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American Association of Hip and Knee Surgeons

22nd Annual Fall Meeting

November 2-4, 2012

Sheraton Dallas Hotel, Dallas, Texas

Goals and Objectives

The AAHKS 22nd 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:

- Total Knee Arthroplasty
- Total Hip Arthroplasty
- Total Joint Infection
- Complications
- Health Policy

Symposia--- Topics include:

- Optimizing Management of Patients with Metal-on-Metal Hips
- Accountable Care Organizations and Bundled Payments
- Periprosthetic Joint Infection
- Practice Management
- CMS THA/TKA Audits
- Hip Preservation Surgery
- Are All TJR the Same or Do We Need a TJR Co-Morbidity Index?



22nd Annual Fall Meeting

Advances in Arthroplasty

November 2-4, 2012 -Sheraton Dallas Hotel, Dallas, Texas

THURSDAY, NOVEMBER 1, 2012

5:30 PM-8:00 PM Board of Directors Meeting
Majestic 1 Room

FRIDAY, NOVEMBER 2, 2012

7:00 AM-10:00 AM 4th Annual Resident Course
Houston Ballroom

6:55 AM-3:55 PM Orthopaedic Team Member
Course
Dallas Hall

8:00 AM-11:00 AM AAHKS Research Design
Course
Seminar Theater

8:00 AM-10:00 AM Perioperative Pain
Management for
Orthopedic Surgery

**Sponsored by Cadence
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

10:00 AM-4:00 PM Exhibit/Poster Setup

10:00 AM-8:00 PM Registration
Grand Hall

11:00 AM-1:00 PM Surgical Site Infection in Total
Hip & Knee Arthroplasty
**Sponsored by ConvaTec*

11:00 AM-1:00 PM Advancements in Anatomy
and Kinematics in TJA
**Sponsored by Stryker*

11:00 AM-1:00 PM Modern Components and
Approaches in Total
Hip Arthroplasty
**Sponsored by DePuy
Orthopaedics, Inc*

NOON-1:00 PM Resident's Lunch
Austin 1-2

NOON-1:00 PM Orthopaedic Team Member
Lunch Dallas Hall

NOON-5:30 PM Speaker Ready Room
Dallas Hall

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

2:00 PM-4:00 PM AMA/RUC Physicians Work
Survey Training Course
Seminar Theater

2:00 PM-4:00 PM Experience Solutions for
Existing Challenges in TKA
**Sponsored by DePuy Synthes*

2:00 PM-4:00 PM Bearing Options in TJR:
Where are we Today?
**Sponsored by CeramTec
Medical Products*

2:00 PM-4:00 PM Advancement in Technology
and Instrumentation for
Partial Knee Arthroplasty
**Sponsored by Biomet
Orthopedics*

**Please note that the Optional Mini-Symposium
are not part of the official program as planned by
AAHKS Annual Meeting Program Committee*

Dallas Hall

4:10 PM Welcome - Michael E. Berend,
MD Program Chair

SESSION ONE Revision TKA

4:15-5:23 PM MODERATORS: William G.
Hamilton, MD and
Robert T. Trousdale, MD

- 4:15 PM**
Paper #1 Comparison of Outcomes and Survivorship between Patients of Different Age Groups following Total Knee Arthroplasty
Steven J. MacDonald, MD, FRCSC, Ontario, Canada
- 4:21 PM**
Paper #2 Risk Factors for Early Revision following Primary TKA in Medicare Patients
Harry E. Rubash, MD, Boston, MA
- 4:27 PM**
Paper #3 Why are Total Knees being Revised: A Review of 872 Consecutive Cases
David F. Dalury, MD, Towson, MD
- 4:33 PM**
Paper #4 Why are Total Knees Failing Today? Etiology of Knee Revision in 2010 and 2011
William C. Schroer, MD, St. Louis, MO
- 4:39 PM**
Discussion
- 4:49 PM**
Paper #5 Supracondylar Femur Fractures after TKA: Comparison of Modern Retrograde IM Nails versus Periarticular Locked Plates
Brian J. Keyes, DO, Indianapolis, IN
- 4:55 PM**
Paper #6 Analysis of Tibial Component Rotation following Total Knee Arthroplasty using 3D High Definition Computed Tomography
Henry D. Clarke, MD, Phoenix, AZ
- 5:01 PM**
Paper #7 Surgeon Implant and Patient Variables Can Explain Variability in UKA Revision Rates
Stefano A. Bini, MD, Oakland, CA
- 5:07 PM**
Paper #8 Revision UKA to TKA: Not Always a Slam Dunk
Rafael J. Sierra, MD, Rochester, MN
- 5:13 PM**
Discussion

Dallas Hall

- SYMPOSIUM I** Optimizing Management of Patients with Metal-on-Metal Hips: Understanding and Applying the Best Evidence into Practice
5:23-6:23 PM MODERATOR: Adolph V. Lombardi, Jr., MD
William L. Griffin, MD, Joshua J. Jacobs, MD, Young-Min Kwon, MD, PhD, Steven J. MacDonald, MD

Houston Ballroom

- 4:10 PM** Welcome - Craig J. Della Valle, MD - Education Chair

- SYMPOSIUM II** Accountable Care Organizations and Bundled Payments: Passing Trends or a New Paradigm
4:15-5:15 PM MODERATOR: Kevin J. Bozic, MD, MBA
John M. Cherf, MBA, MPH, Steven F. Schutzer, MD

- SESSION TWO** Health Policy/NonArthroplasty
5:15-6:23 PM MODERATORS: Mark I. Froimson, MD and William J. Macaulay, MD

- 5:15 PM**
Paper #9 Variability in Hospital-Level Risk Standardized Complication Rates following Primary TJA in Medicare Patients
Daniel J. Berry, MD, Rochester, MN
- 5:21 PM**
Paper #10 Public Perception of Medicare Reimbursement to Orthopedic Surgeons for Primary THA and TKA
Joel A. Tucker, MD, Biloxi, MS
- 5:27 PM**
Paper #11 Bundled Payments in TJA: Targeting Opportunities for Quality Improvement and Cost Reduction
Kevin J. Bozic, MD, MBA, San Francisco, CA
- 5:33 PM**
Discussion
- 5:43 PM**
Paper #12 Surgical Treatment of Femoroacetabular Impingement: Does it Impact Quality of Life?
Claudio Diaz-Ledezma, MD, Philadelphia, PA
- 5:49 PM**
Paper #13 Conflict of Interest in the Assessment of Hyaluronic Acid Injections for Osteoarthritis of the Knee: An Updated Systematic Review
Jonathon O. Printz, MD, Ann Arbor, MI
- 5:55 PM**
Paper #14 The Rising Incidence of Hip Arthroscopy in the United States
Thomas P. Vail, MD
- 6:01 PM**
Paper #15 Clinical Presentation and Imaging Results of Patients with Symptomatic Gluteus Medius Tears
Dror Lindner, MD
- 6:07 PM**
Discussion
- 6:23-8:23 PM** Welcome Reception (All Attendees Invited)
- 6:23-8:23 PM** Posters/Exhibits Open



SATURDAY, NOVEMBER 3, 2012

- 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** President's Welcome
Dallas Hall
- 6:55-7:00 AM** Program Chair Welcome
- SESSION THREE**
7:00-7:56 AM Perioperative Factors and Arthroplasty Outcomes
MODERATORS: Jay R. Lieberman, MD and Keith R. Berend, MD
- 7:00 AM** Topical Tranexamic Acid in Total Knee Arthroplasty: A Double-Blind, Randomized, Placebo Controlled Trial
Paper #16
Andrew G. Georgiadis, MD, Detroit, MI
- 7:06 AM** Economic Impact of Tranexamic Acid in Healthy Patients Undergoing Primary Hip and Knee Arthroplasty
Paper #17
Blake P. Gillette, MD, Rochester, MN
- 7:12 AM** One Intraoperative Dose of Tranexamic Acid is Safe and Effective in Revision Total Knee Arthroplasty
Paper #18
James Howard, MD, MSc, FRCSC, Ontario Canada
- 7:18 AM** Discussion
- 7:28 AM** Transfusion Rates Are Increasing Following Total Hip Arthroplasty: Risk Factors and Outcomes
Paper #19
James A. Browne, MD, Charlottesville, VA
- 7:34 AM** An Evaluation of the Use of Topical Tranexamic Acid in Total Knee Arthroplasty
Paper #20
George F. Chimento, MD, FACS, New Orleans, LA
- 7:40 AM** Hemoglobin A1C is a Marker for Surgical Risk in Diabetic Patients Undergoing Total Joint Arthroplasty
Paper #21
Nicholas J. Giori, MD, Palo Alto, CA
- 7:46 AM** Discussion
- SYMPOSIUM III**
7:56-8:51 AM Periprosthetic Joint Infection: The Current State of Affairs
MODERATOR: Javad Parvizi, MD, FRCS
Keith R. Berend, MD, Craig J. Della Valle, MD, Bryan D. Springer, MD

- SESSION FOUR**
8:51-9:47 AM Primary TKA
MODERATORS: Brian J. McGrory, MD and Christopher L. Peters, MD
- 8:51 AM** Retrieval Analysis of Fixed versus Mobile Bearing Retrieved Polyethylene Inserts using Laser Scanning Technology
Paper #22
Timothy M. Wright, PhD, New York, New York
- 8:57 AM** Effect of Body Mass Index on Limb Alignment after Total Knee Arthroplasty
Paper #23
Kenneth J. Schmidt, MD, Phoenix, AZ
- 9:03 AM** Patient Specific Instrumentation versus Large-Console, Computer-Assisted Navigation in Total Knee Arthroplasty
Paper #24
Denis Nam, MD, New York, NY
- 9:09 AM** Discussion
- 9:19 AM** Simultaneous vs Staged Bilateral Total Knee Arthroplasty among Medicare Beneficiaries, 2000-2009
Paper #25
Michael P. Bolognesi, MD, Durham, NC
- 9:25 AM** RCT Multicenter Comparison of Primary TKA using Patient Specific Versus Conventional Instrumentation
Paper #26
Moussa Hamadouche, MD, PhD, Paris, France
- 9:31 AM** Risk Factors for Aseptic Revision of Primary Total Knee Arthroplasty
Paper #27
Robert S. Namba, MD, Corona Del Mar, CA
- 9:37 AM** Discussion
- 9:47-10:17 AM** BREAK in the Exhibit Hall
Dallas Hall
- SESSION FIVE**
10:17-11:13 AM Primary Hip
MODERATORS: Douglas E. Padgett, MD and Mary I. O'Connor, MD
- 10:17 AM** RSA Analysis of Early Migration of a Short Metaphyseal vs. Standard Length Metaphyseal Cementless Stem: A Prospective Randomized Controlled Trial
Paper #28
Richard W. McCalden, MD, Ontario Canada
- 10:23 AM** Multi-Center Analysis of Clinical Factors affecting Polyethylene Wear in 945 Total Hip Arthroplasties
Paper #29
Charles R. Bragdon, PhD, Boston, MA

10:29 AM Paper #30	What Happens to Serum Metal Ion Levels after a Metal-on-Metal Bearing is Removed? <i>Scott T. Ball, MD, San Diego, CA</i>	1:28 PM Paper #39	Patient Specific Instrumentation Does Not Shorten Surgical Time: A Prospective Randomized Trial <i>William G. Hamilton, MD, Alexandria, VA</i>
10:35 AM Paper #31	Trunnion Wear and Corrosion: The Real Issue in Large Head Metal-on-Metal Total Hip Failures <i>Nader A. Nassif, MD, New York, NY</i>	1:34 PM	Discussion
10:41 AM	Discussion	SYMPOSIUM IV 1:44-2:14 PM	Audience Response - Practice Norm/Trends <i>Daniel J. Berry, MD</i>
10:51 AM Paper #32	Ten-Year Outcome of Serum Metal Ion Levels after Primary Total Hip Arthroplasty <i>Brett R. Levine, MD, MS, Chicago, IL</i>	AWARDS 2:14-2:44 PM	AAHKS Award Papers <i>MODERATORS: Michael E. Berend, MD and Craig J. Della Valle, MD</i>
10:57 AM Paper #33	Metal on Metal Hips Surveillance Program: Welsh Experience of 1400 Hips from a High Volume Centre <i>Alun John, FRCS, Cardiff, Wales</i>	2:14 PM	JAMES A. RAND AWARD Presentation of Award: William J. Robb III, MD Is Increased Modularity Associated With Increased Wear Debris in Metal-on-Metal Total Hip Arthroplast Devices? <i>Genymphas Higgs, Philadelphia, PA</i>
11:03 AM	Discussion	2:20 PM	Discussion
11:18 AM-12:08 PM	KEYNOTE ADDRESS: John C. Goodman, PhD INTRODUCTION: <i>Thomas P. Vail, MD</i>	2:24 PM	LAWRENCE D. DORR AWARD Presentation of Award: Carlos J. Lavernia, MD Risk Factors, Causes and the Economic Implications of Unplanned Readmissions following Total Hip Arthroplasty <i>Peter B. Derman, MD, MBA, New York, NY</i>
12:08-12:48 PM	LUNCH	2:30 PM	Discussion
SESSION SIX 12:48-1:44 PM	Primary TKA <i>MODERATORS: William L. Griffin, MD and Mark J. Spanghel, MD</i>	2:34 PM	AAHKS CLINICAL AWARD Presentation of Award: David G. Lewallen, MD Dexamethasone Reduces Length of Hospitalization and Improves Postoperative Pain and Nausea After Total Joint Arthroplasty: A Prospective, Randomized Controlled Trial <i>Jeffrey R. Backes, MD, Columbus, OH</i>
12:48 PM Paper #34	National Obesity Trends in Total Knee Arthroplasty <i>Bryan D. Springer, MD, Charlotte, NC</i>	2:40 PM	Discussion
12:54 PM Paper #35	Should Patients Undergoing Elective Arthroplasty be Screened for Malnutrition? <i>Matthew S. Austin, MD, Philadelphia, PA</i>	2:50 PM	AJRR Update <i>David G. Lewallen, MD</i>
1:00 PM Paper #36	Differences in Short-Term Complications Between Spinal and General Anesthesia for Primary Total Knee Arthroplasty <i>Andrew J. Pugely, MD, Coralville, IA</i>	2:56 PM-3:15 PM	BREAK
1:06 PM	Discussion	SYMPOSIUM V 3:15-4:10 PM	CMS THA/TKA Audits: What you Need to Know <i>MODERATOR: David A. Halsey, MD</i> Multi-stakeholder Perspective - Physician, Hospital, Regulator and Payors
1:16 PM Paper #37	10-Year Prospective Matched-Pair Wear Analysis of Rotating Platform, Fixed-Bearing and All-Polyethylene Designs with Magnetic Resonance Imaging <i>Morteza Meftah, MD, New York, NY</i>		
1:22 PM Paper #38	Pharmacologic Predictors of Post-Operative Delirium (POD) in Total Joint Arthroplasty: A Case-Control Study <i>Sumon Nandi, MD, Boston, MA</i>		

SESSION SEVEN Infection
4:10-4:56 PM *MODERATORS: William A. Jiranek, MD and Matthew S. Austin, MD*

4:10 PM Periprosthetic Joint Infection: A Fatal
 Paper #40 Condition?
Javad Parvizi, MD, FRCS, Philadelphia, PA

4:16 PM Postoperative Infections Associated
 Paper #41 with Allogeneic versus Autologous
 and No Blood Transfusions after
 Orthopaedic Surgery
Richard J. Friedman, MD, FRCSC, Charleston, SC

4:22 PM Should Draining Wounds and Sinuses
 Paper #42 Associated with Hip and Knee
 Arthroplasties be Cultured?
Matthew W. Tetreault, BA, Chicago, IL

4:28 PM Discussion

4:38 PM Infection following Simultaneous
 Paper #43 Bilateral Total Knee Arthroplasty
Lazaros A. Poultsides, MD, MSc, PhD, New York, NY

4:44 PM The Impact of Multiple Cultures and
 Paper #44 Prolonged Incubation on Antibiotic
 Usage: An Improved Standardized
 Protocol for Hip and Knee Prosthetic
 Joint Revisions
Alexander M. DeHaan, MD, Portland, OR

4:50 PM Staphylococcus Decolonization in
 Paper #45 Total Joint Arthroplasty is Effective
Antonia F. Chen, MD, MBA, Pittsburgh, PA

4:56 PM Comparison of One versus Two-Stage
 Paper #46 Revision Results for Infected Total Hip
 Arthroplasty
Andrew A. Freiberg, MD, Boston, MA

5:02 PM Discussion

5:12 PM Boots on the Ground Developing
 AAHKS's Health Policy Advocacy
 Response at the State Level
Thomas K. Fehring, MD, Charlotte, NC

5:18-6:00 PM AAHKS Membership Business
 Meeting (*AAHKS Members Only*)

6:00-8:00 PM Poster Session Reception
 (*All Attendees Invited*)

SUNDAY, NOVEMBER 4, 2012

6:00-10:00 AM Registration

6:00-10:00 AM Speaker Ready Room

6:00-7:00 AM Continental Breakfast

SYMPOSIUM VI Contemporary Concepts in Hip
7:00-8:00 AM Preservation Surgery
MODERATOR: John C. Clohisy, MD

Patient Evaluation - Rafael J. Sierra, MD

Hip Arthroscopy - William A. Jiranek, MD

Surgical Hip Dislocation - Paul E. Beaulé, MD

Periacetabular Osteotomy - John C. Clohisy, MD

Surgical Decision-Making for Successful Outcomes - Christopher L. Peters, MD

SESSION EIGHT Revision THA
8:00-8:56 AM *MODERATORS: Michael L. Parks, MD and Christian P. Christensen, MD*

8:00 AM Increased Complications following
 Paper #47 Total Hip Replacement after
 Cephalomedullary Fixation for
 Intertrochanteric Hip Fracture
Christine M Pui, MD, Minneapolis, MN

8:06 AM A Randomized Trial Comparing
 Paper #48 Acetabular Component Fixation of
 Two Porous Ingrowth Surfaces
 using RSA
Douglas Naudie, MD, FRCSC

8:12 AM A Comparison of Modular Tapered
 Paper #49 versus Cylindrical Stems for Complex
 Femoral Revisions
Hany S. Bedair, MD, Boston, MA

8:18 AM Discussion

8:28 AM Reconstruction of Failed Hip
 Paper #50 Abductors following Total Hip
 Arthroplasty - A New Surgical
 Technique using Graft Jacket Matrix
Biyyam M. Rao, FRCS, United Kingdom

8:34 AM Risk Factors for Early Revision
 Paper #51 following Primary THA in Medicare
 Patients
Steven M. Kurtz, PhD, Philadelphia, PA

8:40 AM "Cup within a Cup" Technique in
 Paper #52 Revision Hip Arthroplasty
Steven H. Weeden, MD, Fort Worth, TX

8:46 AM Discussion

SYMPOSIUM VII
8:56-9:56 AM

Are All Total Joint Replacements the Same? Or Do We Need an Arthroplasty Comorbidity Index?
Moderator: Thomas K. Fehring, MD

Pat Franklin, MD, MPH, MBA - The Importance of Clinical Factors in Determining Risk Adjustment Outcome.

Susan Odum, PhDc - Medical Comorbidity Measures: Are They Relevant for use in Total Joint Replacement?

David Ayers, MD -How CMS is Grading your Performance; the Importance of an Arthroplasty Comorbidity Index

SESSION NINE
9:56-10:40 AM

Revision THA/Primary THA
MODERATORS: John B. Meding, MD and Bryan J. Springer, MD

9:56 AM Paper #53 Mortality after Septic and Aseptic Revision Total Hip Arthroplasty: A Matched-Cohort Study
Ho Rim Choi, MD, Boston, MA

10:02 AM Paper #54 Inpatient Myocardial Infarction after Elective Primary Hip or Knee
Robert S. Sterling, MD, Baltimore, MD

10:08 AM Paper #55 RCT Comparison after a Minimal 8-year Follow-up of XLPE Versus Contemporary Annealed Polyethylene in THA
Jean Lenglois, MD, PhD, Paris France

10:14 AM Discussion

10:24 AM Paper #56 Are Morbidly Obese Patients Undergoing Total Hip Arthroplasty at Higher Risk for Component Malposition?
Young-Min Kwon, MD PhD, Boston, MA

10:30 AM Paper #57 The Short and "Shorter" of It: >1,450 Tapered Titanium Stems at 6 to 84 Month Follow-Up
John W. Barrington, MD, Plano, TX

10:36 AM Paper #58 Effect of Surgical Approach and Intra-operative Imaging on Acetabular Component Alignment in Total Hip Arthroplasty
John L. Masonis, MD, Charlotte, NC

10:42 AM Discussion

10:52 AM Concluding Remarks

10:57 AM ADJOURN



Comparison of Outcomes and Survivorship between Patients of Different Age Groups Following Total Knee Arthroplasty

Richard McCalden, MD, **Steven J. MacDonald, MD, FRCSC**,
Robert B. Bourne, MD, FRCSC, James P. McAuley, MD FRCSC,
Douglas Naudie, MD, FRCSC, James Howard, MD, MSc, FRCSC

Introduction: TKR is being performed with increasing frequency in younger patients. The purpose of this study was to evaluate and compare the survivorship (5 and 10 year) and clinical outcomes of patients of different age groups that underwent TKR at our institution.

Methods: A retrospective review based on a prospective database was performed on 6,708 consecutive patients that underwent primary TKA between 1996 to 2009. Patients were then divided into 3 groups based on their age: < 55, 55-70 and > 70 years. Clinical outcomes were assessed using the WOMAC, SF-12 and Knee Society Score (KSS). The change in outcome score (preoperative score to most recent postoperative score) was compared between the three age groups. Kaplan-Meier analysis was performed on each group to calculate survivorship at 5 and 10yrs with revision for any reason being the endpoint.

Results: Comparing the < 55, 55-70 and > 70 age groups respectively, there was a statistically significantly difference in the WOMAC total change score (32 vs 31 vs 26, $p < 0.0001$). This pattern was confirmed with the WOMAC subscales of pain, stiffness and function. There was a statistically significant difference in the change in KSS favoring the younger populations (< 55yrs: 78.9 vs 55-70yrs: 76.0 vs > 70yrs: 69.0). The Kaplan-Meier survivorship for the < 55, 55-70, and > 70 years age groups at 5 years was 95.5%, 97.2% and 98.1% and at 10 years was 92.2%, 95.9% and 97.6% respectively. Revision secondary to infection was the most frequent cause for failure in all groups.

Conclusion: This study has shown that younger patients experience better clinical outcomes following TKA according to the KSS, WOMAC and SF-12, but lower survivorship, when compared to older patient populations. TKA is an excellent treatment for arthritis of the knee even in younger patients.

Risk Factors for Early Revision following Primary TKA in Medicare Patients

Kevin J. Bozic, MD, MBA, Edmund Lau, MS, Kevin L. Ong, PhD, Vanessa Chiu, MPH, Steven M Kurtz, PhD, Thomas P. Vail, MD, **Harry E. Rubash, MD**, Daniel J. Berry, MD

Introduction: Patient, surgeon, health system, and device factors are all known to influence outcomes in TKA. However, patient-related factors associated with an increased risk of early failure are poorly understood, particularly in elderly patients. The purpose of this study was to identify specific demographic and clinical characteristics associated with an increased risk of early revision in Medicare TKA patients.

Methods: The Medicare 5% sample was used to calculate the relative risk of revision TKA within 12 months of primary TKA as a function of baseline medical comorbidities in 117,903 Medicare patients between 1998 and 2010. The impact of 29 co-morbid conditions on risk of early revision was examined using Cox regression, controlling for age, sex, race, Census region, socioeconomic status, and all other baseline comorbidities. Adjusted hazard ratios were constructed for each condition, and Wald's χ^2 statistic was used to rank the degree of association of comorbidities with the risk of early revision.

Results: The most significant independent risk factors for early revision TKA (in order of significance, $p < 0.040$, for all comparisons) were chronic pulmonary disease (adjusted hazard ratio [HR] = 1.32; 95% confidence interval [CI], 1.17 to 1.49), depression (HR = 1.30; 95% CI, 1.10 to 1.54), alcohol abuse (HR = 1.80; 95% CI, 1.15 to 2.83), drug abuse (HR = 2.08; 95% CI, 1.17 to 3.72), renal disease (HR = 1.25; 95% CI, 1.02 to 1.52), hemiplegia/paraplegia (HR = 1.91; 95% CI, 1.07 to 3.42), and obesity HR = 1.19; 95% CI, 1.01 to 1.39).

