)
Rossi, Mark: (n)
Roth, Joshua: (n)
Rothman, Richard: 1,3B(Stryker); 7(Journal of Arthroplasty); 8(Journal of Arthroplasty)
Rothrauff, Benjamin: (n)
Rousseau, Marc: (n)
Rowe, Philip (n)
Rowell, Shannon: 6(Biomet Inc.); 6(DePuy Inc.)
Royal, Mike: 3A,4(AcelRx Pharmaceuticals)
Rozbruch, Robert: (n)
Rubash, Harry: 3B(Pipeline, MAKO); 7(Lippincott, Williams and Wilkins); 9(Hip Society)
Ruberte Thiele, Ramon A: (n)
Rubin, Lee: (n)
Ruel, Allison: (n)
Ruffolo, Michael: (n)
Ruh, Erin: (n)
Ruiz, David: (n)
Russell, Nick: (n)
Russell, Robert: (n)
Rutherford-Davies, Jill: (n)
Rutt, Brian: (n)
Ryan, Joseph: (n)
Ryu, Jae-Jin: (n)
Ryu, Robert: (n)
Sabah, Atif: (n)
Sacerdote, Julie: (n)
Sadeghi-Naini, Mohsen: (n)
Sadik, Adam: (n)
Sadler, Adam: (n)
Sadr, Kamran: (n)
Safir, Oleg: (n)
Safran, Marc: 1(Shoulder Anchor – Arthrocare, Stryker); 1(Shoulder Sling - DJO); 3C(Cool Systems); 3C,4(Biomimedica); 5(Smith and Nephew, Ferring Pharmceuticals); 7(Elsevier, Lippincott); 8(American Journal of Sports Medicine); 9(American Orthopaedic Society for Sports Medicine, International Society for Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine, International Society for Hip Arthroscopy)
Sakellariou, Vasileios: (n)
Saleh, Anas: (n)
Samiezadeh, Saeid: (n)
Samujh, Christopher: (n)
Sanchez, Hugo: 5(Biomet)
Sanchez, Fernando: 2,5(Depuy (J&J))
Sanchez-Sotelo, Joaquin: 1,5(Stryker); 5(Zimmer, DePuy); 8(Journal of Shoulder and Elbow Surgery); 9(AAOS International Committee)
Santore, Richard: (n)
Sarin, Vineet: 3A(Kinamed Inc); 4(Kinamed Inc); 9(ICJR - Industry Relations Committee)
Sarrel, Kara: (n)
Sassoon, Adam: (n)
Satterwhite Keri: (n)
Sauerberg, Iris: 3A(Zimmer GmbH)
Sawan, Hind: (n)
Scarborough, Donna: (n)
Scemama, Caroline: (n)
Schairer, William: (n)
Schank, Kristin: (n)
Schemitsch, Emil: 1(Wright Medical), 1,3B,6(Stryker); 1,5,6,(Smith&Nephew); 6(Zimmer, Synthes, Sanofi, Amgen); 7(Elsevier); 8(Journal of Orthopaedic Trauma); 9(International Society for Fracture Repair, Osteosynthesis and Trauma Care Foundation, Canadian Orthopaedic Association, Canadian Arthroplasty Society)
Schepps, Alan: (n)
Schiller, Kevin: 3A(CD Diangostics Inc)
Schilling, Peter: (n)
Schiltz, Nicholas: (n)
Schindel, Jennifer: (n)
Schmalzried, Hope: (n)
Schmalzried, Tom: 1,3B(Stryker); 1,3B(DePuy-Synthes); 8(Orthopedics Today); 9(OREF)
Schmidt, Robert: 1(Wright Medical Technologies Group)
Schmier, Jordana: 6(Do not receive support directly, but employer (Exponent) contracts with manufacturers.); 8(Journal of Managed Care Pharmacy, Applied Health Economics and Health Policy)
Schneiderbauer, Michaela: (n)