Conclusions: Chronic pulmonary disease, depression, alcohol abuse, drug abuse, renal disease, hemiplegia/paraplegia, and obesity were associated with an increased risk of early revision in Medicare TKA patients. This information is important when counseling elderly TKA patients regarding their individual risk of early failure, and for risk-stratifying publicly reported outcomes in Medicare TKA patients.

Why are Total Knees being Revised: A Review of 872 Consecutive Cases

David F. Dalury, MD, Donald L. Pomeroy, MD, Robert S. Gorab, MD, Mary Jo Adams, BSN

Introduction: Despite widespread 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%, Periprosthetic 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 room for improvement in these areas. Infection unfortunately continues to be a major challenge.

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Why are Total Knees Failing Today? Etiology of Knee Revision in 2010 and 2011

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C. Lowry Barnes, MD, Ryan M. Nunley, MD,
Michael E. Berend, MD, Adolph V. Lombardi, MD, FACS

Introduction: Understanding the etiology of TKA failure is critical to improving implant design, instrumentation, and surgeon performance. The etiology of knee revision was evaluated at six centers from January 2010 through December 2011.

Methods: The primary mechanism of knee failure was determined through patient history, operative reports, and radiographic evaluations of 681 revision cases. Time-to-failure was categorized < 2 years, 2-5 years, 5-15 years, and > 15 years. The location of primary TKA was determined and the complexity of the knee revision was classified as a complete, single component, or poly only revision.

Results: Mean age (65 years) and BMI (33.7) were similar to the centers' primary TKA populations. Mean time to revision was 5.9 years, range 10 days to 29 years. 243 (36%) knee revisions occurred in the first two years, 172 (25%) from 2-5 years, 199 (29%) from 5-15 years, and 67 (10%) after 15 years. The mechanism of failure was aseptic loosening (29%), instability (21%), infection (13%), polyethylene wear (11%), arthrofibrosis (9%), and malalignment (8%). The predominant failure mechanism was instability at < 2 years, and aseptic loosening from 2-15 years. Polyethylene wear was rare early but represented 60% of revisions after 15 years. 74% of revisions were initially performed at outside centers. 66% of knees required complete revision, 14% required tibial or femoral revision, while 20% of knees required only polyethylene revision.

Conclusions: The majority of knee failures still present early with 61% occurring within five years. The predominant early mechanisms of failure are primarily surgeon-dependent. In contrast to previous reports, which are likely biased by differences in implant designs and polyethylene quality, wear is not a primary mechanism of failure and only presents after 15 years. Implant performance is not a predominant factor of knee failure. Improving surgeon performance through training, instrumentation, and technique development may reduce early revisions.

Supracondylar Femur Fractures after TKA: Comparison of Modern Retrograde IM Nails versus Periarticular Locked Plates

Brian J. Keyes, DO, R. Michael Meneghini, MD, Kartheek K. Reddy, MD, Dean Maar, MD

Supracondylar femur fractures after total knee replacement (TKR) can be challenging. Fixed-angle or “locked” devices, either nails or plates, are reported to offer improved fixation and subsequent union. The purpose of this study was to evaluate the radiographic and clinical outcomes of modern intramedullary (IM) nails with locked distal fixation compared to periarticular locking plates for the treatment of periprosthetic supracondylar fractures in TKR.

From 2001 to 2011, 96 consecutive periprosthetic supracondylar femur fractures in 93 patients (AO/OTA classification 33) were retrospectively reviewed. Fixation was performed in 29 knees with a retrograde IM nail with a locked distal screw and in 67 periarticular locked plates. Clinical and radiographic follow up was obtained until fracture union. Nonunion or delayed union was considered a clinical failure. Statistical analysis was performed to assess differences in outcomes between groups and variables predictive of nonunion or failure.

Six patients died and 5 patients were lost to follow-up, leaving 85 TKR periprosthetic fractures (22 IM nails, 63 locked plates) with a minimum of 6 weeks follow-up. Seventy-one of 85 knees (83.5%) went on to union at an average of 16 weeks. There were 2 (9%) nonunions in the IM nail group and 12 nonunions or delayed unions (19%) in the locked plate group ($p = 0.34$). There was no difference in time to union between groups ($p = 0.64$). A mean of 5.0 (range, 3-8) distal screws were used in the locked plate group, compared to 3.8 (range, 3-4) distal screws in the IM nail group ($p = 0.000001$)

To our knowledge, this is the largest consecutive series in the literature documenting operative fixation of supracondylar periprosthetic femur fractures after TKR. Despite having a greater quantity of screws in the distal fragment, the failure rate of locked plate fixation was twice that of IM nail fixation. Preserving the local fracture biology via modern IM retrograde nails with fixed angle interlocking screws may lead to higher union rates in these challenging periprosthetic fractures.

Analysis of Tibial Component Rotation following Total Knee Arthroplasty using 3D High Definition Computed Tomography

Adam Bloemke, Glade Roper, Catherine Roberts,
Mark J. Spangehl, MD, **Henry D. Clarke, MD**

Introduction: Rotational mal-alignment of the components in total knee arthroplasty (TKA) has been associated with poor outcomes. However, diagnosing mal-rotation, especially of the tibial component can be difficult. Prior protocols, using multiple transposed axial cuts from a standard computed tomography (CT) scan, are cumbersome and have not been validated for intra or inter-observer reliability. In this study, we developed and validated the intra and inter-observer reliability for a new method to measure tibial component rotation using a single axial view from a high definition, 3D CT reconstruction of the proximal tibia.

Materials and Methods: An IRB approved, retrospective review of 60 CT scans from 59 patients who had undergone TKA was performed. Each CT scan was performed with a high definition, metal artifact reduction protocol. 3D reconstruction of the proximal tibial with super-imposed prosthesis was then performed. Two distinct methods for measuring tibial component rotation from de-identified axial images were performed on two separate occasions, by five observers (2 radiologists; 3 orthopedic surgeons). One method used the center of the tray, and one used the mid-point of the posterior aspect of the tray for calculating the rotation angle. Intra and inter-rater reliability were assessed using intra-class correlation coefficients (ICC).

Results: Intra-observer reliability was excellent for both techniques: 0.941 (95% CI 0.912–0.956) for the center angle; 0.949 (95% CI 0.916–0.958) for the posterior angle. Inter-observer reliability was similarly excellent for both: 0.936 (95% CI 0.916–0.961) for the center angle; 0.943 (95% CI 0.919–0.963) for the posterior angle.

Conclusion: Our data indicate that both techniques for measuring tibial component mal-rotation using a single axial 3D high definition CT image are easy and reproducible. Application of this method to future studies evaluating tibial component rotation should allow both accurate determination of an acceptable rotational range for the tibial component, and comparison of results between institutions.

Surgeon, Implant and Patient Variables can Explain Variability in UKA Revision Rates

Stefano A. Bini, MD, Monti Khatod, MD, Guy Cafri, PhD, Yuexin Chen, Elizabeth Paxton, MA

Introduction: The reported revision rates (RR) of cemented unicompartmental knee arthroplasty (UKA) have varied widely. The effects of implant, patient and surgeon variables on RRs have not been fully addressed and may help explain this discrepancy. We report the aseptic (RR) of three commonly used UKA implants and quantify the impact of variables related to patient, implant and surgeon selection on the risk of revision.

Methods: We identified all cemented primary UKAs performed between 2001 and 2009 to assess the non infection related RR for cemented, primary UKAs. Using a Cox regression model, we calculated the relative risk of revision of UKAs when adjusting for implant design, surgeon and hospital volume, surgeon experience, fellowship training, patient age, gender, weight, BMI, and ASA score.

Results: 1,746 UKAs were identified. The overall revision rate was 4.98%. Unadjusted differences in revision rates (RR) between implant designs were statistically different ($P < 0.001$). In a multivariable Cox model, the Hazard ratio for aseptic revision relative to the fixed, metal backed implant was significantly higher for the all polyethelene implant (ZUKA vs. PAP, HR 4.24, 1.68-10.70, $P=0.02$), and the 'Other' category (HR: 4.17, CI 1.45-11.96, $P=0.008$). Younger age (age < 55 vs. > 65 ; HR=4.65, 95% CI: 2.48-8.72, $P < .001$) was associated with increased risk. Higher ASA score (> 3 vs. < 3 ; HR=.52, 95% CI: .31-.90, $P=.021$) and average yearly surgeon volume > 12 were associated with reduced risk (HR=2.07, 95% CI: 1.25-3.45, $P =.005$).

Conclusion: In over 1700 UKAs, patient age, ASA score, , implant selection and yearly surgeon volume were found to be strong independent risk factors for aseptic revision. The latter two are modifiable risk factors. Differences between study cohorts relative to these variables may help explain the variability in survivorship of UKA found in the literature.

Symposium I

Optimizing Management of Patients with Metal-on-Metal Hips: Understanding and Applying the Best Evidence into Practice

Adolph V. Lombardi, Jr., MD, William L. Griffin, MD, Joshua J. Jacobs, MD,
Young-Min Kwon, MD, PhD, Steven J. MacDonald, MD



Symposium II

Accountable Care Organizations and Bundled Payments: Passing Trends or a New Paradigm

Kevin J. Bozic, MD, MBA, John M. Cherf, MD, Steven F. Schutzer, MD



Revision UKA to TKA: Not Always a Slam Dunk

Cale A. Kassel, MD, Nathan Wetters, BS, Craig J. Della Valle, MD,
Michael E. Berend, MD, Keith R. Berend, MD, **Rafael J. Sierra, MD**

Objective: The number of unicompartmental arthroplasties performed in the US has grown significantly in the last few years. As the number of UKA grows so will the number of failures. A better understanding of the reasons for failure and outcomes after revision to TKA is warranted. The objective of this study is to report the outcomes of modern UKA revised to TKA in 3 US centers.

Methods: 192 revisions in 185 patients (91 Males, 95 females) with an average age of 66 years were performed from 1995 to 2010 in 3 centers. Individual joint registries and chart reviews were performed to collect data regarding reasons for revision, type of implants used, and re-revision rates.

Results: The average time to revision TKA from UKA was 65.5 months (range 1 month to 313 months). The most common reasons for failure of the UKA were implant failure/loosening (125 knees, 65.1%), progressive osteoarthritis (58 knees, 30.2%) and infection (5 knees, 2.6%). Stemmed implants were used in 67 knees (34.9%) and augments were used in 47 knees (24.5%). Nine of the 192 knees (4.7%) were subsequently revised at an average of 48.8 months (range 7 months to 123 months.) The reasons for re-revision included: loosening of components (7), infection (1), and arthrofibrosis (1). Other complications included continued pain, stiffness, and instability. Knee Society knee and functional scores prior to revision were 54 and 53, respectively. At most recent follow-up, knee and functional scores were 75 and 66, respectively.

Conclusions: The re-revision rate after revision TKA from UKA was 4.7% at just over 4 years in this series. The survivorship of a revised UKA to TKA is less than primary TKA and should be considered comparable to revision TKA.

Variability in Hospital-Level Risk Standardized Complication Rates following Primary TJA in Medicare Patients

Kevin J. Bozic, MD, MBA, Laura M. Grosso, PhD, MPH, Zhenqiu Lin, PhD,
Lisa Suter, Michael Rapp, Jay R. Lieberman, MD,
Robert W. Bucholz, MD, **Daniel J. Berry, MD**, Elizabeth E. Drye, MD, SM

Introduction: Despite the widely reported success of lower extremity TJA procedures (THA and TKA), little is known regarding the rate of and variation in complication rates across hospitals in the United States. The purpose of this study was to use an NQF-approved quality metric to calculate hospital-level risk-standardized complication rates (RSCRs) for primary TJA procedures and to describe regional variations in complication rates.

Methods: We calculated hospital-specific RSCRs using Medicare claims data for 878,098 fee-for-service Medicare beneficiaries, 65 years or older, who underwent elective primary TJA in 3479 hospitals between 2008 and 2010. Both medical (acute MI, pneumonia, or sepsis/septicemia within 7 days) and surgical (surgical site bleeding, PE or death within 30 days; mechanical complication or periprosthetic joint/wound infection within 90 days) complications were included in the complication measure. RSCRs were calculated using hierarchical logistic regression to account for patient clustering, and risk-adjusted for age, sex and patient comorbidities. RSCRs were compared across hospital referral regions (HRR).

Results: The raw rate of having any complication was 3.6%. The most common complications were Pneumonia (0.86%), Pulmonary Embolism (0.75%), and Infection (0.67%). The median (range) RSCR was 3.6% (1.8-9.0%). The odds of a complication if treated at a hospital one standard deviation above the national average were 1.93 times higher than the odds of a complication if treated at a hospital one standard deviation below the national average. Distinct regional patterns in complication rates were evident. The three risk factors associated with the greatest risk of complication were protein-calorie malnutrition (OR(95% CI): 2.7(2.5-2.9)), end-stage renal disease or dialysis (OR(95% CI): 1.7(1.4-2.0)), and number of procedures (two vs. one) (OR(95% CI): 1.7(1.6-1.8)).

Conclusion: Risk-stratified complication rates for primary TJA procedures demonstrate marked variation across hospitals that cannot be accounted for by patient factors alone. This suggests there are substantial opportunities for quality improvement by identifying and sharing best practices.

Public Perception of Medicare Reimbursement to Orthopedic Surgeons for Primary THA and TKA

Mary I. O'Connor, MD, **Joel A. Tucker, MD**, Carolyn Scott, Colleen S. Thomas, MS

Introduction: The purpose of this study was to assess the awareness of the public relative to Medicare reimbursement for surgeons performing primary THA and TKA. Secondary aims included respondent willingness to pay out-of-pocket for the procedure or for advanced technology and how long they would be willing to wait for the surgery.

Methods: 1200 surveys were voluntarily completed by people in an outpatient orthopedic clinic in Florida. Respondents were first surveyed on what they felt was a reasonable fee for surgeons; subsequently shown the actual payment and queried as to whether this was high, lower or appropriate reimbursement.

Results: Typically respondents did not answer every question on the survey. Respondents were typically older (median age, 64 years), female (61%) and did not have THA or TKA (71%). Medicare was the primary insurance in 50% of respondents and 49% reported household incomes of \$75,000 or greater. Of the 1200 surveys, 668 individuals completed the open ended question as to what they felt was a reasonable surgical fee for primary THA or TKA. The median value was \$5,000 while respondents estimated Medicare reimbursement to be much lower at \$2,000. When the actual Medicare reimbursement rate was disclosed (\$1,700), 62% of respondents reported this being much lower or somewhat lower than expected and 13% reported to somewhat or much higher than expected. The median amount of out-of-pocket expenses respondents reported being willing to pay for the surgery or for advance technology related to the procedures was \$2,000. Most respondents were willing to wait 3-7 weeks for surgery to be performed.

Conclusion: Public perception of Medicare reimbursement to surgeons for THA and TKA showed that the nearly 700 respondents placed a higher monetary value on THA and TKA (median value for surgical fee, \$5,000) than actual reimbursement and 62% expressing that actual reimbursement (\$1,700) was lower than expected.

Bundled Payments in TJA: Targeting Opportunities for Quality Improvement and Cost Reduction

Kevin J. Bozic, MD, MBA, Lorraine Ward, Thomas P. Vail, MD, Mervyn Maze

Introduction: Little is known regarding the financial risks assumed by providers who accept bundled payments, and which aspects of the episode of care should be targeted for quality improvement and cost reduction. The purpose of this study was to evaluate 30-day episode of care payments for Medicare TJA patients, and to identify areas for quality improvement and cost reduction.

Methods: All payments made to Medicare providers (hospitals, post-acute care facilities, physicians, and other healthcare providers) for services beginning with the index procedure and extending over a 30-day period were analyzed for 250 Medicare primary and revision TJA patients from a single institution over a 12-month period. Payments and services were aggregated by procedure type and categorized as index procedure/hospital stay, post-acute care, related hospital readmissions, and emergency department visits.

Results: Mean episode of care payments ranged from \$25,568 for primary TJA procedures to \$50,648 for revision TJA procedures in patients with major comorbidities or complications. Post-discharge payments accounted for 35.8% of total episode of care payments. The coefficient of variation was significantly higher for post-discharge payments than for index procedure payments (86.5 vs. 30.5). 61.6% of patients were transferred to post-acute care facilities, accounting for 69.8% of post-discharge payments. The overall 30-day readmission rate was 9.6%, accounting for 11.2% of post-discharge payments. 60.8% of patients received home health services (HHS), accounting for 17.2% of post-discharge payments.

Conclusion: Episode of care payments for TJA procedures vary widely depending on the type of procedure (e.g., primary vs. revision), patient comorbidities, discharge disposition, and readmission rates. Post-discharge care accounted for over 35% of total episode payments, and varied substantially across patients and procedures. Post-acute care (SNF, ARF, and HHS) and readmissions accounted for over 98% of post-discharge payments. Care redesign efforts should be targeted at optimizing post-acute care and reducing unplanned readmissions.

Surgical Treatment of Femoroacetabular Impingement: Does it Impact Quality of Life?

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Camilo Restrepo, MD, Javad Parvizi, MD, FRCS

Introduction: Femoroacetabular Impingement (FAI) is a relatively ill-understood condition. It is not known if surgery influences the health related quality of life (HRQoL) for these patients and if so which factors can predict the impact of surgery on HRQoL.

Methods: We included 108 patients who had undergone surgical treatment for FAI between 2005 and 2011. HRQoL was measured using SF-36 V.2™. The influence of both: 1) intraoperatively-confirmed extent of articular damage (grade of acetabular chondral lesions/ type of labral tears), and 2) patient demographics over physical (PCS) and mental (MCS) component scores were investigated. Predictive and explanatory variables were identified using multiple imputation modeling, backward stepwise regression model and the Akaike information criterion.

Results: Surgical treatment of FAI appeared to positively impact HRQoL as measured by SF-36. Extent of intra-articular damage (full-thickness vs partial thickness vs no damage), and the extent of labral damage (frayed and irreparable versus repairable) were not correlated with the outcome of surgery and measured HRQoL. Males patients had better PCS score ($p = 0.027$) and patients with higher activity level ($p = 0.006$). A linear model based on gender and UCLA scale had predicted that PCS improve 8.9 points in male patients ($p = 0.012$) and 3.7 points per point of UCLA scale ($p = 0.001$). Model p -value: 0.001, adjusted R^2 : 0.29. For the MCS, both obese patients ($p = 0.004$) and those with psychiatric comorbidities ($p = 0.058$) had significant lower scores. In this model, obesity reduced MCS by 12.7 points ($p = 0.018$), psychiatric comorbidity reduced it by 11.1 points ($p = 0.013$); and their combination by 19 points ($p = 0.114$). Model p -value: 0.0001, adjusted R^2 : 0.18.

Discussion: The impact of FAI over HRQoL is dependent on the type of patient and not on the extent of intra-articular chondral or labral damage. Patient gender, activity level, obesity and psychiatric comorbidities can influence the HRQoL in FAI patients and should be taken into account at the time of decision making for surgical intervention.

Conflict of Interest in the Assessment of Hyaluronic Acid Injections for Osteoarthritis of the Knee: An Updated Systematic Review

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Introduction: Hyaluronic acid injections have become a popular non-operative treatment for knee osteoarthritis, though the evidence for its efficacy is still debated. Financial conflict of interest related to medical and pharmaceutical research is a widespread concern. The purpose of the present study was to determine what proportion of studies on hyaluronic acid injections for knee osteoarthritis were sponsored by industry and whether the assessments of its efficacy were associated with a financial conflict of interest of the authors.

Methods: We updated the search results of a recent systematic review. PubMed, Embase, Scopus, and Web of Science were searched for prospective, randomized, placebo-controlled trials on hyaluronic acid injections for knee osteoarthritis published since this analysis. The combined search results were reviewed for funding source and financial conflict of interest of the authors. Qualitative conclusions regarding the efficacy were classified as being favorable, neutral, or unfavorable.

Results: Forty-eight studies were identified; thirty (62.5%) were industry funded, and three (6.25%) were not. Fifteen (31.3%) studies did not identify a funding source. A significant association was observed between a reported financial conflict of interest of the author and the qualitative conclusion ($p = 0.018$). None of the studies with a reported financial conflict of interest of at least one author had an unfavorable conclusion; whereas, eleven (35%) of the thirty-one studies with no industry-affiliated authors concluded the effects hyaluronic acid injection for knee osteoarthritis was no more effective than a placebo injection.

Discussion: Most studies on hyaluronic acid injections for knee osteoarthritis are sponsored by industry. Moreover, the qualitative conclusions regarding the efficacy of these products are associated with a financial conflict of interest of the authors. Clinicians should be aware of the financial conflict of interest of the authors reporting on hyaluronic acid injections for knee osteoarthritis and carefully evaluate recommendations from these studies based on the authors' objectivity.

The Rising Incidence of Hip Arthroscopy in the United States

Kevin J. Bozic, MD, MBA, Vanessa Chiu, MPH, **Thomas P. Vail, MD**

Introduction: Hip arthroscopy has been used as a diagnostic and therapeutic tool in the management of hip disease. However, specific indications for hip arthroscopy have not been well defined, and patient outcomes for different indications remain unclear. The purpose of this study was to evaluate changes in the incidence of hip arthroscopy, surgical indications, and complications associated with hip arthroscopy in the United States.

Methods: The ABOS database was used to evaluate the annual incidence of hip arthroscopy among ABOS Part II examinees for calendar years 2006-2010. Procedures were categorized by indication (FAI/OA, labral tear, or Other) and type of procedure (diagnostic hip arthroscopy; hip arthroscopy with removal of loose bodies; hip arthroscopy with debridement, chondroplasty, and/or resection of the labrum; and hip arthroscopy with synovectomy). The rate of surgical complications was calculated and compared between hip arthroscopy procedures performed for FAI/OA and those performed for labral tears using two-proportion z-test.

Results: The overall incidence of hip arthroscopy performed by ABOS Part II examinees increased by over 600% during the 5-year period under study. The most common procedure was hip arthroscopy with debridement, chondroplasty, and/or resection of the labrum. The incidence of hip arthroscopy for FAI/OA increased steadily over the time period under study, while the incidence of hip arthroscopy for labral tears was variable. The rate of surgical complications was 5.9% (30/512) for hip arthroscopy for a diagnosis of FAI/OA vs. 4.4% (22/502) for a diagnosis of labral tear ($p=0.3$).

Conclusions: The incidence of hip arthroscopy has increased dramatically over the past 5 years, particularly for the indication of FAI/OA. Reported surgical complication rates are relatively low. Further study is needed to define the appropriate indications for hip arthroscopy and to compare outcomes, complications, and reoperation rates among patients who undergo hip arthroscopy for different indications.

Clinical Presentation and Imaging Results of Patients with Symptomatic Gluteus Medius Tears

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Introduction: Greater trochanteric pain syndrome (GTPS) is a common complaint. Recently, it has become well recognized that tendinopathy and tears of the gluteus medius (GM) and gluteus minimus tendons are a common cause of recalcitrant GTPS. Nevertheless, the clinical syndrome associated with GM tears is not fully characterized. The purpose of this study is to characterize the clinical history, physical examination, imaging findings, and intraoperative findings associated with symptomatic GM tears.

Methods: We evaluated 47 cases with a confirmed GM tear at the time of surgical repair. Evaluation of the clinical history, and a physical exam was performed. Preoperative pain was estimated on the VAS and four hip-specific scores were administered to evaluate the patient's functional status. The imaging modalities were reviewed and intraoperative findings were recorded.

Results: The average patient age was 54 years (17-76), 33 patients (73%) were over 50 years old and 93% were female. Symptom onset was commonly insidious (75%) and the average time to diagnosis was 28 months (2-240). The most common pain location was the lateral hip (75%), yet many patients had associated pain in the groin and posterior hip regions. On examination, 39 hips (83%) had tenderness with palpation over the greater trochanter, 36 (76%) had a positive anterior impingement test, 33 (55%) had gait abnormalities, 32 (68%) had Trendelenburg sign, and 30 (64%) had abductor muscle weakness. The average preoperative VAS and modified Harris Hip Score (mHHS) was 6.65 (0-10) and 55.5 (12-90), respectively. All patients had pathological findings on MRI ranging from tendinosis to complete tears of the GM tendon.

Conclusion: Gluteus medius tears are increasingly recognized as a cause of hip pain and weakness. These data describe the clinical presentation and imaging results of patients with gluteus medius tears, and may facilitate identification of patients affected by such pathology.

Topical Tranexamic Acid in Total Knee Arthroplasty: A Double-Blind, Randomized, Placebo Controlled Trial

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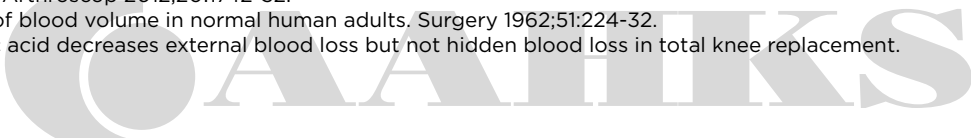
Background: Tranexamic acid (TNA) has been used in multiple surgical specialties in intravenous (IV) and topical form.¹⁻³ There have been several studies evaluating IV TNA and its effect on blood loss in joint arthroplasty.^{4,5} We proposed to further evaluate the effect of topical TNA on postoperative blood loss and transfusion rates total knee arthroplasty (TKA).

Methods: One hundred and one patients were enrolled in a prospective, double blind, placebo-controlled trial. Patients were randomized to topical administration of 2.0 g of TNA in 75 mL of normal saline (50 patients) or saline placebo (51 patients). Medication was applied to the wound bed after component placement. Operative technique, drug administration, and venous thromboembolism (VTE) prophylaxis were standardized. All patients underwent day 2 ultrasound of the operative extremity. Any patient meeting transfusion criteria (symptomatic Hgb <8.0 g/dL or any patient with Hgb less than 7.0 g/dL) was transfused. Postoperative blood loss was calculated with previously validated statistical methods incorporating the patient's body surface area.^{6,7}

Results: Calculated blood loss was significantly lower in the TNA group (940 ± 327 mL) than the placebo group (1293 ± 532 mL)($p < 0.001$). Postoperative hemoglobin was higher in the TNA group (10.9 ± 1.3 g/dL vs. 10.0 ± 1.5 g/dL)($p = 0.004$) and hemoglobin loss was lower in the TNA group (2.5 ± 0.8 vs. 3.3 ± 1.2 g/dL)($p < 0.001$). There were 4 patients (8%) transfused in the placebo group and zero in the TNA group, which was not statistically significant ($p = 0.11$). There was no difference in VTE complications between groups.

Discussion: Topical TNA significantly decreases blood loss in total knee arthroplasty by almost over 350 mL per patient in the perioperative period. Topical TNA is a fast, inexpensive, and efficacious method for decreasing perioperative blood loss in total knee arthroplasty without an increased risk of VTE.

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Economic Impact of Tranexamic Acid in Healthy Patients Undergoing Primary Hip and Knee Arthroplasty

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Introduction: Antifibrinolytic therapy with tranexamic acid (TA) in total joint arthroplasty has been shown to reduce intraoperative blood loss and decrease transfusion rates post-operatively. However, it is unknown if the potential cost savings from decreased OR time, blood transfusions and hospital stay offsets the additional expense of the drug.

Methods: Patients undergoing primary total hip or knee arthroplasty by one of six surgeons at a single institution during 2007-2008 were retrospectively reviewed. Patients with an American Society of Anesthesiologists (ASA) physical status classification of III or greater and another surgery within 90 days were excluded. The estimated mean total direct hospital costs as well subclassification of operating room (OR), blood/lab, room and board, and pharmacy costs were compared between patients who did and did not receive TA. Direct medical costs were calculated by using standardized, inflation-adjusted costs for services and procedures billed during hospitalization and analyzed with student t-tests.

Results: 1018 patients were included with 580 patients who received TA compared to 438 who did not. The mean total direct cost of hospitalization with and without TA was \$15099 and \$15978 ($p < 0.0002$) respectively, a difference of \$879. The operating room cost was \$3418 and \$3640 respectively ($p < 0.0001$). The blood/laboratory cost was \$361 and \$500 ($p < 0.0001$). For room and board, the mean cost respectively was \$2835 and \$3292 ($p < 0.0001$). The only increased cost associated with TA was the pharmacy cost which was \$921 and \$781 respectively ($p < 0.0001$).

Conclusion: The increased mean pharmacy cost was offset by cost savings in OR, blood/laboratory, as well as room and board costs as seen by the statistically significant decreased mean total inpatient cost. Tranexamic acid may be considered for use in total hip and knee arthroplasty patients not only for the presumed benefit of decreased blood loss, transfusion rates and hospital stay, but also for estimated mean hospital cost savings.

One Intraoperative Dose of Tranexamic Acid is Safe and Effective in Revision Total Knee Arthroplasty

Kevin M. Smit, BSc, MD, Douglas Naudie, MD, FRCSC,
Fiona E. Ralley, BSc, MBChB, FRCA, Donna Berta, **James Howard, MD, MSc, FRCSC**

Introduction: Revision total knee arthroplasty (TKA) has been associated with an increased risk of perioperative blood loss requiring transfusions. Tranexamic Acid (TXA) has been proven to be safe and effective in preventing blood loss in primary TKA. Our purpose was to study the effect of TXA on blood loss in revision TKA.

Methods: We performed a retrospective comparative study on 424 patients who had undergone revision TKA between January 2006 and March 2010. 178 patients did not receive TXA while 246 patients received one intraoperative dose of 20 mg/kg of TXA given prior to tourniquet deflation. We then compared change in hemoglobin, transfusion rates, hospital length of stay, and complications between the two groups. No other routine patient care practices or blood conservation program strategies were altered during this time.

Results: There was a significant reduction in hemoglobin (Hb) loss in the TXA group compared to the No TXA group for revision TKA (42316 g/L and 38315 g/L, respectively, $p=0.005$) and a significant reduction in transfusion rates (30.3% and 17.1%, respectively, $p=0.001$) and average amount transfused (1.031.9 units and 0.531.1 units, respectively, $p=0.001$). There was not a significant difference in recorded major adverse events with the administration of TXA (6 and 9 respectively).

Discussion and Conclusion: One 20 mg/kg intraoperative dose of TXA significantly reduced red blood cells loss and transfusion rates in patients undergoing revision TKA compared to a patient cohort whom did not receive the TXA protocol. This single dose protocol was not associated in an increased complication rate.

Transfusion Rates are Increasing following Total Hip Arthroplasty: Risk Factors and Outcomes

Farshad Adib Hadji Bagheri, MD, Wendy M. Novicoff , PhD,
Thomas D. Brown, PhD, **James A. Browne, MD**

Introduction: Despite attempts to minimize exposure to allogeneic blood, there is little data on recent nationwide trends in transfusion following total hip arthroplasty (THA) and no consensus on indications. The purpose of this study was to examine the rate, predictors, and inpatient outcomes associated with transfusion after primary THA.

Methods: This retrospective cohort study analyzed the data collected from US Nationwide Inpatient Sample (NIS) for each year during period 2005-2008 to assess the trends in transfusion in patients whom underwent elective primary THA. Logistic regression models were used to evaluate the predictive risk factors for blood transfusion. The University Hospital Consortium (UHC) database was also queried to examine the variability if rates of transfusion at different academic medical centers.

Results: A total of 129,901 patients were identified in the NIS database. The transfusion rates following THA consistently increased from 18.12% in 2005 to 21.21% in 2008 ($p < 0.0001$). Hospitals in the Northeast and Midwest region had the highest and lowest rates of transfusion, respectively. Significant risk factors for blood transfusion were female gender (odds ratio, OR 2.1), age above 85 (OR 2.9), African-American race (OR 1.7), Medicare payor status (OR 1.6), being at a hospital in the Northeast Region (OR 1.4), the presence of preoperative anemia (OR 1.6), having at least one comorbidity (OR 1.3), and a high Charlson Index score (OR 2.2). Patients receiving blood transfusions had increased in-hospital mortality, longer lengths of stay, and higher total charges compared to non-transfused patients ($p < 0.001$). The UHC database demonstrated that transfusion rates vary widely across different institutions from $< 5\%$ to $> 80\%$.

Conclusion: The incidence of blood transfusion has recently increased following total hip arthroplasty and there is great variability in practice. We identified several patient risk factors along with the morbidity and mortality independently associated with transfusion following THA. Further work is needed to standardize the approach to blood conservation and minimize exposure to allogenic blood.

An Evaluation of the use of Topical Tranexamic Acid in Total Knee Arthroplasty

George F. Chimento, MD, FACS, Tamara Huff, Sheena Babin,
Luci Brandner, Mark S. Meyer, MD, Lock Ochsner

The use of topical tranexamic acid to decrease peri-operative blood loss following total knee arthroplasty (TKA) has increased. To our knowledge, the economic impact associated with its use has not been described. The purpose of this study was to evaluate the effectiveness of topical tranexamic acid in primary TKA from a clinical and economic standpoint. We hypothesized that decreased blood loss would result in cost savings. We retrospectively reviewed 683 primary total knee arthroplasties performed by 3 surgeons at a single institution over a 2-year period. We compared 373 TKA's performed in 2010 without the application of tranexamic acid to 310 TKA's performed in 2011 with the application of tranexamic acid. Demographic data, pre-operative and post-operative hemoglobin, transfusion rates, hospital length of stay, cost, and perioperative complications during the first 3 months were collected. Statistical analysis was performed using two sample t-tests and Fisher's exact tests. There was no difference in age, sex, height, or pre-operative hemoglobin between the two groups. Patients treated with tranexamic acid had significantly higher post-operative hemoglobin ($p < 0.0001$), received significantly fewer transfusions ($p < 0.0001$), had decreased length of stay ($p < 0.0001$), decreased blood bank costs ($p < 0.0001$), increased pharmacy cost ($p < 0.0001$), and decreased total direct cost to the hospital ($P < 0.0001$). The average savings was approximately \$1500 per patient. There were no differences in thromboembolic events or infection. The use of topical tranexamic acid in primary TKA is safe, effective, and results in significant cost savings.

Hemoglobin A1C is a Marker for Surgical Risk in Diabetic Patients Undergoing Total Joint Arthroplasty

Nicholas J. Giori, MD, Alexander Harris

Introduction: Diabetes is a risk factor for postoperative complications following total joint arthroplasty (TJA). Poorly controlled diabetes further increases this risk. It is unclear whether Hemoglobin A1c (HbA1c) can be used to identify patients with elevated postoperative complication risk due to poorly controlled diabetes. The goal of this study was to determine if patients with HbA1c > 7% have elevated risk of complications compared to patients with HbA1c < 7%, after controlling for demographic, clinical, surgical, and medical center effects, and to evaluate the utility of alternative thresholds.

Methods: This retrospective cohort study included 6090 diabetic patients undergoing primary total hip or knee arthroplasty from 2006 to 2009 for a diagnosis of osteoarthritis in the Department of Veterans Affairs system. All had a HbA1c lab value in the 90 days prior to surgery. Pre- and peri-surgical data, and any peri or post-operative complications (yes-no), were obtained from the VA Surgical Quality Improvement Program. Propensity-score weighted mixed-effects logistic regression models were used to estimate risk of complications as a function of HbA1c lab values.

Results: 8.7% of patients with HbA1c > 7% had complications, compared to 7.1% of patients with hemoglobin A1c < 7% (Odds Ratio = 1.24, p = .02). Patients with HbA1c also had 68% increased odds of 30 day mortality (p < 0.05).

Analysis of the functional relationship between hemoglobin A1c and complications revealed little change in the risk of complications with HbA1c less than 6.5%. As HbA1c rose from 6.5% to 7.5%, the risk of complications rose linearly from 8.13% to 9.33%. Risk of complications for patients with HbA1c values above 7.5% continued to rise but at a lower rate.

Conclusion: Pre-surgical HbA1c is significantly related to risk of complications in diabetic patients undergoing joint replacement. Thresholds for delaying surgery for better diabetic control need to balance estimated risks and benefits.

Symposium III

Periprosthetic Joint Infection: The Current State of Affairs

Javad Parvizi, MD, FRCS, Keith R. Berend, MD,
Craig J. Della Valle, MD, Bryan D. Springer, MD



Retrieval Analysis of Fixed versus Mobile Bearing Retrieved Polyethylene Inserts using Laser Scanning Technology

Nader A. Nassif, MD, Kirsten E. Stoner, MEng, Marcella Elpers,
Timothy M. Wright, PhD, Douglas E. Padgett, MD

Introduction: Compared to fixed bearing (FB), the increased conformity in rotating platform (RP) designs is intended to decrease contact stresses and hence polyethylene wear and also provide better load transfer. Implant retrieval analysis can help determine if the implants are behaving as designed. The aim of the study was to evaluate the pattern of wear and deformation of a single-design fixed and mobile bearing total knee implant.

Methods: 30 implants were identified in our institutional retrieval lab. 13 FB and 17 RP design-matched posterior-stabilized components were analyzed. Damage mapping of the articular surface was performed. All retrieved inserts were scanned with a 3D laser digitizer and compared to size-matched pristine inserts. Linear wear of the medial and lateral plateaus as well as deflection of the tibial post were analyzed.

Results: For the FB design, analysis demonstrated a mean wear of the medial and lateral compartment of 0.06330.033 mm/year and 0.04230.030 mm/year, respectively. The RP design demonstrated wear rate of the 0.1130.11 mm/year and 0.1130.11 mm/year for medial and lateral sides respectively. The lateral linear wear rate was less in the FB design ($p=0.02$). Tibial posts deflected more in the FB inserts than the RP inserts. Volume subtraction images correlated areas of material loss to regions of burnishing noted on damage mapping.

Discussion and Conclusion: Laser scanning correlated well with areas of burnishing, a damage mode consistent with abrasive wear. Decreased post deflection in RP inserts supports the design hypothesis that RP find their own axis of internal-external rotation, decreasing post impingement. Higher linear wear rates seen at the condyles suggest RP designs may not provide the inherent benefit of lower wear due to increased conformity but rather may result in substantially increased wear which may result in early implant failure.

Effect of Body Mass Index on Limb Alignment after Total Knee Arthroplasty

Chris Estes, DO, **Kenneth J. Schmidt, MD**, Ryan McLemore, PhD, Henry D. Clarke, MD

Introduction: Prior studies have reported increased failure rates in the obese with postoperative limb mal-alignment after total knee arthroplasty (TKA). This may be due to obesity accentuating the abnormal joint loading attributed to mal-alignment, leading to increased risk of early failure. The effect of increased body mass index (BMI) on the surgeon's ability to achieve neutral postoperative limb alignment is controversial. We were unable to identify adequately powered studies using full length, standing hip to ankle x-rays that investigated this issue. This study was undertaken to determine if a relationship exists between postoperative limb alignment and body mass index in patients undergoing primary TKA, using standard mechanical instruments.

Methods: An IRB approved, retrospective review was performed. All patients undergoing primary TKA by the senior author received pre and post-operative full-length standing AP x-rays of the legs. Surgeries were performed with intra-medullary femoral, and extra-medullary tibial guides. The study group included 196 knees, (112 with BMI <35; 84 with BMI >35, including 36 with BMI>40). The primary outcome was effect of gender, side, preoperative mechanical alignment and BMI on postoperative mechanical alignment via multivariate logistic regression analysis. Secondary outcomes included incidence of mal-alignment (defined as >3° from neutral) in patients with BMI <35 versus those with BMI >35.

Results: Both pre-operative mechanical limb alignment ($p < 0.001$) and BMI ($p = 0.009$) had a significant effect on degree of post-operative limb alignment. Pearson chi squared analysis revealed a strong trend for increased incidence of mal-alignment in patients with BMI > 35 compared to those with a BMI < 35 ($p = 0.077$ (OR 1.75; 95% CI = 0.94-3.26))

Discussion and Conclusion: The degree of preoperative deformity and BMI have a significant effect on postoperative limb alignment in TKA performed with mechanical instruments.

◇Patient Specific Instrumentation versus Large-Console, Computer-Assisted Navigation in Total Knee Arthroplasty

Denis Nam, MD, Patrick Maher, Brian Rebolledo, Alexander McLawhorn, Andrew Pearle, MD

Introduction: Patient specific instrumentation (PSI) in total knee arthroplasty (TKA) has recently been introduced, in which preoperative 3-dimensional imaging is used to manufacture disposable cutting blocks specific to a patient's anatomy. However, early results of PSI, regarding postoperative mechanical alignment, have been equivocal. The purpose of this study was to compare the alignment accuracy of PSI to an imageless, computer assisted surgery (CAS) system in total knee arthroplasty.

Methods: This was a retrospective review of two cohorts. All surgeries were performed by a single surgeon. 37 patients (41 knees) received a TKA using a large-console, imageless CAS system. Subsequently, 38 patients (41 knees) received a TKA using a MRI-based, PSI system. Postoperatively, standing AP hip-to-ankle radiographs were obtained, from which the lower extremity mechanical axis, tibial component mechanical alignment, and femoral component mechanical alignment were digitally measured. Each measurement was performed by two, blinded independent observers, and the interclass correlation for each measurement was calculated. A student's two-tailed t test was used to compare the two cohorts ($p < 0.05$ = significant).

Results: There was no significant difference between the two cohorts regarding preoperative age, BMI, or degree of mechanical deformity.

In the PSI cohort, 70.7% of patients had an overall alignment within 3° of a neutral mechanical axis (vs. 92.7% with CAS, $p=0.02$), 87.8% had a tibial component alignment within 2° of perpendicular to the tibial mechanical axis (vs. 100% with CAS, $p=0.04$), and 90.2% had a femoral component alignment within 2° of perpendicular to the femoral mechanical axis (vs. 100% with CAS, $p=0.2$).

The interclass correlation coefficient for measurement of the postoperative tibial alignment was 0.90, for femoral alignment was 0.88, and for overall lower extremity alignment was 0.91.

Conclusion: While PSI may potentially decrease operative times and increase the cost-effectiveness of TKA, in its current form, PSI is not able to reproduce the same degree of alignment accuracy as CAS techniques.

◇The FDA has not cleared the following pharmaceutical (Pfizer, Cyclokapron-tranexamic acid) for use described in this presentation.



Simultaneous vs Staged Bilateral Total Knee Arthroplasty among Medicare Beneficiaries, 2000-2009

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Introduction: Simultaneous bilateral total knee arthroplasty (TKA) reportedly has higher postoperative complication rates than staged bilateral TKA, but little is known about recent trends in the use and outcomes of these procedures among Medicare beneficiaries.

Methods: In a 5% national sample of fee-for-service Medicare beneficiaries older than 65, we identified patients who underwent elective TKA (CPT code 27447) between 2000 and 2009. We defined simultaneous TKA as either one claim with modifier code 50 or two claims on the same day, one with modifier L (“left”) and one R (“right”). We defined staged TKA as two claims on different days within 365 days, with modifiers L and R. We calculated the annual incidence of the procedures and assessed length of stay; 5-year revision risk; acute (90-day) periprosthetic infection risk; hospitalization for venous thromboembolism and myocardial infarction; and death using Kaplan-Meier methods.

Results: Among 83,441 patients (mean age, 74 years; 35% male; 92% white), we identified 5036 simultaneous TKAs and 3999 staged TKAs. Use of simultaneous TKA did not change over time (3 in 10,000), but use of staged TKA increased from 1.4 to 4.4 in 10,000 between 2000 and 2009. Mean length of stay was 4.4 days (SD, 2.5) for simultaneous TKA and 3.8 days (SD, 1.9) for staged TKA. Simultaneous TKA was associated with higher 90-day risk of death (0.7% vs 0.3%), venous thromboembolism (0.9% vs 0.5%), and myocardial infarction (0.5% vs 0.2%). Infection, revision, and removal rates were similar between the 2 procedures.

Conclusion: Use of staged bilateral TKA increased over time and became more common than simultaneous TKA in 2009. Relative to staged TKA, patients undergoing simultaneous TKA had longer length of stay and higher complication rates except for infection. Further studies are needed to understand the comparative effectiveness of the 2 procedures in elderly patients.

RCT Multicenter Comparison of Primary TKA using Patient Specific versus Conventional Instrumentation

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Introduction: The purpose of this prospective randomized multicenter study was to compare the results of primary TKA using patient-specific (PSI) versus conventional instrumentation (CI).

Methods: A total of 110 patients with a median age of 70 years requiring primary TKA were randomized (power of 80%, alpha of 5%) to undergo surgery using MRI and standing long-leg radiograph PSI (55 patients) or CI (55 patients). The main criterion for evaluation was postoperative mechanical axis measured 3 months postoperatively using Roman software by an independent observer blinded to the instrumentation. Outliers in coronal alignment were defined as $> 3^\circ$. Secondary criteria included surgery time, IKS and Oxford Knee (OK) scores at 3 months, and implants position on plain radiographs.

Results: A total of 93 patients (CI 50, PSI 43) had complete clinical and radiologic data. The median skin-to-skin operative time was 90 versus 100 minutes in the CI and PSI group, respectively ($p=0.67$). The median IKS and OK scores at 3 months were 169.5 and 42 versus 171.5 and 43 in the CI and PSI group, respectively ($p=0.68$ and 0.57). The median HKA value was 178.9 versus 178.1 in the CI and PSI group, respectively ($p=0.08$). Outliers were recorded in 15 of 50 (30%) and 14 of 43 (32.6%) knees in the CI and PSI group, respectively (Chi2, $p=0.34$). There was no significant difference in the coronal alignment of the tibial component between the CI and PSI group (median 90.1 versus 88.9, $p=0.15$). However the coronal alignment of the femoral component was significantly in a varus position in the PSI group (median 90.1 versus 88.9, $p=0.002$).

Discussion and Conclusion: This RCT did not show any advantage of PSI over CI in primary TKA with a significant trend towards varus placement of the femoral component. PSI based on standing long-leg radiograph should be reconsidered.

Risk Factors for Aseptic Revision of Primary Total Knee Arthroplasty

Robert S. Namba, MD, Maria C. Inacio, MS,
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Introduction: The purpose of this study is to perform a multivariate analysis of risk factors associated with primary total knee arthroplasty (TKA) aseptic revisions.

Methods: All primary TKA between 2001 and 2010 were identified using a Total Joint Replacement Registry. Revision risk factors included patient, surgical, implant characteristics, surgeon and hospital volume, and surgeons' training. Descriptive statistics, Kaplan Meier survival curves, and multivariate marginal Cox proportional hazard models were used to evaluate risk factors associated with TKA failure.

Results: 69469 primary TKA cases were followed for a median time of 3.2 years. Patients were predominantly female (63%), white (67%), osteoarthritic (97%), and obese (56% had BMI > =30kg/m²). The mean age was 67 years old (sd=9) and prevalence of diabetes was 26%. The crude revision rate is 2.2% (N=1538) and aseptic revision rate is 1.3% (N=886). The cumulative survival at 8 years is 97.6% (95%CI 97.4%-97.8%). The main reasons for revision were infection (42%), instability (18%), and aseptic loosening (13%). Adjusted multivariable regression models revealed that age, race, diabetic status, bilateral procedures, high-flex implants, and mobile bearing implants are associated with risk of revision. For every 10 year increase in age the risk of revision decreases by 38% (95%CI 33%-42%), $p < 0.001$. Black patients have a 1.8 (95%CI 1.4-2.3) higher risk of revision, $p < 0.001$. Diabetics have a 1.2 (95%CI 1.0-1.4) higher risk of revision, $p=0.0125$. Bilateral procedures have a 35% decreased risk of revision (95%CI 12%-52%), $p=0.006$. High-flex implants have a 1.6 (95%CI 1.2-2.1) increased risk of revision, $p=0.004$. Mobile bearings have a 2.0 (95%CI 1.5-2.7) times higher risk, $p < 0.001$.

Discussion: TKA cumulative survival at 8 years was 97.6%. Patient factors affecting TKA aseptic revision included age, race, and diabetic status. Mobile bearing and high-flex designs were found to be risk factors for aseptic revision.

RSA Analysis of Early Migration of a Short Metaphyseal vs. Standard Length Metaphyseal Cementless Stem: A Prospective Randomized Controlled Trial

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Introduction: The purpose of this study was to compare the early clinical outcomes and micro-motion (using radiostereometric analysis - RSA) of a new short metaphyseal fixation stem (short) to that of a standard length tapered metaphyseal fixation stem (standard) with known long-term clinical success.