Schoenecker, Perry: (n)
Schold, Jesse: (n)
Schroer, William: 2,5(Biomet, Inc); 2(Pfizer Inc)
Schueler, Beth: 9(American Association of Physicists in Medicine, Society of Directors of Academic Medical Physics Programs)
Schutzer, Steve: 3C(Renovis Surgical); 4(Renovis Surgical); 8(Journal of Arthroplasty)
Schwarzkopf, Ran: 3B(Smith&Nephew); 8(JOurnal of Arthroplasty); 9(AAOS)
Schwechter, Evan: (n)
Schwindel, Leslie: (n)
Scott, Daniel: (n)
Scott, David: 2,3B,5(OMNI Life Science); 5(Stryker)
Scot, Norman: 1(Zimmer); 7(Elseveir); 8(Journal of Arthroplasty); 9(ICJR president, CEO)
Scott, Richard: 1,3B(Depuy, Inc.); 4(Conformis, Inc); 7(Springer-Verlag)
Scuderi, Giles: 2(Convatec, 2(Medtronic); 1,2,3B(Zimmer); 3B(Convatec, Medtronic); 7(World Scientific, Thieme, Springer, Elsevier); 8(Orthopedic Clinics NA); 9(The Knee Society); 9(Operation Walk USA); 9(ICJR)
Sculco, Peter: (n)
Sculco, Thomas: (n)
Seamans, David: (n)
Sebastian, Arjun: (n)
Sellan, Michael: (n)
Sems, Stephen: 1(Biomet Affixus Nail)
Sems, Stephen: (n)
Severns, Dustyn: (n)
Severson Erik: (n)
Shah, Kaiser: (n)
Shah, Mehul: (n)
Shah, Ritesh: (n)
Shah, Roshan: (n)
Shah, Vivek: (n)
Shalaby, Michael: (n)
Sharareh, Behnam: (n)
Sharkey, Peter: (n)
Shaw, Lindsey: (n)
Shea, Kevin: (n)
Shea, Raymond: (n)
Shemor, Scott: (n)
Sherman, Courtney: (n)
Sheth, Neil: 3B(Zimmer)
Shin, Tae-Jin: 3A,4(Corentec)
Shinar, Andrew: 1,3B(Smith and Nephew); 9(Southern Orthopaedic Association)
Shinar, Paul: 1,3B(Smith and Nephew); 9(Southern Orthopaedic Association)
Shirname-More, Lata: (n)
Shubert, Daniel: 9(my sister is president of the maine society of orthopaedic surgeons)
Shue, Jennifer: (n)
Sidhu, Sanbir: (n)
Sierra, Rafael: 1,5,7(Biomet); 9(AAHKS, Midamerica OS, Mueller Foundation)
Siggelkow, Eik: 3A(Zimmer GmbH); 4(ZMH)
Sikora-Klak, Jakub: (n)
Siliski, John: (n)
Sillesen, Nanna: 6(Biomet)
Silverton, Craig: 1(Biomet); 9(MOAOS)
Silvestre, Jason: (n)
Sim, Frank: (n)
Simon, April: (n)
Simpson, Kathy: 5(Arthrex, Inc.)
Sinha, Sumi: (n)
Sink, Ernest: 2,3B(Pivot Medical)
Sisto, Domenick: 8(American Journal of Sports Medicine - Reviewer)
Slover, James: 5(Biomet; DJO Orthopaedics)
Sluka, Kathleen: (n)
Small, Travis: (n)
Smith, Daniel: (n)
Smith, Eric: 3B,5(DePuy); 3B(OMNIlife Science); 5(Pfizer, Inc., Stryker Orthopaedics)
Smith, John: (n)
Smith, Julie: 3A(Blue Belt Technologies)
Smith, Langan: (n)
Smith, Michael: (n)
Smith, Paul: (n)
Smith, William: (n)
Smits, Shelly: (n)
Sneller, Michael: (n)
Snider, Mathew: (n)
Snir, Nimrod: (n)
Snyder Benjamin: (n)
Sodhi, Guneet: (n)
Soever, Leslie: (n)
Soheili, Aydin: (n)
Somerville, Lyndsay: (n)