Methods: Forty-three patients were enrolled in which twenty-two patients were randomized to receive a short stem while twenty-one patients received a standard stem. All patients received the identical cementless acetabular component. Tantalum beads were inserted at the time of surgery and had been placed on the implant by the manufacturer to allow RSA following surgery. RSA was performed at 48 hours (baseline) and at 6 weeks, 3, 6, 12 & 24 months following surgery. WOMAC, SF-12 and Harris Hip Scores were documented pre and post-operatively.

Results: At average follow-up of 2.5 years (range 2.0 to 3.2 yrs.) the clinical outcome scores were virtually identical between groups and there were no re-operations. RSA demonstrated no significant differences in micro-motion between groups (subsidence 0.8031.41 vs. 0.3730.49 mm, rotation 0.7031.40 vs. 1.7633.48 degrees, and total migration 0.9631.44 vs. 0.7530.87 mm, for the short vs. standard, respectively). After removing the outliers in each group (4 short stem and 3 standard stem with migration greater than 1.0 mm), micro-motion was very low and virtually identical between groups (subsidence 0.1230.09 vs. 0.1930.18 mm, rotation 0.1230.49 vs. 0.5831.00 degrees, total migration 0.2630.11 vs. 0.4330.25 mm, for short vs. standard, respectively).

Conclusion: Overall, the early migration patterns were very similar between stems, thus confirming the hypothesis. However, for the outliers in each group (with total migration of > 1.0 mm) the long-term stability of the stem may not be certain. The introduction of this new shorter stem design can now be supported with RSA data, arguably the best way with which to introduce new technology.

Multi-center Analysis of Clinical Factors affecting Polyethylene Wear in 945 Total Hip Arthroplasties

Charles R. Bragdon, PhD, Christopher J. Barr, BS,

Young-Min Kwon, MD, PhD, FRCS, FRACS, John M. Martell, MD, Henrik Malchau, MD, PhD

Introduction: Polyethylene wear in total hip arthroplasty (THA) has been linked to a number of adverse clinical outcomes. A recent study reported higher wear rates of highly cross-linked polyethylene (HXLPE) coupled with large-diameter femoral heads. This study compares a variety of clinical and demographic variables against polyethylene wear performance in a large cohort.

Methods: Nine centers contributed a total of 945 primary THAs (875 patients) paired with 26, 28, 32 or 36mm femoral heads. All patients had either a Longevity HXLPE liner, a gamma-air-sterilized conventional liner (Gamma-Air), or an N2Vac-sterilized conventional liner (N2Vac). AP-Pelvis radiographs were measured in Martell Hip Analysis Suite at two intervals to calculate cup position and wear rate. Variables analyzed included cup position, polyethylene-type, head size, age, gender, body mass index (BMI), liner thickness, and Harris Hip Score. Significance was assessed using the binary logistic regression method.

Results: 926 hips (856 patients) had sufficient radiographic follow-up, including 744 with Longevity, 144 with Gamma-Air, and 38 with N2Vac. The median wear rate of the Longevity group was significantly different from the Gamma-Air and N2Vac groups (26.033.7Qm/year, 82.039.4Qm/year, 134.9362.3Qm/year, $p < 0.0005$). Increasing head size was observed to contribute to increased wear in both the HXLPE and conventional groups ($p < 0.0005$, $p < 0.05$). Odds-ratio in the HXLPE cohort was 1.51, suggesting a 51% increased risk of higher wear for each 2mm increase in head size. Cup abduction was also significant in the HXLPE group, with cups inclined $> 50^\circ$ contributing to increased wear ($p < 0.05$).

Conclusion: Our results reflect a previous finding that larger head sizes may increase polyethylene wear rates. Furthermore, our observations suggest that over-abducted acetabular cups may also affect HXLPE wear resistance. These results necessitate continuing follow-up of THA patients with HXLPE liners, and reinforce the importance of proper surgical technique in maximizing successful clinical outcomes for THA patients.

What Happens to Serum Metal Ion Levels after a Metal-on-Metal Bearing is Removed?

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Introduction: Serum cobalt (Co) and chromium (Cr) ion levels are commonly used to screen metal-on-metal (MM) hip implants. Elevated levels are concerning to patients due to the potential risk of prolonged systemic exposure. In the current study, we explore the rate of decline of Co and Cr ions after revision surgery.

Methods: Patients were considered for inclusion if they had a unilateral MM hip implant and if their pre-revision serum Co or Cr levels were above 7 Qg/L. Only patients with normal renal function (based on glomerular filtration rate) were included in this study. Co and Cr ion levels were measured using inductively-coupled plasma mass spectrometry. Values were recorded pre-revision and post-revision with serial measurements until levels fell below 7 Qg/L.

Results: 26 patients were identified with average pre-revision serum Co = 58 Qg/L (7.2 Qg/L - 220 Qg/L) and Cr = 21 Qg/L (1.5 ug/L - 61 Qg/L). The rate of decline was significantly faster during the first 6 weeks compared to later intervals for both Co ($p < 0.001$) and Cr ($p < 0.001$). The rates of decline are reported as percent decline per day over the following intervals: 6 weeks Co = 2.15%/day, Cr = 2.07%/day; 12 weeks Co = 1.12%/day, Cr = 1.04%/day; 6 months Co = 0.75%/day, Cr = 0.60%/day; and 12 months Co = 0.36%/day, Cr = 0.23%/day. Overall, the rate of decline of Cr was significantly slower than Co ($p=0.027$). As a result, all patients with starting Cr levels > 15 Qg/L have persistently detectable Cr levels, even beyond one year after revision.

Conclusion: Over the first 6 to 12 weeks after revision, Co and Cr ion levels come down rapidly which means a return to low or undetectable levels for most patients. However, patients with pre-revision Cr levels > 15 Qg/L may show persistently detectable levels even beyond one year after revision.

Trunnion Wear and Corrosion: The Real Issue in Large Head Metal-on-Metal Total Hip Failures

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Introduction: Large head metal-on-metal (MOM) total hip arthroplasties (THA) have demonstrated poor performance and significant adverse local tissue reaction. Increased wear at the trunnion-taper junction may contribute to worse survival and higher revision rates. We assessed the taper junction of retrieved implants following revision of MOM THA to determine damage modes and severity of wear and correlate them with taper geometry, implant manufacturer, and head size.

Methods: 50 large metal-on-metal heads were identified in our institutional implant retrieval system. Female tapers were examined visually for gross wear and deformation of the taper. Discoloration associated with oxidative wear was also recorded. Observed damage and linear wear were then correlated to manufacturer, taper geometry, and head size. Intraoperative tissue destruction was correlated to the observed damage modes.

Results: Gross mechanical damage was found in 16% of examined tapers. Corrosive damage of the trunnion interface was present on 58% of implants demonstrating circumferential discoloration varying in severity. All taper types demonstrated discoloration consistent with corrosive damage. Implants with “11/13” taper geometries had a significantly higher evidence of mechanical wear compared to “12/14” and “Type I” tapers. Implants from all manufacturers demonstrated high incidence of oxidative wear. Linear wear rate did not correlate to head diameter. Patients with more severe tissue destruction (abductor damage and bone loss) had an 80% incidence of corrosive wear at the trunnion junction. Less severe soft tissue damage was associated more with mechanical wear, but had only a 50% incidence of corrosive wear.

Conclusions: Taper-trunnion micromotion and corrosion in large head MOM THA is significantly affected by taper geometries. Nonetheless, corrosive damage is present across all taper designs and implant manufacturers and may result in more tissue damage. Corrosive damage needs to be considered when designing implant systems with modular interfaces to avoid early failures and minimize adverse local tissue reaction.

Ten-Year Outcome of Serum Metal Ion Levels after Primary Total Hip Arthroplasty

Brett R. Levine, MD, Andrew R. Hsu, MD, Anastasia K. Skipor, Nadim J. Hallab, Wayne G. Paprosky, MD, Jorge Galante, MD, DMSc, Joshua J. Jacobs, MD

Introduction: Serum metal ion levels are increased following primary total hip arthroplasty (THA) with all articulation couples. The purpose of this prospective, controlled, longitudinal study was to determine the changes in serum metal ion concentrations in patients with primary metal-on-polyethylene THA at ten-year follow-up.

Methods: Forty patients were included in this study. Ten patients received a hybrid THA consisting of a modular cobalt-alloy femoral stem and head inserted with cement and titanium socket inserted without cement (Hybrid). Nine patients received an extensively-porous coated modular cobalt-alloy stem and head with a titanium socket without cement (CoCr), and eight received a proximally porous-coated modular titanium stem and cobalt-alloy head with titanium socket without cement (Ti). Thirteen patients had no implant and were controls (Control). Blood samples were collected pre-operatively and at 12, 36, 60, 84, 96, 108, and 120 months follow-up. Serum was analyzed for cobalt, chromium, and titanium levels using mass spectrometry. Intergroup comparisons were made with Wilcoxon-Mann-Whitney tests and intragroup comparisons with Friedman tests.

Results: Hybrid THA had cobalt levels 3.2 times higher at 120 months compared with baseline and elevated cobalt concentrations compared with Ti THA at 36, 60, 84, 96, and 120 months ($p < 0.01$). Hybrid THA had chromium levels 3.9 times higher at 120 months compared with baseline, and CoCr THA had chromium levels 3.6 times higher at 120 months than baseline. Serum titanium levels were higher in Ti THA compared to all other groups at all follow-up intervals with levels at 120 months 18 times higher than baseline ($p < 0.01$).

Conclusions: Patients with primary metal-on-polyethylene THA had elevated serum metal ion levels 10 years after surgery. Metal ion release at modular head-neck junctions, rather than passive dissolution from porous in-growth surfaces, was the dominant source of serum cobalt and chromium ions. This study contributes to the understanding of long-term changes in metal ion levels after primary THA and how they are influenced by component composition and taper geometry.

Metal on Metal Hips Surveillance Program: Welsh Experience of 1400 Hips from a High Volume Centre

Ibrahim A. Malek, MBBS, MRCSEd, Amanda C. King, BSc, MB BCh, MRCS (Eng),
Kathleen Lyons, Marcellino Maheson, Stephen A. Jones, FRCS(Orth),
Alun John, FRCS

Introduction: The Medicine and Healthcare products Regulatory Agency (MHRA) in the UK first issued guidance on MoM bearing hips in February 2010 and suggested regular follow up of these patients. We started a designated MoM surveillance for these patients in April 2010.

Methods: All 1324 patients (1442 MoM hips) operated between 2003 and 2009 were invited for follow up in a nurse led clinic. All patients completed various outcome measures including an Oxford hip score and plain radiographs. Blood samples were collected for measurement of plasma cobalt and chromium levels. All symptomatic patients and those with elevated plasma metal ions were reviewed by an arthroplasty surgeon and subsequently referred for Metal Artefact Reduction Sequence (MARS) MRI scan.

Results: Sixty five patients died of natural causes. Ninety one patients declined follow up. Further thirty patients did not respond. Twenty two patients declined blood test. Total 1116 patients (1230 hips) attended and had their metal ions checked. Nine hundred and ninety eight patients had unilateral procedures and 118 had bilateral hip procedures. Several brands of implants were identified. Median oxford score was 41 (Range: 5 to 48). Median plasma cobalt and chromium levels were 3.2 Qg/L (Range: 0.06-335) and 4.0 Qg/L (Range: 0.1-163). Three hundred and fifty one patients (31%) had plasma metal ions more than 7 Qg/L. Four hundred and fifty six MARS-MRI scans have been performed in 388 patients. Positive findings consistent with ARMD were identified in 174 MARS-MRI scans. As of April 2012, One hundred and fifty six hips have been revised or awaiting surgery mainly for Adverse Reaction to Metal Debris (ARMD).

Discussion and Conclusion: This confirms that a well managed, designated MoM surveillance program enabled us to identify the majority of symptomatic patients and institute an appropriate management plan for them.

National Obesity Trends in Total Knee Arthroplasty

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Introduction: Obesity has reached epidemic proportions with over 502 million people classified as obese worldwide. In the United States (US), the age-adjusted obesity prevalence is 32% for men and 36% for women. The osteoarthritis risk is nearly four-fold for obese men and five-fold for obese women, which translates into an increased need for total knee arthroplasty (TKA). Current literature documents increased perioperative complications for obese TKA patients. It is unclear whether this negative impact has been reflected in TKA utilization. The purpose of this study was to evaluate the US national obesity trends of TKA utilization.

Methods: The Nationwide Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality (AHRQ) 2002 - 2009 datasets were merged together to identify 753,268 TKAs. AHRQ defines obesity as a BMI greater than 30. Frequencies and proportions were calculated. Chi-Square was used to determine differences in proportions.

Results: Over the seven year period, obese patients represented 15% of all TKAs. However, the proportion of obese TKA patients nearly doubled ($p < .001$) from 2002 (10.6 %) to 2009 (20%) during this time period. Of the 114,396 obese TKA patients, 20% were done in 2009, compared to 6% in 2002 ($p < .001$). 72% of these patients were female, 57% were under the age of 64. Additionally, 30% of obese patients had greater than 3 co-morbidities, compared to 7% in the non-obese group ($p < .001$).

Discussion: Despite well documented concerns regarding perioperative complications associated with TKA in obese patients, TKA utilization doubled over the seven year period. These data suggest greater proportions of younger patients with greater co-morbidities are undergoing TKA. With greater complication risks, the increasing TKA utilization in obese patients is concerning and warrants increased attention to obesity prevention and management.

Should Patients Undergoing Elective Arthroplasty be Screened for Malnutrition?

Glenn J. Kerr, MD, Max Greenky, BA, Ronald Huang, BS, **Matthew S. Austin, MD**,
James J. Purtill, MD, William J. Hozack, MD, Javad Parvizi, MD, FRCS

Introduction: Association between malnutrition and adverse outcome following surgical procedures is known. The incidence of “malnutrition” and the influence on outcome following elective arthroplasty was investigated in this study.

Methods: Nutritional parameters were measured in 2,161 patients undergoing elective TJA at our institution, including serum albumin and serum transferrin. Demographics, comorbidities, complications were collected. Malnourished set at serum albumin < 3.5mg/dl or serum transferrin < 216mg/dl. The geriatric nutritional risk index (GNRI) was selected to stratify patients into a low, medium and high risk. Logistic regression analysis was used for risk factors of complications.

Results: Incidence of malnutrition was 8.5% (184/2,161). Patients with abnormal serum transferrin or albumin, the complication was 12.0% (22/184) compared to 2.9% (58/1,977) with normal transferrin or albumin ($p < 0.0001$). Postoperative complication rates in patients with a GNRI below 98 (high risk) was 19.1% (9/47) compared to 3.4% in patients with a GNRI above 98 (64/1861) ($p < 0.0001$). The incidence of complications was significantly higher in patients with paradoxical malnutrition at 10.4% (8/77) compared to 3.2% (30/946) in obese patients with normal nutritional values ($p < 0.0001$). Wound and hematoma complications occurred in 3.8% of malnutrition group compared to 0.7% with normal nutrition ($p < 0.0001$). Malnutrition was found to be an independent risk factor for all complication ($p < 0.0001$).

Conclusion: Malnutrition is prevalent in patients undergoing TJA and leads to a significant increase in post-operative complications. In particular patients with obesity and malnutrition (paradoxical obesity) are also at increased risk of complications. Serum albumin and transferrin are useful pre-operative screening labs and are predictive of an increased rate of complications. The GNRI which only requires the patient’s body weight and serum albumin is also a useful screening tool, also predictive of postoperative complications. We recommend that GNRI index be determined in all patients and nutritional parameters measured in those at high risk. The influence of correction of nutritional parameters on outcome following TJA will be determined in a subsequent study.

Differences in Short-Term Complications between Spinal and General Anesthesia for Primary Total Knee Arthroplasty

Andrew J. Pugely, MD, John J. Callaghan, MD, Christopher T. Martin, MD,
Yubo Gao, PhD, Sergio Mendoza-Lattes, MD

Introduction: Spinal anesthesia has been associated with lower DVT rates, shorter operative time, and less blood loss when compared to general anesthesia. The purpose of this study was to identify differences in 30 day perioperative morbidity and mortality between anesthesia choice in patients undergoing TKA who had been entered in The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP).

Methods: The ACS NSQIP database was queried for patients undergoing primary TKA between 2005 and 2010. Patient characteristics, 30-day complications, and mortality were compared. Multivariate logistic regression identified predictors of 30-day morbidity and stratified propensity scores were used to adjust for selection bias.

Results: 14,052 cases of primary TKA were indentified; 6,030 (42.9%) and 8,022 (57.1%) were performed under spinal and general anesthesia, respectively. The spinal group had a lower unadjusted frequency of superficial wound infections (0.68% vs 0.92%; $p = 0.0003$), blood transfusions (5.0% vs 6.1%; $p = 0.0086$) and overall complications (10.72% vs 12.34%, $p = 0.0032$). The length of operation (96 vs 100 minutes; $p < 0.0001$) and hospital stay (3.45 vs 3.77 days; $p < 0.0001$) were shorter with spinal anesthesia. After adjusting for potential confounders, the overall likelihood of complication with general anesthesia was significantly higher (odds ratio 1.129; 95% CI 1.004-1.269). Patients with the highest number of pre-operative co-morbidities demonstrated significant differences (11.63% vs 15.28%; $p = 0.0152$) in short term complication rates. Age, female gender, black race, elevated creatinine, ASA class, operative time, and anesthetic choice were all independent risk factors of short term complication.

Conclusion: TKA patients undergoing general anesthesia had a small, but statistically significant increased risk of complications as compared to patients who received spinals; a difference greatest in patients with multiple comorbidities. In light of these results, surgeons should consider spinal anesthesia in the co-morbid TKA patient.

10-Year Prospective Matched-Pair Wear Analysis of Rotating Platform, Fixed-Bearing and All-polyethylene Designs with Magnetic Resonance Imaging

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Introduction: Several knee simulator studies have shown a decrease in volumetric wear and biologic burden in unidirectional mobile-bearing knees as compared to the fixed-bearing total knee arthroplasty (TKA). However, no significant clinical differences have been shown in level I and II studies at short- to mid-term follow-up. This is the first long-term prospective comparative magnetic resonance imaging (MRI) study to analyze particle-induced synovitis and osteolysis between fixed bearing metal back (FB-MB), all-polyethylene (AP), and rotating platform posterior stabilized (RP-PS) designs in active patients.

Methods: From September 1999 to October 2001, 8 matched-pair analysis of 24 TKAs (18 patients, 3 groups: 8 RP-PS, 8 FB-MB, and 8 AP) was performed. TKAs were matched for age, sex, BMI and UCLA scores. All patients underwent MRI using a standard knee protocol designed to reduce metal susceptibility artifact. Images were evaluated by a senior MRI attending for volumetric measure of synovitis and/or osteolysis, and presence of avascular necrosis, demarcation at the cement-bone interface or fibrous membrane formation.

Results: The mean age was 64.1 \pm 4.7 years (59.5 – 72.7). The mean follow-up was 11.6 \pm 0.7 years (10.2 – 13). The mean UCLA score at the time of surgery was 8.5 \pm 2.6 (5 – 10). Reactive synovitis using MAVRIC (multi-acquisition variable-resonance image combination) pulse sequence measurements was observed in 6 RPs (75%), all 8 FB-MBs (100%), and 6 APs (75%, Table – 1). There was a significant difference between RP and FB-MB in volumetric synovitis (5,469.1 mm³ \pm 5,973.1 mm³ versus 24,498.2 mm³ \pm 22,248.6 mm³, p=0.035). Osteolysis with bone loss more than 4 mm was seen in 3 FB-MBs (2,275.7 mm³ \pm 3,694.8 mm³), one AP (494.9 mm³ \pm 1,399.6 mm³) and none in RP knees. There was no statistical difference for osteolysis between the three designs.

Conclusion: Using MRI, reactive synovitis was significantly less in RP in this matched pair analysis. More osteolysis was noted in FB-MB but did not reach statistical significance.

Pharmacologic Predictors of Post-Operative Delirium (POD) in Total Joint Arthroplasty: A Case-Control Study

Sumon Nandi, MD, William F. Harvey, MD, MSc, Jason C. Saillant, MD,
Anatoly Kazakin, Arjun Kanuri, Carl T. Talmo, MD, Ling Li, Nebh, James Bono

Introduction: Delirium, an acute confusional state, may result in morbidity, mortality, as well as cognitive and functional decline. The incidence of POD approaches 50% among orthopaedic patients. Total joint arthroplasty patients are at increased risk, given their demographics and functional impairment. While patient factors that increase the likelihood of POD are known, pharmacologic agents that may cause delirium following total joint arthroplasty are unknown. Our aim was to explore if anesthetic agents, narcotic pain medications, or benzodiazepines increase the likelihood of POD following total joint arthroplasty.

Methods: A matched case-control design was used to examine risk factors for POD among patients undergoing total hip or knee arthroplasty at our institution from 2006 to 2010. Controls (n=365) were matched at a ratio of 4 controls per case (delirium, n=98) by age, type of surgery, and year performed. Risk factors of interest were anesthetic agents, narcotic pain medications, and benzodiazepines. The risk of POD was assessed utilizing conditional logistic regression models, where outcome was case versus control status. Models were adjusted for gender, pre-operative alcohol use, and pre-operative depression. The power to detect the desired differences was 0.99.

Results: Isoflurane administration increased the likelihood of delirium following total joint arthroplasty (OR 5.75, 95%CI 1.68 to 19.72, $p = 0.005$). Administration of hydromorphone (OR 0.32, 95%CI 0.16-0.64, $p = 0.001$) or morphine (OR 0.34, 95%CI 0.14-0.85, $p = 0.021$) decreased the likelihood of delirium. None of the other narcotics examined affected rate of delirium. Benzodiazepine administration increased the likelihood of delirium (OR 7.82, 95%CI 3.94-15.55, $p < 0.0001$).

Conclusion: Our data suggest isoflurane and benzodiazepines should be avoided during admission for total joint arthroplasty in patients at high-risk for delirium. Hydromorphone or morphine may be considered for post-operative pain control in these patients to minimize the risk of delirium.

Patient Specific Instrumentation does not Shorten Surgical Time: A Prospective, Randomized Trial

William G. Hamilton, MD, Arjun Saxena, MD, Nancy L. Parks, MS

Introduction: Patient-specific instrumentation (PSI) has been developed for total knee arthroplasty (TKA) with several potential advantages over traditional instrumentation (TI). Shortened surgical time, fewer instruments, and improved alignment are some of these proposed advantages. We sought to examine these assertions.

Methods: 52 patients (26 per group) were enrolled in a prospective, randomized trial comparing CT-based PSI with TI. A single surgeon performed the surgeries with the same knee prostheses, and all cases were videotaped to measure the length of surgery and each individual step. Additional bone cuts, size changes, or ligament releases were documented. The number of instrument trays opened for each case was recorded. Post-operative long alignment and lateral radiographs were taken to measure component alignment and mechanical axis in each patient.

Results: Total surgical time was over 4 minutes shorter for patients in the TI group (57.4 minutes vs. 61.8 minutes; $p < 0.01$). The time for the tibial cut was similar in the TI group vs. the PSI group (113 seconds vs. 130 seconds; $p=0.087$), whereas the time for the distal femoral cut was significantly shorter in the TI group (94 seconds vs. 170 seconds; $p < 0.001$). Factors that increased surgical time for the PSI group included downsizing or re-cutting the femur. In cases with no re-cuts or size changes, the mean time of PSI cases was the same as TI cases (57.2 minutes). The number of instrument trays was greater in the TI group (mean 7.3 +/- 0.7 trays vs. 2.5 +/- 1 trays; $p < 0.001$). There was no difference in mechanical alignment between groups on postoperative long alignment radiographs (0.7° valgus +/- 3.1° vs. 0.5° valgus +/- 3.2° , $p=0.77$).

Conclusions: PSI did not shorten surgical time or improve alignment compared with TI in this prospective, randomized trial. Significantly fewer instrument trays were needed for the PSI cases.

Symposium IV

Audience Response Session Practice/Norm/Trends

Daniel J. Berry, MD



Is Increased Modularity Associated with Increased Wear Debris in Metal-on-Metal Total Hip Arthroplasty Devices?

Genymphas Higgs, Josa A. Hanzlik, MS, Gregg R. Klein, MD, Daniel MacDonald, MS, Javad Parvizi, MD, FRCS, Michael A. Mont, MD, Matthew J. Kraay, MS, MD, Clare M. Rimnac, Ph.D., Steven M. Kurtz, PhD

Introduction: Wear debris in MOM THA systems has raised much concern but only recently has clinically significant fretting and corrosion been reported at head-taper junctions of MOM hip prostheses. Our study characterizes taper damage at various modular interfaces in retrieved MOM THA systems and investigates if taper integrity degrades with time in-situ.

Methods and Materials: 106 MOM bearing systems were collected between 2003-2012, yielding 76 heads and 31 stems (22 modular necks) of 7 different bearing designs (5 manufacturers) for analysis. 10 modular CoCr acetabular liners and 5 corresponding acetabular shells were also examined. The predominant revision reason was loosening (n=52) and implantation time averaged 2.2 3 1.8 years (range, 0 - 11.0 years). Explants were cleaned and scored at the head tapers, stem tapers, male neck tapers, modular liners and modular shells in accordance with the semi-quantitative method of Higgs et al. (2012).

Results: Fretting and corrosion were observed on 68 of 76 (89%) head tapers, 21 of 31 (68%) stem tapers, 20 of 22 (91%) male neck tapers, and all modular liners and shells. Damage scores tended to increase with implantation time at the head tapers ($\Delta=0.28$, $p < 0.016$), stem tapers ($\Delta=0.68$, $p < 0.001$), and male neck tapers of modular stems ($\Delta=0.78$, $p < 0.001$). Scores were higher at head tapers paired with modular neck stems than head tapers paired with monolithic stems ($p=0.001$). At the male neck tapers, damage was localized primarily to the curved medial and lateral surfaces of the components. Damage at the shell-liner interfaces was manifested primarily as scratching with discoloration on the backside rim of liners and circular fretting patterns on shells.

Discussion: The various modular components in contemporary MOM THA's are subject to the fretting and corrosion damage that has raised concern at the head-stem interface. This study is limited primarily by the small sample size and the unequal distribution across device designs. Further investigation of modular interface damage is indeed warranted.

Lawrence D. Dorr Award

Risk Factors, Causes, and the Economic Implications of Unplanned Readmissions following Total Hip Arthroplasty

R. Carter Clement, MD, MBA, **Peter B. Derman, MD, MBA,**
Rebecca Speck, MPH, David Flynn, L. Scott Levin, Lee Fleisher

Introduction: With growing national attention on cost containment, payors have become focused on minimizing unplanned readmissions. The purpose of this study is to identify the risks, causes, and financial implications of unplanned readmissions following total hip arthroplasty (THA).

Methods: A retrospective review of 1,599 consecutive hip replacements at our home institution was conducted using clinical and administrative data. Hospital gross profit (revenues less direct costs) was calculated for each patient using estimated Medicare reimbursement (based on MS-DRG weights) and internal cost data. Breakeven analysis was performed to assess the impact of potential reimbursement changes.

Results: A 30-day readmission rate to our hospital of 6.50% was observed. Increased readmission rate was associated with increased age ($p=0.004$), length of stay ($p<0.001$), and body mass index ($p<0.001$). Gender, race and revision were not significantly associated with readmissions. The most common re-admitting diagnoses were post-operative infection (causing readmission after 1.19% of cases), inflammatory reaction to the prosthetic (0.75%), pain ($p=0.69\%$), and hematoma (0.44%). Deep vein thrombosis caused readmission after 0.13% of cases.

It costs our hospital \$17,653 to care for the average THA patient, and an average profit of \$2,828 is generated through Medicare reimbursement. In the current payment paradigm, re-admitted patients are \$1,135 less profitable than their counterparts who were not re-admitted ($p=0.045$). If CMS stops reimbursing for orthopaedic readmissions, our hospital can expect an average loss of \$12,157 for episodes of care involving readmissions – even before considering variable costs. In that scenario, our program would need to hold the readmission rate under 22.5% to cover its direct costs.

Conclusion: Data from our institution suggests that total hip arthroplasty patients with unplanned readmissions are more expensive and less profitable for hospitals. If our findings are generalizable to US hospitals, hospitals will begin sustaining negative contribution margins for readmitted arthroplasty patients if CMS extends its new reimbursement policies.



Dexamethasone Reduces Length of Hospitalization and Improves Postoperative Pain and Nausea after Total Hip Arthroplasty: A Prospective, Randomized Controlled Trial

Jeffrey R. Backes, MD, Joel Politi, Bryan Chambers, Jared Bentley

Introduction: Controlling postoperative pain and nausea after total hip arthroplasty (THA) remains an important challenge. We hypothesized that dexamethasone given intraoperatively and twenty-four hours postoperatively would reduce opioid consumption and pain scores, reduce rescue antiemetic use, improve mobilization, and shorten hospital length of stay (LOS).

Methods: A prospective, randomized controlled trial was conducted September 2011 through February 2012 within one hospital system. Forty-five patients undergoing THA were randomized into one of three groups: Group 1 (16 patients) received Zofran 4 mg IV intraoperatively, group 2 (12 patients) received Zofran 4 mg IV and Dexamethasone 10 mg IV intraoperatively, and group 3 (17 patients) received Zofran 4 mg IV and Dexamethasone 10 mg IV intraoperatively and a second dose of Dexamethasone 10 mg IV twenty-four hours after surgery. Patients on chronic corticosteroid medications, immunosuppressed hosts, and diabetics with Hg A1c > 7.5 were excluded. Postoperative outcomes included analgesic consumption and pain scores, antiemetic consumption and nausea scores, distance ambulated, and hospital length of stay.

Results: Demographic data were comparable between groups. Groups receiving dexamethasone (groups 2 and 3) had lower pain and nausea scores, less patient controlled analgesic (PCA) consumption, less opioid consumption on postoperative day (POD) 1, 2, and 3, less in-hospital antiemetic consumption, and shorter LOS ($p < 0.05$). Distance ambulated was greater in the dexamethasone groups ($p < 0.05$). The group receiving a second dose of dexamethasone twenty-four hours postoperatively (group 3) used less opioids and reported better pain scores on POD 2 and had an even shorter LOS when compared to groups 1 and 2 ($p < 0.05$). There was no difference in adverse events between groups (power = 0.9).

Conclusion: Perioperative use of dexamethasone reduces pain, opioid consumption, nausea, antiemetic consumption, improves postoperative mobilization, and shortens LOS after total hip arthroplasty. A second dose of dexamethasone twenty-four hours postoperatively provides additional pain control and further reduces LOS.

Symposium V

CMS THA/TKA Audits: What you Need to Know

MODERATOR: David A. Halsey, MD

Multi-stakeholder Perspective - Physician, Hospital, Regulator and Payors



Periprosthetic Joint Infection: A Fatal Condition?

Benjamin Zmistowski, BS, Joseph A. Karam, MD, Joel Durinka,
David Casper, **Javad Parvizi, MD, FRCS**

Background and Rationale: Periprosthetic joint infection (PJI) continues to complicate an otherwise successful joint replacement. The management of this condition often requires multiple surgical procedures associated with increased complications and morbidity. This study examines (a) the effect of PJI on mortality and (b) any predictors of mortality in patients suffering PJI.

Methods: 436 patients with at least one surgical intervention secondary to confirmed PJI were compared to 2,342 patients undergoing aseptic joint revision. The rate of mortality at 30 days, 90 days, one year, and two years after surgery was assessed. Multivariate analysis was used to determine the independence of PJI in predicting mortality. Potential predictors of mortality investigated included age, gender, ethnicity, number of joint-related procedures, type of joint, age-independent Charlson Index, infecting organism, and specific comorbidities.

Results: Mortality was significantly greater in patients with PJI versus aseptic revision at 90 days (3.7% vs. 0.8%), at the first-year (10.6% vs. 2.0%), and second year (13.6% vs. 3.9%), respectively ($p < 0.001$). After controlling for age, gender, ethnicity, number of procedures, joint, and Charlson Index, PJI was associated with four-fold increase in mortality compared to patients undergoing revision surgery for aseptic failures. In the PJI population significant predictors of mortality were advanced age ($p < 0.001$), higher Charlson Index ($p < 0.001$), history of cerebrovascular accident ($p < 0.001$), Gram-negative PJI ($p=0.02$), cardiovascular disease ($p < 0.001$), and gastrointestinal disease ($p < 0.001$).

Discussion: These results implicate PJI as an independent predictor of mortality. After controlling for confounding factors the risk of first-year mortality was four times greater in patients suffering PJI than those undergoing aseptic joint revision. Within the PJI cohort, markers of poor systemic health were recognized as predictors of mortality. PJI is a devastating complication that severely limits joint function and is consistently difficult to eradicate. In addition, surgeons must be cognizant of the systemic impact of PJI and its influence on fatal outcome in one-tenth of patients.

Postoperative Infections Associated with Allogeneic versus Autologous and No Blood Transfusions after Orthopaedic Surgery

Richard J. Friedman, MD, FRCSC, Martin Homering, Susanne Hess, Scott D. Berkowitz, MD

Introduction: Between 30% and 45% of patients who undergo total hip arthroplasty (THA) or total knee arthroplasty (TKA) receive blood transfusions, but questions remain regarding the risk of postoperative infection associated with different types of transfusion. This analysis assessed the hypothesis that higher infection rates may result after allogeneic blood transfusion.

Methods: In a post hoc analysis of 12,177 patients undergoing THA or TKA enrolled in the RECORD program, the rate of infection in patients receiving no transfusion (n=6313), autologous blood only (n=1902), or allogeneic transfusion (with or without autologous transfusion; n=3962) was investigated. Adverse events were classified (Medical Dictionary for Regulatory Activities) and captured up to 2.0 months after THA and 1.5 months after TKA. P-values were derived from logistic regression with adjustment for age, gender, type of surgery, BMI ≥ 40 kg/m², geographic region, and operation duration.

Results: The incidence of 'any infections and infestations' was significantly higher in the allogeneic (9.9%) compared with the autologous (7.3%) group; p=0.003; there was no significant difference in incidence between autologous and no transfusion (7.3% vs 8.0%; p=0.516). The incidence of 'lower or upper respiratory tract and lung infections' (2.1% vs 1.3%; p=0.023) and other infections (3.0% vs 1.9%; p=0.010) was significantly higher in the allogeneic group compared with the autologous group; there was also an increase in the incidence of 'wound inflammation or infection' (2.4% vs 1.7%) and 'bone and joint infections' (0.4% vs 0.1%).

Conclusion: This post hoc analysis of data from the RECORD program showed that allogeneic blood transfusion after TKA or THA was associated with an increased risk of infection compared with autologous transfusion. Autologous and no transfusion had a similar risk of infection.

Should Draining Wounds and Sinuses Associated with Hip and Knee Arthroplasties be Cultured?

Matthew W. Tetreault, BA, Nathan G. Wetters, BS, Vinay K. Aggarwal, John Segreti, MD, James I. Huddleston, MD, Javad Parvizi, MD, FRCS, Craig J. Della Valle, MD

Introduction: Obtaining cultures from a draining wound or sinus tract after total joint arthroplasty is controversial. While some believe valuable information can be gained, others think such cultures lead to confusion and the treatment of non-pathogenic bacteria from the skin. The purpose of this study was to evaluate the value of superficial wound cultures in the diagnosis and treatment of periprosthetic joint infection (PJI).

Methods: Fifty-five patients with a draining wound or sinus after total joint arthroplasty (28 hips, 27 knees) and off of antibiotics for at least 2 weeks were prospectively studied. Superficial wound swab cultures were compared to intra-articular cultures to determine accuracy in isolating infecting organism(s). An infectious disease specialist determined how often erroneous wound cultures would have led to a change in antibiotic treatment. The study was initially powered to test the non-inferiority of wound cultures to intra-articular cultures in diagnosing PJI.

Results: Superficial cultures were concordant with intra-articular cultures in only 26 of 55 cases (47.3%; 95% CI 34.7% to 60.2%). In 23 cases (43.4%), superficial cultures generated additional organisms (false positives), while in 10 cases (18.9%), they failed to recognize any or all infecting organisms identified on deep cultures (false negatives). Superficial samples were significantly more likely to generate polymicrobial cultures (27.3% vs. 10.9%; $p = 0.023$) and yielded bacterial growth in 8 of 10 cases (80%) when deep cultures and further work-up suggested absence of deep infection. In 23 of 55 cases (41.8%), superficial culture results would have changed preferred antibiotics when compared to intra-articular cultures.

Conclusion: Cultures from draining wounds or sinuses can often confound diagnostic, antibiotic, and surgical decision-making in the setting of possible PJI. Potential fiscal and clinical ramifications of these culture results are substantial. We thus discourage the obtainment of superficial cultures in the evaluation of patients with drainage after total joint arthroplasty.

Infection following Simultaneous Bilateral Total Knee Arthroplasty

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Introduction: The purpose of this study was to compare the incidence of infection between patients undergoing simultaneous bilateral TKA(SBTKA), staged(in two separate admissions within 1 year) or unilateral TKA(UTKA) with a minimum follow-up of one year after the index procedure.

Methods: Between 2000 and 2009, all patients undergoing SBTKA, staged or UTKA at a single institution were retrospectively reviewed. Demographics, comorbidity, ASA score, time to infection, and type of microorganism isolated were compared.

Results: During the study period, 2,841(14%) patients underwent SB, 1,128(6%) staged, and 15,568(80%) UTKA. The overall infection rate following SBTKA(0.7%) was lower compared to staged(1.5%) or UTKA(0.9%) ($p=.03$). The in-hospital infection rate was lower for the SB group (0.39% vs 1.0% vs 0.45%, respectively, $p=.01$). There were no significant differences in infected patients' demographics among 3 groups. The rate of late infections was comparable between the groups(0.35%, 0.44%, and 0.44%, respectively, $p=.67$). Among patients with late infection, age, gender, proportion of patients with ASA score 3 or 4, time to infection, and most common organism isolated were not significantly different between the groups. Among 36 infected patients (acute and late) after SB or staged TKA, two SB patients(10.5%), and 2 staged(12%) had bilateral involvement($p=1.0$). Of all infected cases, after staged BTKA 5 (30%) involved the side performed first, compared to 14 (67%) after SBTKA($p=.04$). A multivariable regression model showed that each additional hospital day increased the risk of infection by 28% (OR: 1.267, 95% CI 1.230-1.306, $p < .0001$). Patients undergoing UTKA were nearly twice as likely to develop infection compared to SBTKA patients (OR: 1.987, 95% CI 1.220-3.235, $p=0.26$), while staged ones were almost 3 times more likely (OR: 2.617, 95% CI 1.360-5.035, $p=.02$).

Conclusion: In appropriately selected patients, SBTKA demonstrates an advantage over staged and maintains the safety profile of unilateral approaches with respect to infectious complications.

Multiple and Prolonged Cultures for Hip and Knee Revision Arthroplasty: Impact on Clinical Care

Alexander M. DeHaan, MD, Michael Kuhne, Yee-Cheen Doung,
James Hayden, MD PhD, Thomas Huff, Pen Barnes, MBBS, PhD, Kathryn Schabel

Introduction: Skin flora organisms (SFOs) isolated from 1 or 2 biopsies during hip and knee revision arthroplasty are difficult to distinguish as contamination or infection. This study examined the change in microbiological diagnosis and resultant antibiotic treatment when the number of intra-operative tissue cultures held for prolonged anaerobic incubation was increased from 1-2 to 5 or more.

Methods: A cohort of patient cases was constructed from a 15 month retrospective chart review. Inclusion criteria were patients undergoing hip or knee revision arthroplasty who had ≥ 5 separate biopsies taken in the operating room. Each biopsy was separately cultured for 10 days, with no patients receiving antibiotics in the month prior to surgery. Coagulase negative Staphylococcus, Corynebacteria and Propionibacteria were defined as skin flora organisms. Infection was defined as ≥ 3 biopsies growing the same SFO, or any positive biopsy with a virulent organism. 1-2 biopsies growing SFOs were defined as contaminant. Patient outcomes were reviewed one year post-operatively.

Results: Seventy-seven cases in 73 patients fulfilled the inclusion criteria. When compared to obtaining one culture, this protocol altered the microbiological diagnosis in 34% of hip and knee arthroplasty revision cases (95% Confidence Interval (CI): 23%-45%). Seven cases of cultured SFOs were defined as true pathogens, 11 cases of SFOs were defined as being contaminants, and 8 cases of virulent organisms were identified that may have been missed with only one culture. The antibiotic management was altered in 30% of cases (95% CI: 20-41%). Five of 7 cases of SFO infection had antibiotics specifically targeting the SFO, 10 of 11 cases of SFO contaminants avoided antibiotics, and all 8 cases of virulent organisms that may have been missed with only one culture received antibiotics. Additionally, joint sterility was predicted in 95% of culture negative cases (95% CI: 85-99%).

Conclusion: The addition of 5 or more tissue biopsies held for prolonged incubation appeared to be a powerful tool to help differentiate between joint infection, contamination, and sterility. The protocol was continued at our institution.

Staphylococcus Decolonization in Total Joint Arthroplasty is Effective

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Peter Xu, Nalini Rao, Brian Klatt, MD

Introduction: To prevent surgical site infections (SSIs) after total joint arthroplasty (TJA), patients have been routinely screened for MRSA/MSSA and are decolonized prior to surgery if positive. The purpose of our study was to determine if current treatment protocols result in successful decolonization of MRSA/MSSA in TJA patients.

Methods: A prospective study was conducted on 106 patients (109 joints, 47 hips/62 knees) undergoing elective TJA at a single institution. Patients were screened for nasal MRSA/MSSA colonization 2-6 weeks prior to surgery (average 35.1days/318.5). Those who were positive underwent decolonization using a standardized treatment protocol of intranasal mupirocin twice a day and chlorhexidine body wash daily 5 days prior to surgery. Patients were then reswabbed on the day of surgery to determine if the decolonization protocol was effective. Pre-operative swabs were compared to operative swabs using the McNemar test.

Results: For pre-operative nasal swabs, 26 joints (23.9%) were positive for MSSA colonization and 5 joints (4.6%) were positive for MRSA colonization. On the day of surgery, 10 joints (9.2%) were positive for MSSA colonization and 0 joints were positive for MRSA colonization. The reduction in MSSA colonization was significant ($p = 0.004$), while the eradication of MRSA colonization approached statistical significance ($p = 0.063$). The compliance rate was 97%.

Patients were followed for an average of 131.5 days, during which only one patient developed a periprosthetic joint infection (PJI). This patient had a negative MRSA/MSSA screen both pre-operatively and on the day of surgery, but developed a MRSA PJI. This patient was successfully treated with two-stage exchange arthroplasty and intravenous antibiotics.

Conclusion: The results of our study demonstrate that current decolonization protocols using intranasal mupirocin and chlorhexidine washes are effective for reducing MRSA/MSSA colonization, but do not completely eradicate MSSA from the nares. Future actions should be taken to further reduce bacterial burden prior to TJA.

Comparison of One- versus Two-stage Revision Results for Infected Total Hip Arthroplasty

Ho-Rim Choi, MD, Young-Min Kwon, MD,
Andrew A. Freiberg, MD, Henrik Malchau, MD, PhD

Introduction: While a number of studies have reported successful infection control by one-stage revision, there is paucity of data regarding comparison between one- and two-stage revision for infected total hip arthroplasty (THA). The purpose of this study was to compare the patient characteristics and treatment outcomes between one- and two-stage revision procedures for infected THA.

Methods: From January 1999 to December 2009, 83 patients of infected total hip arthroplasty treated by implant removal and staged revision were retrospectively analyzed. Clinical characteristics and treatment outcomes were compared between three groups: 17 one-stage revisions (one-stage group), 44 two-stage revisions with second stage reimplantation (two-stage reimplanted group), and 22 planned two-stage but no reimplantation (two-stage non-reimplanted group). The mean followup period was 61 months (range, 12-132 months).

Results: There was no significant difference in preoperative laboratory data and patient characteristics between the three groups except higher incidence of draining sinus in the two-stage non-reimplanted group ($p=0.02$). The rate of infection control was 82% (14/17) in the one-stage group, 75% (33/44) in the two-stage reimplanted group, and 68% (15/22) in the two-stage non-reimplanted group ($p=0.60$). The mean of latest Harris hip score was 77, 60, and 58 ($p=0.14$), and the UCLA activity score was 4.0, 4.2, and 3.6 ($p=0.74$) for each group, respectively.

Conclusion: In the present study, one- versus two-stage treatment had similar results in terms of patient characteristics and clinical outcomes including infection control. Our data suggest that one-stage revision arthroplasty can be a treatment option in selected cases of infected THA with a satisfactory infection control rate and functional outcomes comparable to that of two-stage revision.

Symposium VI

Contemporary Concepts in Hip Preservation Surgery

Moderator: John C. Clohisy, MD

Patient Evaluation - Rafael J. Sierra, MD

Hip Arthroscopy - William A. Jiranek, MD

Surgical Hip Dislocation - Paul E. Beaulé, MD

Periacetabular Osteotomy - John C. Clohisy, MD

Surgical Decision-Making for Successful Outcomes - Christopher L. Peters, MD



Increased Complications following Total Hip Replacement after Cephalomedullary Fixation for Intertrochanteric Hip Fracture

Christine M. Pui, MD, Mathias Bostrom, MD,
Geoffrey H. Westrich, MD, Craig J. Della Valle, MD, William B. Macaulay, MD,
Michael A. Mont, MD, Douglas E. Padgett, MD

Introduction: Cephalomedullary devices (CMN) have increasingly popular as treatment for intertrochanteric hip fractures compared to sliding hip screw and side plate (SHS) devices. Despite operative treatment, some fractures lead to degenerative disease and ultimately require hip replacement. Conversion to total hip arthroplasty (THA) is a reasonable option; however, surgery is considered technically more difficult than primary THA, can utilize significantly more operating room time, and may be associated with a greater risk for complications.

Methods: We performed a multi-institutional retrospective review study where computerized databases from 1999 to 2009 were analyzed. There were 91 hips in 91 patients identified who underwent conversion THA following treatment of intertrochanteric hip fracture with SHS or CMN devices. Sixty patients with prior SHS devices and 31 patients with prior CMN devices were converted to THA. Average length of follow-up was 37 and 35 months, respectively.

Results: Harris Hip Score improved from 41.6 preoperatively to 83.6 at final follow-up in the SHS group and from 41.6 to 78.6 in the CMN group, with no significant difference at final follow-up between the two groups ($p=0.23$). However, the complication rate in converted CMN patients was significantly higher at 41.9% compared with 11.7% in converted SHS patients ($p < 0.001$). When we looked at orthopaedic complications specifically, the CMN group sustained twice as many complications compared with the SHS group. Complications included periprosthetic fractures, dislocations, infection, nerve injury, and heterotopic ossification. Medical complications included pulmonary embolism, postoperative atrial fibrillation, acute renal failure, cerebral vascular accident, post-operative gastrointestinal bleed and urinary tract infections.

Conclusion: Conversion to total hip arthroplasty is a good option for failed fixation of intertrochanteric fractures. However, prior fixation with CMN may be associated with significantly higher total and orthopaedic complication rates during conversion THA, as compared to prior fixation with SHS devices.

A Randomized Trial Comparing Acetabular Component Fixation of Two Porous Ingrowth Surfaces using RSA

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Abigail E. Thompson, RN, BScN, CTC, Xunhua Yuan, David Holdsworth,
Robert B. Bourne, MD, FRCSC

Introduction: Several new porous ingrowth surfaces for acetabular component fixation have recently been developed. The purpose of this study was to compare the in vivo acetabular fixation achieved by two different porosity ingrowth surfaces using radiostereometric analysis (RSA).

Methods: Sixty-two patients undergoing primary THA were randomized to receive a cementless acetabular component with either a 61% high porosity asymmetric titanium porous surface or a 45% low porosity sintered bead porous surface. Clinical, radiographic, and RSA examinations were done 6-weeks, 3-months, 6-months, 1-year and 2-years post-operatively.

Results: The two patient cohorts were similar in terms of gender (69% female), age (mean of 75 years), and body mass index (mean of 28). Of the 62 enrolled patients, three patients have died from unrelated causes, three patients were withdrawn from the study due to poor bead visualization, three patients refused further participation for medical reasons, two patients were lost to follow-up, and one patient had an acetabular fracture after 6 weeks and is being treated non-operatively. At 2-year follow-up, the “X,” “Y,” and “Z” axis translations for High porosity were 0.0130.28, 0.0430.20, and 0.0030.63 mm, and for Lower porosity were -0.1630.33, 0.1530.17, and 0.1530.48 mm; the “X,” “Y,” and “Z” rotations for High porosity were 0.4231.42, -0.0330.67, and 0.1730.63 degrees, and for Lower porosity were 0.1330.74, 0.0630.56, and -0.1030.57 degrees. There was no statistically significant difference ($p=0.66$) in total 3D translation between groups (High porosity 0.4930.51 and Lower porosity 0.5530.33). Curiously, there was a statistically significant difference ($p < 0.05$) in WOMAC pain scores between the two groups (High porosity 84.07319.32 versus Lower porosity 93.91312.70) at 2 years.