Song, Yanna: (n)
Sonn, Kevin: (n)
Soo Hoo, Nelson: 8(Orthopedics Today)
Spangehl, Mark: 5(Stryker, Depuy) 9(AAOS)
Spanyer, Jonathon: (n)
Specht, Lawarence: (n)
Springer, Bryan: 2(Depuy, Ceramtec); 3B(Stryker, Convatec Surgical); 8(Journal of Arthroplasty)
Sproul, Robert: (n)
Spurgeon, Garrett: (n)
Sritulanondha, Supatra: (n)
Stake, Christine: 5(MAKO Surgical)
Stal, Drew: (n)
Stambaugh, Jeffrey: (n)
Stanga, Daryl: (n)
Star, Andrew: 2(depuy speaking); 3A(Cynthia Star Johnson and johnson Diabetes full time employee); 3B(Depuy speaker and training); 4(johnson and johnson stock and options); 5(Depuy joint registry); 9(Pennsylvania orthopaedic society board of directors.)
Starr, Roland: (n)
Stas, Venessa: (n)
Steckelberg, James: (n)
Stefl, Michael: (n)
Stegman Jacob: (n)
Steiger, David: (n)
Steinwinder, Michael: (n)
Stephenson, Jason: 3B(Biomedical Systems Inc.); 3B(Biomedical Systems Inc.);
Stevens, David: 3B(Biomet UK);
Stevens-Lapsley, Jennifer: (n)
Stiehl, James: 4(Blu Ortho SAS; Traumis LLC; Osteosys SAS); 3C(Exactech); 3B(Zimmer); 2(ICJR, Zimmer); 1(Zimmer; Innomed); 7(The Knee); 8(The Knee)
Stimac, Jeffrey: (n)
Stirton, John: (n)
Stocks, Gregory: 4(Nimbic Systems, Inc)
Stone, Jennifer: (n)
Stover, Matthew: (n)
Strnad, Gregory: (n)
Stryker, Louis: (n)
Stuart, Michael: 5(Stryker); 3B(Arthrex); 1(Arthrex)
Stulberg S. David: (n)
Stulberg, Samuel: 1(Aesculap, Biomet, Innomed); 2(zimmer, aesculap); 3B(zimmer, stryker,); 4(blue belt technologies); 7(Peachtree Publishers)
Stulberg, Bernard: 1(Exactech); 2(Pacira, Corin, Medtronic); 3B(Exactech, Stryker, Pacira); 5(Zimmer); 8(Journal of Arthroplasty); 9(Mid-America Orthopaedic Association)
Stundner, Ottokar: (n)
Styron, Joseph: 2(Warner-Chilcott, Valiant)
Su, Edwin: 3B,5,9(Smith and Nephew, Inc); 8(American Journal of Orthopedics);
Su, Sherwin: 3B,5(Smith and Nephew)
Suarez, Juan: 2(Pacira, Orth Align); 3B(Orth Align)
Sucato, Daniel: (n)
Succar, Julien: (n)
Suh, You-Sung: (n)
Suleiman, Linda: (n)
Sullivan, Jamesz: 1(Depuy Johnson & johnson); 4(Stryker, Johnson & Johnson, Exactech)
Sun, Doo H.: 3A, 4(Corentec)
Sunderland, Adam: (n)
Sungar, Gannon: (n)
Sutphen, Sean: (n)
Swartz, George: (n)
Sweeney, Patrick: (n)
Swenson, Jeffrey: (n)
Swenson, Craig: 4(Pfizer)
Szubski, Caleb: (n)
Taddonio, Michael: (n)
Tait, Mark: (n)
Takemoto, Richelle: (n)
Talati, Rushi: (n)
Talebi, Masumeh: (n)
Talmo, Carl: 8(Journal of Arthroplasty); 3A(Wife - Astra-Zeneca)
Tamparo, William: (n)
Taneja, Mayank: (n)
Tarwala Rupesh: (n)
Taunton, Michael: 5(Stryker); 3B(DJO, Inc.)
Taylor, Lee: (n)
Tedesco, Nicholas: (n)
Teeter, Matthew: (n)