Discussion: Both the high porosity and lower porosity surfaces provided excellent biologic fixation.

A Comparison of Modular Tapered versus Cylindrical Stems for Complex Femoral Revisions

Matthew W. Tetreault, BA, **Hany S. Bedair, MD**, Robert E. Mayle, MD, Horim Choi, MD, Daniel B. Abbott, BA, Scott M. Sporer, MD, MS, Craig J. Della Valle, MD

Introduction: The use of modular stems in revision THA has increased in recent years. It remains unclear whether the implant's distal geometry affects clinical outcomes. The purpose of this study is to compare the results of femoral revisions with modular tapered versus modular cylindrical titanium stems in Paprosky type III/IV femoral defects.

Methods: A multicenter review of 105 femoral revisions in 104 patients with Paprosky III/IV defects, revised using modular titanium stems, was performed at an average of 5 years (range 24-139 months). A continuous unselected group of 61 hips at one institution received tapered stems while 44 hips at another center received cylindrical stems. Patient demographics, femoral defect, revision rate, stem subsidence, periprosthetic fracture, implant fracture and Harris hip scores were compared between groups.

Results: The average age, gender, and BMI were similar between groups ($p > 0.05$). There were 65 hips with Paprosky IIIA, 27 with IIIB and 13 with IV femoral defects; the tapered group had more IIIB and IV defects (51% vs. 20%; $p=.0009$). The overall rate of re-revision for aseptic loosening or stem fracture was 13.6% in the cylindrical group (6.8%, 6.8% respectively) compared to 0% in the tapered group ($p=.009$). Subsidence averaged 1.5 mm (range, 0-17 mm) in the cylindrical group and 3 mm (range 0-34 mm) in the tapered group ($p=.021$). Bone ongrowth for cylindrical stems was 63.6% compared to 98.4% for tapered stems ($p < .0001$). There were 3 periprosthetic fractures in the cylindrical group compared to 2 in the tapered group ($p=.6474$). Follow-up mean Harris Hip Score was similar between groups at 68.2 (tapered) vs. 75.3 (cylindrical; $p=.210$).

Conclusion: Modular tapered distal stems were associated with lower rates of stem failure and improved bone ongrowth compared to stems with cylindrical geometries despite being used in femurs with greater defects.

Reconstruction of Failed Hip Abductors following Total Hip Arthroplasty – A New Surgical Technique using Graft Jacket Matrix

Biyyam M. Rao, FRCS [Orth], John Vafaye, Lee Taylor, Tamer Kamal

Introduction: Avulsion of hip abductors is a debilitating complication after total hip arthroplasty performed through a trans-gluteal approach. It results in intractable pain, Trendelenberg limp and instability.

Objectives: The aim of our study was to assess a new surgical technique using a modified trans-osseous repair augmented with a Graft Jacket allograft acellular human dermal matrix (Graft jacket; Wright Medical Technology, Arlington, TN).

Patients and Methods: In this prospective study we include 22 patients with hip abductor avulsions following a primary total hip arthroplasty through Hardinge approach presenting with lateral hip pain and a significant Trendelenberg limp. Clinical diagnosis was confirmed by MRI scans.

Surgical Technique: Surgical procedure was performed at mean of 14 months following index procedure. Combined aponeurosis of the Gluteal Medius and Minimus was mobilised from the bony bed of ilium to permit its advancement onto the trochanter. The conjoint Gluteus Medius and Minimus insertion was affixed to the greater trochanter with No.5 non absorbable trans-osseous suture using a Krackow stitch through a series of transverse tunnels made in greater trochanter. An on lay augmentation of the repair at osseo-tendinous junction was performed using a Graft Jacket matrix.

Results: At mean follow up of 34 months, pain improved in all patients with mean VAS improving from 8.25 to 2.33 (p value-0.05). All the patients had improvement in their abductor strength with MRC grade 4 out of 5 in 18 patients and 3 out of 5 in 4 patients. Mean Harris hip score improved from 34 to 82 (p value-0.001). Mean SF-36 Physical Component score was 53.47 and Mental Component score was 56.07 with improvement in gait in all patients.

Conclusions: The Graft Jacket Matrix provides biological bridging and acts as a scaffold allowing cellular and vascular in-growth and constructive tissue remodelling between the hip abductors and its insertion. This allows earlier recovery enhancing the mechanical strength of repair without any donor site morbidity.

Risk Factors for Early Revision following Primary THA in Medicare Patients

Kevin J. Bozic, MD, MBA, Edmund Lau, MS, Kevin L. Ong, Ph.D., Vanessa Chiu, MPH, Steven M. Kurtz, PhD, Thomas P. Vail, MD, Harry E. Rubash, MD, Daniel J. Berry, MD

Introduction: Patient, surgeon, health system, and device factors are all known to influence outcomes in total hip arthroplasty (THA). However, patient-related factors associated with an increased risk of early failure are poorly understood, particularly in elderly patients. The purpose of this study was to identify specific demographic and clinical characteristics associated with an increased risk of early revision in Medicare THA patients.

Methods: The Medicare 5% sample was used to calculate the relative risk of revision TKA within 12 months following primary THA as a function of baseline medical comorbidities in 56,030 Medicare patients between 1998 and 2010. The impact of 29 co-morbid conditions on risk of early revision was examined using Cox regression, controlling for age, sex, race, Census region, socioeconomic status, and all other baseline comorbidities. Adjusted hazard ratios were constructed for each condition, and Wald's χ^2 statistic was used to rank the degree of association of comorbidities with the risk of early revision.

Results: The most significant independent risk factors for early revision THA (in order of significance, $p < 0.040$, for all comparisons) were depression (adjusted hazard ratio [HR] = 1.64; 95% confidence interval [CI], 1.39 to 1.93), rheumatologic disease (HR = 1.32 95% CI, 1.11 to 1.57), psychoses (HR = 1.34; 95% CI, 1.08 to 1.68), renal disease (HR = 1.29; 95% CI, 1.06 to 1.58), urinary tract infection (HR = 1.15; 95% CI, 1.01 to 1.32), and congestive heart failure (HR = 1.20; 95% CI, 1.01 to 1.43).

Conclusions: Depression, rheumatologic disease, psychoses, renal disease, urinary tract infection, and congestive heart failure were associated with an increased risk of early revision following primary THA in Medicare patients. This information is important when counseling elderly THA patients regarding the risk of early failure, and for risk-stratifying publicly reported outcomes in Medicare THA patients.

“Cup within a Cup” Technique in Revision Hip Arthroplasty

Steven H. Weeden, MD, Alan G. Anz, MD

Instability and large pelvic defects are increasing in volume every year. The author has been using a technique for the past 7 years to restore modularity and or provide a large head construct in complex revision hip surgery in younger patients or patients with older femoral technology. This study reviews the technique and the early results.

45 acetabular hip revisions were retrospectively reviewed and have been followed for an average of 7.2 years (range, 6-9). Each revision included either a large metal-on-metal (7) shell or a modular cup with polyethylene (38). These cups were cemented inside of a large nonmodular tantalum revision implant. All cases were Paprosky type 3 defects. The patient average age was 57.4 years. Most patients now ambulate unassisted or with a cane. Two patients have been revised for infection. One patient has been revised for recurrent instability. There have been no cases of aseptic loosening or other major complications. The hip center was restored to within 1.5 cm in all cases. In 24 cases the femoral component was stable and maintained with either a large head or a tripolar construct.

The results from this study suggest that a “cup within a cup” technique may provide a viable revision option for younger patients and patients with severe acetabular defects. It allows less revision of the femur due to older technology and or lack of offset. To the authors knowledge there are few papers that discuss this technique. Other than the increased cost of the implants, the “cup within a cup” technique provides an option to restore modularity in younger patients and/or provide a large head construct in an effort to decrease instability in this difficult revision group. In selected patients, this procedure may allow for an advantage over traditional revision THA. Longer follow-up is needed to determine the success over 10 to 15 years.

Symposium VII

Are All Total Joint Replacements the Same? Or Do We Need an Arthroplasty Comorbidity Index?

Moderator: Thomas K. Fehring, MD

Thomas K. Fehring, MD - Understanding risk adjustment - Why is this important? :

Pat Franklin, MD, MPH, MBA - The importance of clinical factors in determining risk adjustment outcome. Lessons from public reporting of cardiac surgery data.

Susan Odum, PhD - Medical Comorbidity Measures: Are they relevant for use in total joint replacement?

David Ayers, MD - How CMS is grading your performance; the importance of an Arthroplasty Comorbidity Index

Thomas K. Fehring, MD - What AAHKS can do to develop an arthroplasty comorbidity index.



Mortality after Septic and Aseptic Revision Total Hip Arthroplasty: A Matched-Cohort Study

Horim Choi, MD, Benjamin Beecher, MD, Henrik Malchau, MD, PhD, Hany S. Bedair, MD

Introduction: Mortality rates associated with primary THA have been reported previously, but there is paucity of data regarding mortality after revision for periprosthetic sepsis. The purpose of this study is to investigate the rate and contributing factors to mortality after two-stage surgical treatment for periprosthetic THA sepsis and to compare to those for revision surgery for aseptic failure.

Methods: From 1998 to 2010, 93 patients treated by staged revision for an infected total hip arthroplasty (septic group) were compared to 93 age and gender matched patients revised for aseptic failure (aseptic group). Multivariable analysis was used to compare mortality rates, age at death, host co-morbidities, ASA, Charlson Comorbidity Index (CCI), and infecting organism to identify factors contributing to mortality.

Results: The overall mortality was 33% in the septic group and 22% in the aseptic group ($p=0.10$) with median follow up periods of 5 and 6 years, respectively ($p=0.225$). The mean age at the time of revision surgery (66 years) and age at death (septic-74, aseptic-80 years) were similar. Multivariable analysis indicated that only the CCI was an independent predictor of mortality among the septic groups ($p < 0.05$), while age ($p < 0.01$) and CCI ($p < 0.05$) were predictors of mortality in the aseptic group. Advanced age was not correlated with mortality rates in the septic group. Infections with *Staphylococcus aureus* and/or methicillin-resistance were not associated with higher mortality rates.

Conclusion: While mortality was higher in the septic group than the aseptic group, septic revision alone did not predict increased mortality. However, a 33% mortality rate at five years after septic revision in patients with an average age of 66 years is alarming.

Inpatient Myocardial Infarction after Elective Primary Hip or Knee Arthroplasty

Usman Zahir, MD, **Robert S. Sterling, MD**, Mary L. Forte, PhD, DC

Introduction: The frequency of inpatient acute myocardial Infarction (MI) after elective primary arthroplasty is unknown. The goal of this study was to determine whether the incidence and adjusted odds of acute MI differed by the type of procedure following elective primary hip or knee arthroplasty in the US.

Methods: The 2000-09 Healthcare Cost and Utilization Project Nationwide Inpatient Sample (NIS) from the Agency for Healthcare Research and Quality provided a stratified national sample of all-payer hospital discharge data for this retrospective cohort study. Patients age 60 years or older who underwent at least one total hip (THA) or total knee (TKA) arthroplasty were included (ICD-9-CM 81.51, 81.54). Patients with cancer, infection, trauma or revisions were excluded. The outcome was inpatient acute MI (ICD-9 410.x). Analyses were conducted using SAS® SURVEYFREQ and SURVEYLOGISTIC.

Results: There were 4,486,859 patients who underwent at least one primary arthroplasty. Two-thirds of patients underwent unilateral TKA (66.70%); two-joint admissions were 4.34%. The incidence of acute MI was 0.320% overall (95% CL 0.305%, 0.335%). Acute MI differed by procedure and was lowest after unilateral TKA (0.294%; 95%CL 0.278%, 0.310%), more common after THA (0.342%; 95%CL 0.317%, 0.368%) and most frequent in multiple arthroplasty patients (0.570%; 95%CL 0.491%, 0.649%). Inpatient mortality was 8.60% in patients with acute MI and mortality differed by procedure. Nearly 11% of multiple-procedure patients with acute MI died inpatient (10.60%). Multivariate logistic regression showed more pronounced differences in the odds of MI in two-arthroplasty patients compared to TKA, and less pronounced differences between unilateral procedures.

Discussion and Conclusion: MI incidence and odds differ by the type of arthroplasty procedure. Multiple procedures increased MI risk and had higher MI-associated mortality. Early diagnosis and intervention of postoperative MI could lead to better outcomes after elective primary arthroplasty.

RCT Comparison after a Minimal 8-year follow-up of XLPE versus Contemporary Annealed Polyethylene in THA

Jean Langlois, MD, Franck Atlan, Jean Pierre Courpied, MD, Moussa Hamadouche, MD, PhD

Introduction: The purpose of this prospective randomized study was to compare the minimum 8-year follow-up penetration of all-cemented polyethylene sockets of the same design in two configurations in a consecutive series of total hip arthroplasty.

Methods: Between July 2000 and July 2002, 100 patients (100 hips) with a mean age of 66.4 \pm 12.9 years were randomized (power of 80%, alpha of 5%) to receive either highly cross-linked and remelted (e-beam, 10 Mrads, XLPE, 50 hips) or moderately cross-linked and annealed (3 Mrads of gamma radiation in nitrogen, Annealed, 50 hips) material. All other parameters, including the femoral head and stem, surgical approach and postoperative course 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 polyethylene type.

Results: At the time of the minimum 8-year follow-up evaluation, 38 hips in the XLPE group and 30 hips in the Annealed group have had complete data available for analysis (median follow-up of 9.1 and 8.7 years, respectively). At the latest follow up, the mean head penetration measured 1.090 \pm 0.904 mm in the Annealed group versus 0.012 \pm 0.684 mm in the XLPE group (Mann and Whitney test, $p < 0.0001$). The steady state penetration rate from one year onwards was 0.1382 \pm 0.1287 mm/year in the Annealed group versus -0.0002 \pm 0.1076 mm/year in the XLPE group (Mann and Whitney test, $p < 0.0001$). No complication specific to the material was recorded, and no patient was revised because of wear and/or osteolysis.

Discussion and Conclusion: These minimal 8-year follow-up results confirmed the significant reduction in the yearly linear femoral head penetration in highly cross-linked polyethylene. Longer-term results are needed to warrant that these mid-term data will generate less occurrence of osteolysis and aseptic loosening.

Are Morbidly Obese Patients Undergoing Total Hip Arthroplasty at Higher Risk for Component Malposition?

Shaun E. Chandran, MD, Leah Elson, Viktor J. Hansen, MD, Henrik Malchau, MD, PhD,
Young-Min Kwon, MD, PhD, FRCS, FRACS

Introduction: The prevalence of obesity is increasing in a younger population. It has been estimated approximately 40% of adults aged 65 and older were overweight and another 22% were obese. Consequently, there has been a rise in the number of obese patients with osteoarthritis of the hip requiring total hip arthroplasty. Approximately 8% of the U.S. population is morbidly obese (BMI > 35), recent literature have reported that these patients are at high risk for infection and dislocation. This study seeks to identify if morbidly obese patients are at higher risk for component malposition.

Methods: We based our analysis on a hospital-based registry comparing two patient groups; (i) the morbidly obese (BMI > 35), and (ii) a matched control group (BMI < 25) from January of 2000 to December 2005. We carefully matched the 126 patients in the control group (BMI < 25) for age, gender, underlying diagnosis, and surgical approach to those with 126 patients in the BMI > 35 group. Martell analysis was performed to obtain anteversion and abduction angles of the acetabular components. Varus and valgus angles of the femoral stems also recorded. Our hospital-based registry was reviewed patients to identify any revision procedure.

Results: Results demonstrate a revision rate of 5.6% in the BMI > 35 group and 3.2% in the BMI < 25 group. Additionally, upon Martell analysis of acetabular cup position, there is a tendency to place cups with increased abduction and decreased anteversion relative to the normal BMI cohort. We noted that there was no statistical difference ($p=0.96$) in femoral component position in the morbidly obese group compared to the control group.

Conclusions: In the US, there is an increasing prevalence of morbidly obese patients undergoing THA. This is the first study to our knowledge evaluating specifically the risk of component malposition in the morbidly obese population. The results of our study suggest that obese patients are at higher risk for acetabular component malposition.

The Short and “Shorter” of It: >1,750 Tapered Titanium Stems at 6 to 88 Month Follow-Up

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

Introduction: Femoral fixation in THA can be achieved with different design rationales. Our hypothesis was that two short titanium flat tapered stems would demonstrate similar stability.

Methods: Between May 2005 and May 2012, 849 short (135mm-170mm), titanium flat stems (“Short”) were used in THA. Between July 2005 and May 2012, 902 similar, but 35mm shorter, stems (“Shorter”) were utilized. Harris Hip Score, radiographic, and survivorship data were analyzed.

Results: Survivorship of the “Short” stems was 99.1% at 7 years. Eight/849 stems have been revised: 4 for loosening, 3 for fracture, and 1 for infection. Harris Hip Score improved from 41.6 to 88.9.

In the “Shorter” group, 9/902 have been revised: 6 for fracture/loosening, 2 for infection, and 1 for instability. HHs improved from 43.7 to 92.0.
No statistically significant differences were noted.

Conclusion: This study confirms >99% survivorship in >1,750 THA short stems at 6-88 month follow-up.

Effect of Surgical Approach and Intra-operative Imaging on Acetabular Component Alignment in Total Hip Arthroplasty

John L. Masonis, MD, Michael Ruffolo, MD, Susan M. Odum, PhDc,
J. Bohannon Mason, MD, Thomas K. Fehring, MD

Introduction: Cup abduction angle has been shown to influence dislocation rates and wear rates in total hip arthroplasty (THA). The goal of this study was to compare acetabular component alignment in THA performed via posterior approach in the lateral position versus the direct anterior approach in the supine position with fluoroscopic assistance.

Methods: A retrospective radiograph review of a consecutive series of 470 THAs was performed to assess acetabular alignment. All surgeries were performed by eight fellowship trained adult hip reconstruction specialists. Three groups were compared: posterior approach (n=134), posterior approach with intra-operative radiography (n=202), direct anterior approach with intra-operative fluoroscopy (n=134). Traumacad software program was used to calculate post-operative cup abduction and anteversion. Desired component position was defined as 10-30 degrees of anteversion and 30-50 degrees of abduction. Chi-square analysis was used to determine differences in proportions.

Results: Desired abduction alignment was obtained in 87% of posterior approaches with intra-operative radiography, 72% of posterior approaches with no radiography, and 96% of direct anterior approaches with intra-operative fluoroscopy ($p < 0.0001$). Desired anteversion alignment was obtained in 51% of posterior approaches with intra-operative radiography, 55% of posterior approaches with no radiography, and 81% of direct anterior approaches with intra-operative fluoroscopy ($p < 0.0001$). Of the 134 direct anterior cases, 104 (78%) were in the ideal range when combining abduction and anteversion. Only 45% and 42% were within the combined ideal range for the posterior approach with radiography cases and posterior approach without intraoperative imaging, respectively ($p < 0.0001$).

Conclusions: Acetabular component alignment in primary THA improved with the use of a direct anterior approach in supine position with intra-operative fluoroscopy when compared to a posterior approach in the lateral position with or without the use of intra-operative radiography. Desired abduction was more commonly obtained in all groups with desired anteversion being less accurate.

Poster Presentations

1. Peri-Operative Total Hip and Knee Arthroplasty Implant Issues
Natalia A. Wilson, MD, MPH, Tempe, AZ
2. Use of Intraarticular Human Fibrinogen to Reduce Blood Loss in Total Knee Arthroplasty
Thomas J. Heyse, MD, New York, NY
3. Sex Differences in Early Clinical Outcomes of Either UKA or TKA for Unicompartmental Arthrosis
Cale A. Jacobs, PhD, Lexington, KY
4. Variability in the Relationship between the Distal Femoral Mechanical and Anatomic Axes in Patients Undergoing Primary Total Knee Arthroplasty
Denis Nam, MD, New York, NY
5. The Dramatic Increase in Total Knee Replacement Utilization Rates in the United States Cannot be fully Explained by a Disproportionate Increase in Total Knee Replacements among Younger Patients
Peter B. Derman, MD, MBA, New York, NY
6. Correlation of Knee and Hindfoot Deformities in Patients with Advanced Knee Arthritis: Relevance to TKA Reconstruction in Patients with Foot and Ankle Deformity
John J. Callaghan, MD, Iowa City, IA
7. The Ergonomics of Efficient Surgical Technique in TKR
Phillip C. Noble, PhD, Houston, TX
8. Inpatient Pulmonary Embolism following Elective Primary Total Hip and Knee Arthroplasty in the United States
Robert Sterling, MD, Baltimore, MD
9. Impact of the Patellar Tendon on Tibial Rotational Alignment in Lateral UKA
Glenn J. Kerr, MD, Glenn Allen, VA
10. Risk Factors Outcomes and Optimal Timing Associated with Manipulation under Anesthesia following Total Knee Arthroplasty
Thomas A. Herschmiller, MBBS, Durham, NC
11. Comparison of Survival Rates of Failed Primary Standard Total Knee Arthroplasty Components to "Premium" Knee Implants
Eric L. Smith, MD, Boston, MA
12. Long Term Survival of Different Tibia Implant Designs in Primary Total Knee Arthroplasty (TKA)
David G. Lewallen, MD, Rochester, MN
13. Are Bilateral Total Joint Replacement Patients at a Higher Risk of Developing Pulmonary Embolism following Total Hip and Knee Surgery?
Geoffrey H. Westrich, MD, New York, NY
14. Impact of Socioeconomic Factors on Results of Total Knee Arthroplasty
Ryan M. Nunley, MD, St. Louis, MO
15. Use of Nerve Blocks after Total Joint Arthroplasty Leads to Increased Rate of Falls
Brian A. Klatt, MD, Pittsburg, PA

- 16.** Preintervention Pain as a Predictor of Total Joint Arthroplasty Outcome
Jesus Villa, MD, Miami, FL
- 17.** Peri-Operative Morbidity and Mortality of Simultaneous Bilateral TKA: Incidence and Risk factors.
Lazarous A. Poultsides, MD, MSc, PhD, New York, NY
- 18.** Contributions of Femoral Tibial and Patellar Component Malposition to Patellar Maltracking in TKA
Gwo-Chin Lee, MD, Horsham, PA
- 19.** Risk of Symptomatic VTE Associated with Flying in the Early Postoperative Period following Elective Total Joint Arthroplasty
H. John Cooper, MD, New York, NY
- 20.** Risk Factors, Causes, and the Financial Implications of Unplanned Readmissions after Total Knee Arthroplasty
Peter B. Derman, MD, MBA, New York, NY
- 21.** Quantifying the Cost-effectiveness of All-polyethylene Tibial Components in Total Knee Arthroplasty
James A. Browne, MD, Charlottesville, VA
- 22.** Optimizing Tibial Coverage is Detrimental to Proper Rotational Alignment
Phillip C. Noble, PhD, Houston, TX
- 23.** Physiologic and Functional Recovery Following Total Hip Arthroplasty versus Healthy Controls: Outcomes through One Year
Michael R. Dayton, MD, Denver, CO
- 24.** High Risk of Aseptic Loosening in 28 Millimeter MOM Hips Compared to MOP and COP Articulations in a RCT of 396 Hips
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Poster Presentations

Poster #1

Peri-operative Total Hip & Knee Arthroplasty Implant Documentation and Identification Practices: Results of the 2012 AAHKS Member Survey

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Introduction: Unique device identification (UDI) is a health policy issue with important implications for patient care, efficiency, and post-market surveillance in orthopedic surgery. This survey research project was performed to better understand the current process for identification of implant components in revision THA/TKA, and to document the effects of the current process on surgeon efficiency and patient care.

Methods: The 1364 active members of AAHKS were surveyed in May 2012 utilizing Dillman's tailored design method. 606 surveys were returned for a response rate of 44%.