Teng, Yuanjun: (n)
Terry, Michael: 1,5,6(Smith & Nephew); 3B(Arthrex, Inc.); 7(Saunders/Mosby-Elsevier)
Tetreault, Matthew: (n)
Thompson, Jeffrey: (n)
Thompson, Scott: (n)
Thompson, Hilary: (n)
Thurston, Peter: (n)
Tiberi, John: (n)
Tice, Andrew: (n)
Tilzey, John: (n)
Tischler, Eric: (n)
Todd, Julie: (n)
Tohfafarosh, Mariya: (n)
Tokarski, Anthony: (n)
Tomaro, Joe: 3A,4(Zimmer)
Tomek, Ivan: (n)
Toomey, Sean: 2,3B(Angiotech); 2,3B,5(DePuy), 2,3B,4(MAKO); 4(J&J)
Tran, Nho: (n)
Travers, Christopher: (n)
Tripuraneni, Krishna: 4(Orthopedic implant company); 5(DJO surgical)
Troelsen, Anders: 3B(Member of Biomet Nordic Advisory Board); 6(Travel expenses paid by: Protesekompagniet, Denmark); 9(Member of Research Comittee of The Danish Orthopaedic Society)
Trofa, David: (n)
Trousdale, Robert: 1(depuy, mako)
Troyer, Jennifer: (n)
Truzzi, Marcello: (n)
Tsai, Tsung-Yuan: (n)
Tucker, Kim: (n)
Turnbull, Nathan: (n)
Turner, Shelley: (n)
Uhr, Alex: (n)
Underwood, Richard: (n)
Unvala, Zarir: (n)
Urban, Robert: (n)
Urquhart, Andrew: (n)
Vail, Thomas: 1,3B(DePuy); 3B,4(Biomimedica); 4(Pivot Medical); 8(Journal of Arthroplasty); 9(American Association of Hip and Knee Surgeons, Knee Society, American Board of Orthopaedic Surgery)
Valle, Ricardo: (n)
Van Dine, Christin: (n)
Van Eck, Carola: (n)
Van Meeteren, Nico: (n)
Vann, Elliott: (n)
Vasarhelyi, Edward: 5(DePuy, Smith and Nephew, Stryker)
Vaughn, Bradley: (n)
Vaze, Reema: (n)
Vegari, David: (n)
Vekaria, Shyam: (n)
Velazquez, Ana: (n)
Velott, Anthony: (n)
Vendittoli, Pascal-Andra: (n)
Verma, Kushagra: (n)
Vigano, Roberto: 2(DEPUY J&J, MUNDIPHARMA, BBRAUN)
Vigdorchik, Jonathan: (n)
Villa, Jesus: (n)
Virginie, Gauvreau: (n)
Virk, Sohrab: (n)
Viscusi, Eugene: 2(Cadence, Pacira); 3B(Cadence, Pacira, AcelRx, Cubist, Salix, Incline/ Medicines Co); 5(Cumberland, Adolor/ Cubist); 9(American Society of regional Anesthesia and Pain Medicine)
Vissing Jacqueline: (n)
Voleti, Pramod: (n)
Vopat, Bryan: (n)
Voshmeh, Neda: (n)
Waddell, James: 3B(Smith & Nephew, Stryker); 5(Smith & Nephew, Stryker); 7(Elsevier); 9(Canadian Orthopaedic Foundation)
Waespe, David: 4(Own 10 shares of Becton, Dickinson, and company stock)
Wagner, Eric: (n)
Wagner, Russell: 5(Biomet, Inc)
Walcott, Marie: (n)
Waldstein, Wenzel: (n)
Walinchus, Lesley: (n)
Walsh, Christopher: (n)
Walter, William: 1(Stryker, Matortho); 2,3B(Ceramtec); 3B(Matortho); 5(Depuy); 9(ISTA)
Walton, David: (n)
Wang, Stewart: (n)
Wang, Hongsheng: (n)
Wanke, Tyler: (n)
Wannomae, Keith: (n)
Ward, Daniel: 3B,5(Stryker)
Ward, Joseph: (n)
Warth, Lucian: (n)
Wasielewski, Ray: (n)
Waters, Jonathan: 5(The Coramed, Haemonetics); 6(The Gauss); 7(The AABB Press); 8(The Transfusion); 9(The AABB); 8(The Transfusion)
Watson, David: (n)
Watters, Tyler: (n)
Watts, Chad: (n)
Wayne, Paprosky: (n)
Weeks, Kenneth: (n)
Weiir, Robb: (n)
Wellman, Samuel: 5(Zimmer, Stryker, DePuy, Biomet); 8(Journal of Arthroplasty editorial board)
Wenger, Doris: (n)
Wera, Glenn: (n)
Wessel, Robert: (n)
Wessell, Nolan: (n)