Results: 56% of respondents reported regularly utilizing at least 5 methods, and 87% reported regularly using at least 3 methods, to identify components of a failed implant prior to revision surgery. The median time required to identify components was 20 minutes (IQR: 15 to 30) of surgeon time and 30 minutes of staff time (IQR: 20 to 60). 10% of failed implants could not be identified pre-operatively and 2% could not be identified intra-operatively, with resultant clinical and cost impact. Respondents reported UDI in TJR registry as the standard practice that would best support identification of failed implants (48%), save time (49%) and identify patients with recalled implants (57%).

Conclusion: Survey results highlight the inadequacy of the current process to comprehensively obtain device identification for failed implants in THA/TKA. Survey results also highlight surgeon and staff inefficiency as well as clinical and cost impact on patients. With the recent release of the FDA's proposed UDI rule the opportunity exists for hospital systems to assess use of UDI for clinical care, including a standard practice for documentation of implant components in THA/TKA, and support of post-market surveillance activities. Automated capture of UDI during surgery and documentation in EMR would establish a standard place for implant component information and would support UDI in TJR registry as standard practice.



Use of Intraarticular Human Fibrinogen to Reduce Blood Loss in Total Knee Arthroplasty

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Introduction: Bleeding remains an ongoing concern following total knee arthroplasty (TKA). In TKA, the cancellous bone surfaces uncovered by TKA components contribute to bleeding that is difficult to control by cauterization. “Evicel” is a human fibrinogen with a topical thrombin that has been described to stop diffuse bleeding in visceral surgery. It was hypothesized that the use of Evicel would result in a reduction of bleeding, transfusions required, and hemoglobin drop when used in TKA.

Methods: In this study, 200 patients undergoing TKA were prospectively included in a double blind randomized clinical trial to either receive intraarticular Evicel two minutes before tourniquet release or no such treatment. Postoperative hemoglobin and hematocrit levels, drain output and transfusion requirements were recorded and blood loss was calculated. Descriptive analysis was performed using Wilcoxon Paired Rank test.

Results: There were no statistically significant differences for any of the outcome measures between groups. A mean apparent postoperative blood loss of 772 ± 382 ml in the Evicel group compared with 683 ± 300 ml in the control group ($p = 0.15$). The hemoglobin drop at day 2 was 3.36 ± 1.53 g/l in the Evicel group and 3.48 ± 1.24 g/l in the control group ($p = 0.26$). The hematocrit drop at day 2 was 9.3 ± 5.5 g/l in the Evicel group and 10.1 ± 3.9 g/l in the control group ($p = 0.11$). Thirty patients in both groups required a blood transfusion. There were no adverse events directly related to the Evicel use.

Conclusion: The use of Evicel in TKA did not show any adverse effects but based on the data, its use does not lead to a reduction of blood loss or transfusions. Given the costs this procedure adds to TKA its use in osteoarthritic patients cannot be justified.

Sex Differences in Early Clinical Outcomes of Either UKA or TKA for Unicompartmental Arthritis

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Introduction: Sex differences in the bony morphology of the patellofemoral (PF) joint, PF kinematics and the prevalence of PF disorders and anterior knee pain have been well documented in the literature. Both UKA and TKA have been reported to be successful treatment options for patients with unicompartmental arthritis; however, due to the inherent differences in the PF joint between the sexes, it remains unclear if UKA is perhaps more successful in males than females. The purpose of this study was to compare outcomes between groups of male and female patients with unicompartmental arthritis treated with either UKA or TKA.

Methods: Clinical outcome data were collected from consecutive patients with unicompartmental arthritis treated with either UKA (47 women, 25 men) or PCL-retaining TKA (59 women, 41 men). The patella was resurfaced in all TKA cases. Outerbridge scores of each compartment and the condition of the cruciate ligaments and menisci were recorded at the time of surgery for the patella, trochlea, distal lateral femur, proximal lateral tibia. Knee Society Knee (KSS) and Pain Scores were collected as part of our IRB-approved outcomes database, and were compared 4 groups of patients using 2x2 ANOVAs.

Results: KSS demonstrated a significant statistical interaction, meaning that the sexes responded differently to the 2 surgical procedures ($p=0.04$). Male UKA patients demonstrated significantly increased KSS than male TKA patients (96.236.5 vs. 89.2312.9); however, female UKA patients tended to have decreased KSS than female TKA patients (87.9314.7 vs. 89.0312.3). The same trend was also present with Pain Scores, although this did not reach statistical significance ($p=0.06$).

Discussion and Conclusion: These results suggest that men with unicompartmental arthritis may benefit more from UKA than their female counterparts.

Variability in the Relationship between the Distal Femoral Mechanical and Anatomic Axes in Patients Undergoing Primary Total Knee Arthroplasty

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Introduction: An intramedullary (IM) guide is often used for performing the distal femoral resection in TKA. A cut is made at a fixed angle to the IM guide to be perpendicular to the femoral mechanical axis. However, this assumes the distal femoral mechanical-anatomical angle (FMAA) to be 5°. The purpose of this study was to assess the variability of the FMAA in patients undergoing TKA.

Methods: This is a retrospective study of 493 consecutive patients receiving a primary TKA. Patients with a history of THA, or other lower extremity deformities were excluded. Preoperatively, each patient received standing, AP hip-to-ankle xrays, from which the tibial varus/valgus, overall mechanical/anatomic alignment, distal femoral mechanical (DFMA) and anatomic (DFAA) angles, neck-shaft angle (NSA), and femoral and tibial lengths, were measured. Correlation coefficients of the FMAA (=DFMA-DFAA) to the above measurements, height, weight, and BMI were calculated. Patients were then stratified into male vs. female, and varus vs. valgus cohorts, to assess their influence on the FMAA. Each measurement was performed by two, independent observers. Correlations were graded using previously described criteria: excellent ($0.9 < r < 1.0$), good ($0.7 < r < 0.89$), fair/moderate ($0.5 < r < 0.69$), low ($0.25 < r < 0.49$), and poor ($r < 0.24$). A student's two-tailed t test was used to compare the cohorts ($p < 0.05$ = significant).

Results: 28.6% of patients had a FMAA outside of 5° +/- 2° (range 2.0° to 9.6°). The NSA had a fair/moderate correlation with the FMAA ($r = -0.55$). All other measurements and demographics had a poor correlation ($r < 0.2$). No significant difference in the FMAA was seen in the male vs. female ($p = 0.07$), and varus vs. valgus ($p = 0.09$) groups. The interobserver correlation for all measurements was good/excellent (range $0.88 < r < 0.99$).

Conclusion: The FMAA is highly variable. Using an IM fixed angle resection guide, without obtaining AP hip-to-ankle radiographs to determine a patient's true FMAA, may lead to malalignment of the femoral component.

The Dramatic Increase in Total Knee Replacement Utilization Rates in the United States cannot be fully Explained by a Disproportionate Increase in Total Knee Replacements among Younger Patients

Joseph Bernstein, MD, Peter B. Derman, MD, MBA

Introduction: The incidence of total knee replacement in the United States more than doubled between 1999 to 2008, rising from approximately 263,000 to 616,000 cases. Some scholars cited a “disproportionate increase” in knee replacements among younger patients. The purpose of this study is to evaluate the relative increases of knee replacement incidence among various patient-age cohorts. Further, a possible role of increased supply of surgeons was investigated as well.

Methods: Data on the US population for people ages 18-44, 44-65 and 65+ were obtained from census data, 1999 - 2008. The number of total knee replacements performed annually in each age group was acquired from the Agency for Healthcare Research and Quality. Per-capita incidence rates were calculated. Applying the 1999 rates to the 2008 population, the number of knee replacements anticipated on the basis of population growth for each cohort was determined and compared to the number observed, yielding the “unexplained” growth. The membership of the American Association of Hip and Knee Surgeons was used as a proxy for surgical manpower.

Results: In 2008, there were approximately 305,000 knee replacements performed beyond the number predicted by population growth. The largest segment of growth, 151,000 cases, was among patients age 65 and older; likewise, the per-capita rate growth was highest in this 65 and older cohort as well, increasing from 5.2 procedures/ 1,000 people to 9.1. The per-surgeon per-person rate of knee replacement increased only 9%, from 3.9/million/surgeon in 1999 to 4.2 in 2008. The 1999 per-surgeon rate applied to the 2008 population would produce 556,000 procedures, 92% of the observed total.

Conclusions: Increased utilization of knee replacements among patients 65 and older remains the single largest source of growth. Forecasting models must consider whether manpower supply will be adequate to meet demand.

**Correlation of Knee and Hindfoot Deformities
in Patients with Advanced Knee Arthritis:
Relevance to TKA Reconstruction in Patients with Foot and Ankle Deformity**

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Introduction: The purpose of this study was to determine the compensatory hindfoot alignment in patients with endstage knee OA requiring TKA and to determine where (ankle or subtalar joint) the compensation occurred.

Methods: A retrospective cohort of 401 consecutive primary TKAs were evaluated. Standing full-leg-length anteroposterior and Saltzman hindfoot alignment view radiographs were used to determine the mechanical axis angle and the degree of hindfoot malalignment using the Saltzman measurement and the Saltzman hindfoot angle. The relationship between knee deformity and hindfoot alignment was assessed. The relationship between hindfoot deformity and the anatomic lateral distal tibial angle (aLDTA), ankle joint line convergence angle (JLCA), and the subtalar joint (STJ) were also assessed. Intra-class correlation coefficient was used to evaluate intra- and interobserver reliability.

Results: Mechanical axis angle correlated with both the Saltzman hindfoot measurement and the Saltzman hindfoot angle in the entire cohort ($p < 0.01$). Varus knees had valgus hindfoot alignment, and valgus knees had varus hindfoot alignment. The correlation became stronger in a subset of patients with $\geq 10^\circ$ knee deformity. The hindfoot angle was moderately correlated with the aLDTA and ankle JLCA ($p < 0.01$). There was a strong, positive correlation between the hindfoot angle and the subtalar joint ($p < 0.01$). Intra- and interobserver reliability analysis showed excellent reliability in all measurements.

Conclusion: This study demonstrated significant correlation between knee and hindfoot deformities in patients with advanced knee arthritis and $\geq 10^\circ$ knee deformity. In addition, the majority of compensation within the hindfoot occurs through the subtalar joint. These findings have direct implications for treating patients with both knee and foot/ankle problems. If patients have subtalar deformity, arthritis, and/or stiffness, they should be made aware that further ankle or hindfoot surgery may be necessary to accommodate the coronal plane knee alignment changes that occur during TKA.

The Ergonomics of Efficient Surgical Technique in TKR

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With the growing emphasis on the cost of medical care, there is renewed interest in the productivity and efficiency of surgical procedures. We have developed a method to systematically examine the efficiency of the surgical team during primary total knee replacement (TKR). After consent was achieved, videotaped recordings were prepared of ten primary TKR procedures performed by five highly experienced joint surgeons. For quantitative analysis, each procedure was divided into 7 principal tasks from initial incision to wound closure. Starting with a total score of 100 points, deductions were made, based on the number of delaying events and its impact on the efficiency of the procedure. A final score for the surgery was then determined using the individual scores from each principal task. The average duration of the 10 procedures examined was 55 minutes (range: 38 to 81 mins). The longest steps during the procedure were closing the incision (13 mins; 24%) and performing the osteotomies of the distal femur (12 mins; 22%). A total of 570 delaying events were recorded from 10 surgeries, an average of 57 per surgery; least frequently the surgeon was handed the wrong instrument (0.4 /case), and most commonly, the surgeon diverting his attention from the surgical field, (35.2 times/ case). Using our scoring system, the mean efficiency of the surgeries was 81.2%. Surgical team experience correlated positively with efficiency. The mean score of surgeries of teams with 5 years experience was 81.2%, vs. only 71.9% when the surgical tech had never operated with the surgeon previously. The results of this study suggest that team experience has an important impact on operating efficiency, which has a direct impact on operation times. This suggests that a training exercise, which promotes operation knowledge and teamwork, will have a beneficial effect on efficiency.

Inpatient Pulmonary Embolism following Elective Primary Total Hip and Knee Arthroplasty in the United States

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Background: The incidence of inpatient pulmonary embolism in elective primary arthroplasty patients in the United States is unknown. Prior studies have included patients with cancer, trauma, revisions or under age 60. The goal of this study was to determine the incidence and adjusted odds ratios of inpatient pulmonary embolism in elective primary hip and knee arthroplasty patients.

Methods: The 1998-2009 Nationwide Inpatient Sample, Healthcare Cost and Utilization Project of the Agency for Healthcare Research and Quality provided a national stratified probability sample of all-payer hospital discharge data for this retrospective cohort study. Patients age 60 years or older who had an inpatient stay for a total hip (THA) or knee (TKA) arthroplasty were included. Patients with cancer, infection, trauma or revisions were excluded. The outcome was inpatient pulmonary embolism. We determined descriptive statistics and adjusted odds ratios of inpatient pulmonary embolism by procedure, controlling for patient age, sex, atrial fibrillation, Charlson comorbidity score, and surgical indication using SAS survey procedures.

Results: There were 5,056,593 patients with inpatient hospital stays for primary total hip or knee arthroplasty. Two-thirds of patients were female or under age 75. Most patients had osteoarthritis (95.3%). Patients with unilateral TKA comprised 66% of admissions. Fewer than 5% of patients had two arthroplasty procedures (95% were bilateral TKA). The incidence of pulmonary embolism differed by procedure and was lowest after unilateral THA (0.199%) compared with unilateral TKA (0.400%) and two-joint arthroplasty patients (0.777%). The adjusted odds ratios of inpatient pulmonary embolism showed a similar pattern by procedure.

Conclusion: Primary elective total knee arthroplasty is associated with a higher incidence and risk of inpatient pulmonary embolism than total hip arthroplasty. Multiple procedures pose higher risks of pulmonary embolism than unilateral procedures. Our results can assist surgeons in patient education and perioperative planning.

Impact of the Patellar Tendon on Tibial Rotational Alignment in Lateral UKA

Glenn J. Kerr, MD, Jess Lonner, MD

Summary: The optimal rotational axis of the tibial component in lateral unicompartmental knee arthroplasty (UKA) should be aligned parallel to the lateral tibial spines. However, the relatively lateral positions of the tibial tubercle and patellar tendon make the sagittal tibial cut in lateral UKA difficult and commonly predisposes to inadvertent external rotation of the tibial component. The purpose of this study is to quantify the potential rotational impact that occurs when aligning the anterior edge of the sagittal tibial cut with the lateral edge of the patellar tendon in lateral UKA.

Methods: A consecutive cohort of 17 patients undergoing lateral UKA by a single surgeon between June 2011 and May 2012 was examined. All patients underwent preoperative computed tomography (CT) scans with three dimensional reconstruction. The angle between the longitudinal axis of the lateral tibial spines and the axis between the posterior tibia at the posterior tibial spine and the lateral edge of the patellar tendon was calculated to determine the impact of a sagittal tibial resection to the lateral edge of the patellar tendon on the rotational alignment of the tibial component. The mean preoperative anatomic alignment was 10° valgus (range, 5° to 15° valgus).

Results: Compared to a sagittal tibial cut parallel to the lateral tibial spines, resection to the lateral edge of the patellar tendon results in a mean of 7.1° (range, 0.6° to 13°) more external rotation.

Conclusion: Excessive external rotation of the tibial component in lateral UKA may occur if the lateral edge of the patellar tendon is used as a landmark to perform the sagittal tibial cut. This may result in rotational mismatch between the femoral and tibial components, as well as altered contact areas and stresses, which may impact kinematics and durability after lateral UKA.

Risk Factors, Outcomes, and Optimal Timing Associated with Manipulation under Anesthesia following Total Knee Arthroplasty

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Introduction: Knee stiffness requiring manipulation under anesthesia (MUA) is an undesirable outcome following total knee arthroplasty (TKA), but risk factors for and optimal timing of MUA remain unclear.

Methods: Consecutive primary TKAs performed from 1997 to 2007 were reviewed. MUAs within three months of TKA were identified. Variables were compared between patients who underwent MUA and those who did not: age, BMI, diabetes, inflammatory arthropathy, current smoking, prior ipsilateral knee surgery, ASA score, bilateral procedure, and hospitalization duration. A non-MUA control group, matched for significant variables, was identified. Pre- and final postoperative (minimum one-year follow-up) flexion angles were recorded and compared between controls, early (≤ 6 weeks from index) MUAs, and late (> 6 weeks) MUAs.

Results: Of 1729 TKA patients, 62 underwent MUAs. These patients were younger (55.2 vs. 65.3 years, $p < 0.001$) and had higher rates of smoking (21.0 vs. 7.3%, $p < 0.001$) and prior procedure (58.1 vs. 40.3%, $p = 0.005$). A 62-patient control group, matched for these variables and for surgeon, was identified. Appropriate follow-up was available for 51 MUAs (15 early, 36 late) and 50 control knees. Final flexion was greater among controls (115.8°) than MUAs (102.9°, $p < 0.001$), but preoperative flexion did not differ. Late MUAs had significantly lower final flexion values (101.3°, $p < 0.001$) than controls, while early MUAs (106.7°) did not ($p = 0.087$); there were no differences in preoperative flexion between groups

Discussion: Patients who underwent MUAs were younger, more likely to smoke, and more likely to have undergone prior knee surgery. After matching for these variables, there was no difference in preoperative flexion between patients who underwent manipulation and those who did not. Early MUA patients achieved final flexion equal to controls while late MUA patients did not.

Comparison of Survival Rates of Failed Primary Standard Total Knee Arthroplasty Components to “Premium” Knee Implants

David Trofa, BA, Ashley Rogerson, Thomas P. James, PhD, **Eric L. Smith, MD**

Introduction: Premium knees have been designed to increase the in vivo survivability of implants in younger, more active patients. Observationally our institution noticed an increase in consultation for revision in TKA patients with premium knees. Our goal was to evaluate the overall survival, 5-year survival rate, and revision indications for primary TKA failure. We hypothesized that premium knees failed faster than standard knees.

Methods: The charts of all failed primary TKA patients undergoing revision at a tertiary medical center between February 2008 through February 2012 were retrospectively reviewed. We defined premium knees as previously described in the literature. This included rotating platform, high-flexion, gender specific and press fit designs. Objective and subjective comparisons were made between groups. Significance was set at $p < 0.05$.

Results: A total of 78 revisions were identified for primary TKA failure: 40 standard and 38 premium knees. The premium knee group included 19 rotating platform, 8 gender specific, 8 press fit and 3 high-flexion designs. The average time to revision for standard and premium components was 81.5 and 40.0 months, respectively ($p=0.0035$). Premium knees had a higher 5-year failure rate compared to standard knees, 72.2% versus 48.7%, respectively ($p=0.0379$). Indications for revision of standard knees included aseptic loosening (42.5%), infection (35.0%), and pain and/or stiffness (12.5%). Indications for revision of premium knees included pain and/or stiffness (14, 36.8%), aseptic loosening (34.2%), and infection (18.4%) ($p=0.0078$).

Conclusion: In this study, premium knees failed to demonstrate improved survivability and had a higher 5-year failure rate than standard knees. Premium knees also failed more often as a result of pain and/or stiffness compared to standard knees. More large-scale studies looking at revision rates of standard and premium knees are necessary to further evaluate the survivability of these more expensive components.

Long Term Survival of Different Tibia Implant Designs in Primary Total Knee Arthroplasty (TKA)

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Introduction: Few US-based studies have compared the survival of different knee prosthesis designs and brands in primary TKA. The purpose of this study was to compare differences in survival of commonly-used tibia designs in primary TKA.

Methods: The study population included 10601 adult patients with 14524 primary TKA procedures performed at a single US institution between 1/1/1988 and 12/31/2005. Mean age was 68.7 years and 55% were female. Patients were actively followed-up at regular intervals to ascertain details of subsequent revision surgeries. Overall revision rates and revisions for loosening, wear/osteolysis were compared across various tibia designs and brands using Cox proportional hazards regression models adjusting for age, sex, calendar year and body mass index.

Results: Over an average 9 years follow-up, 865 revisions, including 252 tibia revisions were performed, corresponding to overall survival of 89% at 15 years. In comparison to metal modular designs, the risk of tibia revisions was significantly lower with all-poly tibias (HR 0.3, 95% CI: 0.2, 0.5). Overall, posterior cruciate-retaining (CR) designs performed better than the posterior-stabilized (PS) designs ($p=0.002$). In the setting of all-poly tibias, there was no difference between PS and CR designs. With any revision as the endpoint, there were no significant differences across the 18 brands examined. Similarly, there were no significant differences across the 18 brands when we considered revisions for aseptic loosening, wear, osteolysis. Rotating hinge designs, patellar resurfacing, tibia cementing or bone grafting were not associated with the overall risk of revisions. Among patient characteristics, male gender, younger age, higher BMI were all significantly associated with higher risk of revisions ($p < 0.008$). The risk of revisions was significantly lower among patients with inflammatory arthritis (HR 0.4, 95% CI: 0.3, 0.6) than patients with degenerative arthritis.

Conclusions: All-poly tibias and CR designs are associated with better outcomes in primary TKA. No advantage could be shown for specific brands.

Are Bilateral Total Joint Replacement Patients at a Higher Risk of Developing Pulmonary Embolism following Total Hip and Knee Surgery?

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Introduction: Despite developments in prophylactic methods, venous thromboembolism continues to be a serious complication following total joint replacement surgery. The new AAOS and ACCP guidelines on preventing pulmonary embolism after total hip arthroplasty (THA) and total knee arthroplasty (TKA) are focused on choosing prophylaxis based on the individual patient and do not make specific recommendations for bilateral vs. unilateral procedures. Because the literature remains divided on whether simultaneous bilateral joint replacement is as safe as a unilateral procedure, we chose to look at a specific complication, pulmonary embolism, in a large sample of patients who underwent each surgery.

Methods: In-patient pulmonary embolism (PE) rates were examined for patients undergoing unilateral or bilateral TKA and unilateral or bilateral THA at our institution in 2011. These rates were compared within types of surgery and to rates of pulmonary embolism in past years, from 2002 to 2011. A statistical comparison was done using a one-tailed t test.

Results: Of the 7,437 total THA and TKA surgeries completed at our institution in 2011, 36 patients suffered from pulmonary embolism (0.48%). The rate of PE for unilateral TKA was 0.61% (20/3239 patients) and for bilateral TKA was 1.87% (8/428), a three-fold increase. The rate of PE for unilateral THA was 0.17% (6/3576 patients) and the rate for bilateral THA was 0.52% (1/194), also a three-fold increase. The difference in PE rates for 2011 between bilateral and unilateral knee replacement were statistically significant ($p=0.03$).

Discussion: Patients who undergo simultaneous bilateral total joint replacement remain at higher risk for complications, including symptomatic venous thromboembolism. At our institution, simultaneous bilateral hip and knee surgery is associated with a greater risk of pulmonary embolism, and patients should be counseled as such. Clearly, any patient that has a propensity for increased risk of thromboembolism should not have bilateral simultaneous surgery.

Impact of Socioeconomic Factors on Results of Total Knee Arthroplasty

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Introduction: Predictors of outcomes of total knee arthroplasty (TKA) have focused primarily on surgical technique, implant details, and individual patient clinical factors. There is very little data available on socioeconomic factors.

Methods: A multicenter survey was conducted with patients age 18-60 who underwent TKA for non-inflammatory arthritis at one of five orthopedic centers. Data were collected by an independent third party with expertise in collecting health care data for state and federal agencies.

Results: Demographic data were collected on 661 patients (average age 54; 61% female) 1-3 years following modern primary TKA. We looked at a specific series of questions regarding pain, function and satisfaction after TKA and examined the following socioeconomic factors: minority status (African American or Hispanic), gender, household income, and education (high school graduates or less vs. post-high school education). Multiple logistic regression analysis revealed that minority, gender and income were significantly associated with outcomes.

Minority patients were more likely to express difficulty with getting in and out of a car ($p=0.03$) and getting in and out of a chair ($p=0.013$) than non-minority patients.

Females were more likely to express difficulty with going up and down stairs ($p<0.001$), were more likely to report knee pain ($p=0.007$), and were less satisfied with the overall functioning of their knee after surgery ($p=0.006$) when compared to males.

Patients earning $< \$50,000$ were more likely to express difficulty with getting in and out of a car ($p=0.005$) than patients earning $\geq \$50,000$.

Education was not significantly associated with any of the questions regarding pain, function and satisfaction after TKA.

Discussion and Conclusion: The results of this study indicate that socioeconomic factors may affect patient perception of TKA and are just as important as surgical technique, implant details, and individual patient clinical factors in determining outcomes following TKA.