Westrich, Geoffrey: 2,3A(Exactch, Stryker, DJO); 5(Exactch, Stryker); 9(Knee Society, Eastern Orthopaedic Association)
Wetzel, Robert: (n)
Whalen, Joseph: (n)
Whitaker, Colin: (n)
White, Peter: (n) Daichii Sankyo
White, Richard: 3B(Boehringer-Ingelheim; Daichii Sankyo; Janssen), 5(Biomeriux; Novartis; Pfizer)
Whitney, Kate: (n)
Wilke, Benjamin: (n)
Willenborg, Melissa: 9(Publications Committee of AAOS);
Williams, Alexis: (n)
Williams, John: (n)
Williams, Michael: 3A,4(Smith and Nephew)
Williams, Rhodri: (n)
Williamson, Ronda: (n)
Willman, Tyler: (n)
Wilson, Zenus: (n)
Wilson, Travis: (n)
Wilson, Becky: 3A,4(Synthes, Johnson & Johnson)
Winby, Stu: (n)
Wingert, Nathaniel: (n)
Wingerter, Scott: (n)
Wixson, Richard: 1(Innomed, Inc.); 1,3B(Stryker Corporation)
Woehnl, Antonia: (n)
Wolek, Ryan: (n)
Wolfson, Theodore: (n)
Won, Sung-Hun: (n)
Won, Ye-Yeon: (n)
Wong, Andy: (n)
Wong, Wendy: (n)
Wood, Kristin: (n)
Woodard, Erik: (n)
Woodnutt, David: (n)
Wooley, Paul: (n)
Woolson, Steven: 2,4(medical compression systems inc)
Wooten, Clint: (n)
Wright, Elizabeth: 4(Lexicon Pharmaceutical, Johnson and Johnson, Merck, Pfizer)
Wright, Coy: (n)
Wright, Kimberly: (n)
Wright, Timothy: 1(Mathys AB); 4(Exactech); 5(Stryker); 7(Orthopaedic Research Society); 8(Journal of Orthopaedic Research); 9(Education Committee - Knee Society)
Wu, Baohua: (n)
Wu, Chia: (n)
Wuestemann, Thies: 3A(Stryker)
Wynne, Rachael: (n)
Xia, Yayi: (n)
Xu, Peter: (n)
YaDeau, Jacques: (n)
Yaffe, Mark: (n)
Yang, Charlie: (n)
Yang, Judy: (n)
Yarboro, Seth: (n)
Yates, Adolph: 9(AAHKS EBM Committee Chair);
Yau, Paul: (n)
Yazdanshenas, Hamed: (n)
Yeo, Seng-Jin: 2,5(Depuy)
Yerrapragada, Aditya: (n)
Yi, Meghan: (n)
Yi, Paul: (n)
Yoo, Jeong Joon: (n)
Yoo Oui Sik: 3A(Corentec); 4,5(Corentec)
Yoon, Byung-Ho: (n)
York, Sally: 9(Research Committee, AAHKS)
Youm, Jiwon: (n)
Young, Laura: (n)
Younger, Victoria: (n)
Yu, Michael: (n)
Yu, Stephen: (n)
Yuan, Brandon: (n)
Yung, Colin: (n)
Zadzilka, Jayson: (n)
Zaltz, Ira: (n)
Zaoui, Amine: (n)
Zavatsky, Joseph: 3B(DePuy Synthes,Biomet)
Zawadsky, Mark: (n)
Zheng, Hua: (n)
Zheng, Nigel: (n)
Zhou, Cheng-pei: (n)
Zhou, Tianzan: (n)
Zhu, Kaicen: (n)
Zhu, Rebecca: (n)
Zielinska, Olga: (n)
Zmistowski, Benjamin: (n)
Zuckerman, Joseph: 1(Exactech, Inc.); 4(Hip Innovation Technology, Inc.); 7(Slack, Thieme,Wolters Klower); 9(OREF,MTF)
Zuiderbaan, Hendrik: (n)
Zumbrunn, Thomas: (n)
Zybach, Bill: (n)
Zylberberg, Alejandro: (n)

AAHKS
American Association of Hip and Knee Surgeons

FUTURE MEETINGS

AAHKS 24th Annual Meeting
November 7-9, 2014
Sheraton Dallas Hotel
Dallas, TX

AAHKS 25th Annual Meeting
November 6-8, 2015
Sheraton Dallas Hotel
Dallas, TX

AAHKS 26th Annual Meeting
November 4-6, 2016
Sheraton Dallas Hotel
Dallas, TX

Combined Specialty Day Meeting
AAHKS/Hip Society/Knee Society
March 15, 2014
New Orleans, LA

Combined Specialty Day Meeting
AAHKS/Hip Society/Knee Society
March 28, 2015
Las Vegas, NV

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