Use of Nerve Blocks after Total Joint Arthroplasty Leads to Increased Rate of Falls

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Introduction: Falls can be devastating complications following total joint arthroplasty (TJA). The purpose of this study was to analyze falls after TJA and to identify factors that contribute to falling after TJA.

Methods: A retrospective case-control study was conducted on primary and revision total knee arthroplasty (TKA) and total hip arthroplasty (THA) done at one institution from 12/2007-7/2011. Electronic medical records were used to collect demographic and procedure data, hospital costs, falls data, and length of stay. Statistical analysis was performed using univariate and multivariate logistic regression analysis.

Results: 7,093 consecutive patients (mean age 63.7, 3009 male, 4084 female) were analyzed (131 falls, 6962 no falls, 1.85% fall rate). Fall rates based on procedure were: 91 falls/3301 primary TKAs (2.8%), 24 falls/2504 primary THAs (0.96%), 5 falls/662 revision TKAs (0.76%), 11 falls/626 and revision THAs (1.8%). 81 of the 131 falls (62%) occurred while toileting. 14 falls were significant with 7 requiring return to the operating room. No difference in fall rate was found for sex or race. Age was a significant predictor for falls with geriatric patients (65+) having a greater likelihood to fall (OR 1.82, CI 1.28-2.60, $p=0.001$).

Nerve blocks (NBs) were used for 5086 of the 7093 patients. After controlling for age and procedure, NBs were found to be an independent predictor of falls (OR 1.86, CI 1.16-2.98, $p=0.01$). Falls for primary THA with NBs were no different than for primary THA without NBs (Pearson chi-squared=0.39, $p=0.53$). Falls for primary TKA with NBs were significantly higher than falls without NB (Pearson chi-squared=12.89, $p<0.001$).

Conclusion: The use of NBs in TJA leads to a higher rate of falls, especially for primary TKA. Age is a predictor of falls, and most falls occur when toileting. Future work should determine if addressing these factors in TJA protocols reduces post-operative falls.

Preintervention Pain as a Predictor of Total Joint Arthroplasty Outcome

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Introduction: Pain frequently motivates a patient's decision to undergo total joint arthroplasty (TJA). Preintervention pain levels are usually the main driver for patients seeking TJA. Our objective is to assess the presurgical pain level on the outcome of TJA.

Methods: A consecutive series of 640 total joint replacement patients was interviewed prior to surgery and at minimum 2 years following surgery. Statistical analyses were conducted to examine the effect of premorbid pain and other patient characteristics on outcomes (WOMAC, SF-36, and QWB). A high pain (n = 248) and low pain (n = 267) group were determined by a median split of premorbid WOMAC pain scores. Additionally, a stepwise regression analyses was used to determine whether premorbid WOMAC pain scores predicted follow-up WOMAC function score when controlling for key demographic and clinical variables.

Results: After surgery, subjects with very high premorbid pain had significantly worse outcomes than non-distressed subjects for Quality of Well Being-7, SF-36 Bodily Pain Score, SF-36 Physical Functioning, WOMAC Pain, and WOMAC stiffness (p's <0.001). Stepwise regression analyses found that age at follow-up, time since procedure, and baseline WOMAC pain scores significantly predicted follow-up WOMAC function scores. The premorbid WOMAC pain score was the strongest predictor of outcome (p < .001).

Discussion and Conclusions: Preintervention pain significantly influences patient-reported outcomes after TJA. This suggests that waiting until a patient experiences extremes levels of pain before operating may lead to worse outcomes.

Peri-Operative Morbidity and Mortality of Simultaneous Bilateral TKA: Incidence and Risk Factors

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Purpose: The purpose of this study was to compare perioperative morbidity and mortality in consecutive patients undergoing simultaneous bilateral TKA(BTKA) under the same anesthesia, staged BTKA at 2 separate admissions within 1 year or unilateral TKA(UTKA) in a high-volume center.

Methods: Between 1998 and 2009, 3,194 patients underwent simultaneous, 1,212 staged, and 17,235 UTKA. Patient demographics including comorbidities, Deyo comorbidity index, 30-day mortality, perioperative major and minor complications, blood transfusion requirements, length of staying, transfer to rehabilitation hospital or acute general, early knee manipulation for stiffness, and in-hospital cost of care were recorded. A multivariate analysis was conducted to identify independent risk factors for major morbidity and mortality in the simultaneous group.

Results: 30-day mortality rate for simultaneous, staged and unilateral groups was 0.03%, 0.08% and 0.13%, $p=.2$. Simultaneous patients were younger (65.3[13-92] vs 69.6[25-92] vs 67.9 [22-92], $p=.0001$) and had less overall comorbidity burden (0.41[0-12] vs 0.66[0-8] vs 0.51[0.8], $p=.0001$). Except for acute posthemorrhagic anemia, transfusion of allogenic blood, and transfer to rehabilitation (10.5%, 32%, and 89% respectively; $p < 0.0001$), simultaneous group was associated with a lower incidence of major morbidity and mortality (6.9% vs 8.7% vs 9.9%, $p=.0016$), AF/PAT, syncope, acute kidney failure, delirium, and transfer to acute general ($p < 0.005$). Cost of in-hospital care for each patient averaged (\$65,070), (\$91,565, both hospitalizations) and (\$44,796) for simultaneous, staged and unilateral groups, respectively ($p < 0.001$). The age group > 75 years (OR=2.125, CI=[1.128, 4.002], $p=0.0197$) compared to age < 55 , and the presence of congestive heart failure (OR=3.431, CI=[1.515, 7.772], $p=0.0031$) were the most significant factors associated with higher major morbidity and mortality in the simultaneous group.

Conclusion: By utilizing a selective preoperative screening, specifically leading to an exclusion of patients over 75 years and with congestive heart failure, simultaneous bilateral TKA can be safe, with no increase in the risk of death or other perioperative complications.

Contributions of Femoral, Tibial, and Patellar Component Malposition to Patellar Maltracking in TKA

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Introduction: The purpose of this study is to evaluate the contributions of various errors in femoral and tibial component position and rotation and errors in patellar resurfacing towards patellar maltracking in TKA.

Methods: Using a knee simulator, simulations of errors in femoral, tibial, and patellar positioning were conducted. Simulations were conducted at various combinations of femoral component malposition ranging from 2mm under-resection to 4 mm joint line elevation, +/- 2 mm of anterior posterior displacement, +/- 4 degrees from mechanical axis varus/valgus, and +/- 6 degrees of rotation with respect to the intercondylar axis. The tibial component was malpositioned from 3 degrees anterior slope to 9 degrees posterior slope, +/- 6 degrees of varus/valgus, and +/- 6 degrees of malrotation while tibial depth was set based on the extension gap ranging from overstuffing 2 mm gapping 4 mm. The patellar resection was set between +/- 3 mm over/under resection, +/- 6 degrees of medial and lateral tilt, and +4mm lateral placement to 2 mm medial placement in relation to the native patella. Regression coefficients were calculated to measure the relative effect of the implant malposition at various flexion angles.

Results: The largest influences on patellar tracking were femoral component rotation, medial/lateral patella position, femoral valgus/varus position, and an asymmetric patellar cut. The regression coefficients at various flexion angles were 0.91, 0.74, 0.45, 0.11 for femoral component rotation; 0.32, 0.43, 0.57, 0.73 for patellar component position; 0.02, 0.37, 0.54, 0.52 for femoral valgus/varus position; and 0.13, 0.21, 0.40, and 0.42 for a tilted patellar cut. Interestingly, changes in tibial component position, slope, and small deviations in rotation did not affect patellar tracking.

Conclusions: At low flexion angles, femoral component rotation plays the largest role in determining patellar tracking. With increasing flexion angles, the interplay between femoral component position in the coronal plane, patellar component position, and asymmetry in patellar resurfacing play a much larger role than femoral rotation in patellar tracking.

Risk of Symptomatic VTE Associated with Flying in the Early Postoperative Period following Elective Total Joint Arthroplasty

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Introduction: Air travel and joint arthroplasty are both established risk factors for development of venous thromboembolism (VTE); accordingly patients are typically counseled against flying in the early postoperative period. The basis for this recommendation may be unfounded, as the risk of VTE associated with flying in the early postoperative period has not been investigated.

Methods: This is a case-control study of 1465 consecutive THA's and TKA's performed by a single surgeon. A multimodal VTE prophylactic regimen was used including early mobilization, mechanical prophylaxis, and chemoprophylaxis according to a risk-stratification model; 96% of patients received aspirin as the sole chemoprophylactic agent. The study population consisted of 220 patients (15%) who flew at a mean of 2.9 days after surgery; these patients were encouraged to wear anti-embolic stockings, perform frequent ankle-pump exercises, and move around at least every hour. Mean flight duration was 2.7 hours (1.1-13.7 hours). This study population was compared to a control population of 1245 patients (85%) who did not fly during this time. Baseline characteristics were similar between the groups.

Results: Rates of DVT, PE, or overall VTE were not significantly different between groups despite adequate power. Symptomatic DVT occurred in 2 patients (0.91%) in the study group compared with 5 patients (0.40%) in the control group. Symptomatic PE occurred in 1 patient in the study group (0.45%) compared with 10 patients in the control group (0.80%). Mean flight time among patients who developed symptomatic VTE was 2.3 hours.

Conclusion: Using a multimodal approach to prophylaxis, risk of symptomatic VTE was very low among patients who flew during the early postoperative period, and was not increased over the control population. Although there may be some degree of self-selection bias among patients who choose to fly after surgery, allowing them to do so appears to be a safe practice.

Risk Factors, Causes, and the Financial Implications of Unplanned Readmissions after Total Knee Arthroplasty

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Introduction: As cost containment grows increasingly more important, payors have focused on minimizing unplanned readmissions. The purpose of this study is to identify the risks, causes, and economic implications of unplanned readmissions following TKA.

Methods: A retrospective review of 3,224 consecutive TKAs performed at our home institution was conducted using administrative and clinical data. Each patient's hospital gross profit (revenues less direct costs) was calculated using estimated Medicare reimbursement (based on MS-DRG weights) and internal cost data. Breakeven analysis was then carried out to determine the effect of potential modifications to the reimbursement system.

Results: The 30-day readmission rate to our hospital was 5.65%. Increased readmission rate was associated with increased length of stay ($p < 0.001$), revision surgery ($p < 0.001$), and non-white race ($p = 0.041$). Age, gender, and BMI were not significantly associated with readmissions. The most common re-admitting diagnoses were post-operative infection (caused readmission after 0.50% of cases), unspecified prosthetic complication (0.31%), altered mental status (0.28%), and hematoma (0.28%). Pulmonary embolism caused readmission following 0.22% of cases.

Our hospital spends \$16,370 on the care of the average TKA patient, and an average profit of \$5,219 is generated through Medicare reimbursement. In the existing reimbursement system, re-admitted patients are \$2,583 less profitable ($p = 0.001$) than their non-readmitted counterparts. If Medicare stops paying for orthopaedic readmissions, our hospital can expect a net average loss of \$5,326 for episodes of care involving readmissions - even before indirect costs are considered. In that scenario, programs like ours will continue to cover their direct costs if readmission rates remain under 49%.

Conclusion: Arthroplasty patients with unplanned readmissions at our institution are more expensive and less profitable. If these results are broadly applicable and if Medicare extends its new reimbursement policies, hospitals will no longer be able to cover their variable costs for readmitted arthroplasty patients.

Quantifying the Cost-effectiveness of All-polyethylene Tibial Components in Total Knee Arthroplasty

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Introduction: The importance of cost control in total knee arthroplasty is increasing secondary to the changing economic realities of healthcare and the increasing prevalence of joint replacement. Surgeons play a critical role in cost containment and may soon be incentivized to make cost-effective decisions under proposed gainsharing programs. The purpose of this study was to examine the cost-effectiveness of all-polyethylene tibial components and to determine what difference in revision rate would make modular metal-backed tibial implants a more cost-effective intervention.

Methods: Markov models were constructed using variable implant failure rates using previously published probabilities. Cost data was obtained from our institution and published U.S. implant list prices and modeled with a 3% discount rate. The decision tree was continued over a 20-year time frame.

Results: Using our institutional cost data and model assumptions with a 1% annual failure rate for metal-backed implants, an annual failure rate of 4.54% for all-polyethylene components would be required to achieve equivalency. Over a 20 year period, a failure rate of over 60% for the all-polyethylene tibial component would be necessary to achieve equivalent cost-effectiveness compared to the proposed failure rate of 18.2% with metal-backed components.

Conclusion: The all-polyethylene tibial component is overwhelmingly cost-effective, and surgeons, payers, and hospitals should consider this data when considering their selection of implants.

Optimizing Tibial Coverage is Detrimental to Proper Rotational Alignment

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Introduction: Malrotation of the tibial component is a common source of adverse outcomes following TKA. Often the surgeon is faced with the difficult compromise of choosing between optimum coverage without cortical overhang, and the ideal rotational position for restoration of normal knee kinematics. The goal of this study was to assess the consequences of maximizing coverage of the proximal tibia during placement of the tibial component in terms of its rotational alignment.

Methods: Four tibial tray designs (two symmetric, two asymmetric) were chosen from commercially available systems. Thirty tibias were selected and virtually resected perpendicular to the canal axis at a depth of 5mm (medial), and a posterior slope of 5 degrees. Three observers with significant experience in TKR directed computer implantation of the components. Each component was placed to maximize coverage of the resected tibia without cortical overhang. The degree of coverage of the exposed resection surface and rotational orientation of each component was measured.

Results: Overall, 81.132.2% of the proximal tibial surface was covered by the tibial component (symmetric 80.233.9%; asymmetric 81.933.9%). The components, on average, were internally rotated 8.837.3° from the tibial rotational axis. The symmetric designs showed significantly increased internal rotation compared to the asymmetric designs (14.135.10° vs. 3.4234.96°) ($p < .001$). Of the 120 components placed, only 30% were aligned within 35° of the neutral rotational axis (3% symmetric, 57% asymmetric). Using a more liberal range (310°), 58% were properly aligned (25% Symmetric, 90% Asymmetric).

Conclusion: Our study demonstrates a conflict exists between maximizing coverage and rotational alignment. Existing designs of tibial components maximize coverage at the expense of correct rotational alignment. The surgeon should recognize that correctly oriented tibial trays will often not match the shape and orientation of the resected tibia. In general, surgeons should prioritize proper rotational position, not tibial coverage.

Physiologic and Functional Recovery Following Total Hip Arthroplasty versus Healthy Controls: Outcomes through One Year

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Introduction: Surgical success in total hip arthroplasty (THA) as a function of implant integrity, radiographic outcomes or patient report has largely been optimized. Functional recovery measures may better assess patients' capabilities following THA. This controlled study prospectively quantified physical activity, strength, and outcome scores during the first year after THA.

Methods: Twenty-six patients undergoing primary, posterolateral THA (age: 61.038.18 years; BMI: 28.035.02 kg/m²; 19 women) and 18 healthy controls (age: 59.638.8 years, BMI: 28.337.0 kg/m², 11 women) were enrolled. Following surgery, patients participated in home or outpatient physical therapy (range: 0-8 visits). Functional performance was measured using stair climbing, five time sit-to-stand, timed-up-and-go and six minute walk tests. Hip flexors, extensors, abductors, knee extensors (KE) and flexors (KF) were assessed. UCLA activity scores, and all testing sessions occurred preoperatively and 1, 3, 6 and 12-months postoperatively. Healthy adults were tested once for all parameters. Longitudinal outcomes were evaluated using mixed-effects repeated measures model. Between group differences were evaluated using two-tailed independent samples t-tests.

Results: At one month, patients declined in all areas, except hip extensors ($p=0.08$), compared to baseline. At three months, all strength and function were similar to baseline. By 6-12 months, function exceeded baseline levels; strength remained comparable to baseline. Compared to healthy controls, THA patients demonstrated worse functional performance, and KE, KF at all time points. Compared to controls, UCLA scores for pre-op THA patients were low ($p=0.001$); at one month lower ($p<0.001$), but increased at 3 months ($p=0.008$), 6 months ($p=0.08$) and 12 months ($p=0.07$).

Discussion/Conclusions: Initial declines in strength, function and UCLA scores improved to preoperative levels by three months. Yet, the data suggest patients' functional deficits, activity scores, and strength fail to improve to the level of their healthy peers over the first year following THA. Such shortcomings suggest that better outcomes in THA may be realized with focus on improvements in functional rehabilitation.



High Risk of Aseptic Loosening in 28 Millimeter MOM Hips Compared to MOP and COP Articulations in a RCT of 396 Hips

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Introduction: Metal on metal (MOM) articulations have been shown to produce less wear than metal on polyethylene (MOP) and ceramic-on-polyethylene (COP), but there is a dearth of comparative effectiveness studies examining the effect of the bearing. The purpose of this study was to compare the three different bearings in a prospective randomized controlled trial.

Methods: From 1999 to 2003, 396 hips were randomized to MOP, COP or MOM using a cemented triple tapered polished stem with a cemented polyethylene cup and a 28 millimeter head. Harris Hip Score (HHS) and radiological evaluation was performed after two, five, seven years, and 10 years by independent investigators

Results: HHS was available for 316 hips at the latest follow-up. The HHS in the MOP group (112 hips) was 93.6 (SD 9.2), 91.2 in the COP group (105 hips) (SD 11.2), and 89.6 (SD 14.4) in the MOM group (99 hips).

20 revisions had been performed. In the MOP group (137 hips), there were three revisions (infection, dislocation, pain); one in the COP group (131 hips) (infection), and 16 in the MOM group (129 hips) (four infections, 11 aseptic loosening, and one periprosthetic fracture)($p < 0.001$;chi-square). Kaplan-Meier estimated survival of the implant was 11.9 years for MOM, 12.5 years for MOP, and 12.7 years for COP with revision for any cause as end point ($p=0.00002$; log rank test).

Conclusion: Our study indicates that the 28 millimeter MOM articulation has a significantly higher rate of aseptic loosening than a metal-on-polyethylene and ceramic-on-polyethylene bearing.

Corrosion at the Head-Neck Taper as a Cause for Adverse Local Tissue Reactions in Total Hip Arthroplasty

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Introduction: Corrosion at the modular head-neck junction of the femoral component in total hip arthroplasty (THA) has been identified as a potential concern, however symptomatic adverse local tissue reactions secondary to corrosion have rarely been described.

Methods: We retrospectively reviewed 13 patients with a metal-on-polyethylene bearing from three different manufacturers who underwent revision surgery for corrosion at the modular head-neck junction. Patients presented with pain or swelling around the hip and four patients presented with recurrent instability. Serum cobalt levels were typically elevated (mean 11.67 ng/mL; range 1.60 to 49.83) to a greater degree than chromium levels (mean 2.27 ng/mL; range 0.18 to 9.81). Surgical findings included large soft tissue masses and surrounding tissue damage with visible corrosion at the head-neck junction. Patients were treated with debridement and a head and liner exchange, using a ceramic femoral head with a titanium sleeve in ten cases.

Results: Harris Hip Scores improved from 56.5 to 87.9 points ($p = 0.01$) at a mean of 12.5 months (range 1.5 to 30.9 months). Repeat serum cobalt levels, performed at mean of 7.5 months following revision decreased to a mean of 1.75 ng/mL (range 0.18 to 8.93), and chromium levels were similar to pre-revision levels with a mean of 1.35 ng/mL (range 0.16 to 3.16). Three complications occurred including recurrent instability, a sciatic nerve palsy and a deep infection.

Conclusions: Adverse local tissue reactions can occur in patients with a metal on polyethylene bearing secondary to corrosion at the modular head-neck taper and present similarly to patients with a failed metal on metal bearing. A differential elevation in serum cobalt levels with respect to chromium levels, can be helpful in making this diagnosis. Revision surgery with debridement and head and liner exchange using a ceramic head and titanium sleeve provided good short-term results.

No Increased Risk of Venous Thromboembolism with Tranexamic Acid use in Primary Total Hip and Knee Arthroplasty

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Introduction: Antifibrinolytics, such as tranexamic acid (TA), in total joint arthroplasty have been shown to reduce intraoperative blood loss and decrease transfusion rates, but concern remains about the potential additional risk of venous thromboembolism (VTE).

Methods: Patients undergoing primary total hip or knee arthroplasty by one of six surgeons during 2007-2009 were retrospectively reviewed. Patients received one of the following three VTE prophylactic regimens: aspirin, warfarin, or low molecular weight heparin (LMWH, dalteparin). Patients were stratified based on their American Society of Anesthesiologists (ASA) classification score into two subgroups: ASA < 3 and ASA ≥3. The primary outcome measure was any VTE event in the 90-day postoperative period including deep vein thrombosis (DVT) and/or pulmonary embolism (PE). Contingency tables with a Pearson coefficient were used for statistical analysis. For power analysis, 424 patients in each group would be required to detect a difference of 3% in an event occurring 1% of the time.

Results: 3770 patients were included in this study with 994, 1435, and 1341 in the aspirin, warfarin, and LMWH groups respectively. For aspirin, the rates of VTE with and without TA were 1.1% (n=636) and 1.4% (n=358, p=0.69). For warfarin, the respective rates of VTE were 1.2% (n=775) and 1.0% (n=660, p=0.75). For LMWH (dalteparin), the respective rates of VTE were 0.4% (n=803) and 0.5% (n=538, p=0.73). With stratification ASA < 3 and ASA ≥3, there was no statistical difference between rates.

Conclusion: In this large cohort of patients undergoing THA or TKA, there was no increased risk of TE events in patients receiving TA at the time of surgery. Within each specific DVT prophylactic regimen, there was no statistical difference between VTE rates even when stratified by ASA classification score. Independent of surgeon choice for prophylactic regimen, TA can be used during THA or TKA without increase in TE events.

Does CTPA Lead to Overdiagnosis of PE and Subject Patients to Iatrogenic Harm following Total Joint Arthroplasty?

James A. Browne, MD, Wendy M. Novicoff, PhD, Michele R. D'Apuzzo, MD

Introduction: Since its introduction in 1998, computed tomographic pulmonary angiography (CTPA) has become widely adopted to detect pulmonary embolism (PE) following total joint arthroplasty (TJA). CTPA is a sensitive tool that has the ability to detect emboli that may be clinically insignificant and lead to iatrogenic harm from overtreatment. The purpose of this study was to assess the changing incidence, mortality, and treatment complications associated with PE following TJA both before and after the introduction of CTPA.

Methods: The Nationwide Inpatient Sample (NIS) database was used to identify 2,335,248 patients undergoing total hip or total knee arthroplasty from 1993-1998 before the introduction of CTPA and 6,321,671 patients who underwent TJA from 1999-2008 after the introduction of CTPA. Bivariate and multivariate regression analysis was performed to compare the incidence of PE, mortality associated with PE, and potential treatment complications of anticoagulation following TJA.

Results: The in-hospital diagnosis of PE following TJA increased from 0.28% to 0.38% following the introduction of CTPA ($p < 0.001$). The case-fatality (mortality associated with the diagnosis of PE) decreased substantially from 11.4% to 4.6% ($p < 0.001$). The odds ratio of mortality with a PE before CTPA compared to after CTPA was 2.2 (95% CI 1.8-2.6, $p < 0.001$). The diagnosis of PE was associated with substantially increased risks for hematoma/seroma, postoperative infection, gastrointestinal bleed, and drug thrombocytopenia (all $p < 0.001$). In comparison to those patients who were not diagnosed with a PE, patients with PE had increased lengths of stay (8.5 days versus 3.9 days) and total charges (\$60,408 versus \$35,592) (both $p < 0.001$).

Conclusion: The widespread adoption of CTPA appears to be associated with increased diagnosis of PE following TJA. Case-fatality has decreased, raising the concern for overdiagnosis. This study demonstrates that the diagnosis of PE is associated with potential iatrogenic harm from anticoagulation and increases length of stay and hospital charges. The role of CTPA needs to be carefully examined.

Minimum 10-year Wear Analysis of a First-Generation Annealed Highly Cross-Linked Polyethylene in Young and Active Patients

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Introduction: We report the ten-year results of our experience with an annealed highly cross-linked polyethylene (HXLPE). Concerns persist regarding oxidative stability of this type of HXLPE and hence its wear performance in the long-term. The purpose of this study was to assess wear of a first-generation, annealed HXLPE and compare it to conventional polyethylene at a minimum of ten years in young active patients.

Materials and Methods: 91 patients (112 hips) with a mean age of 54.3 years (range 25-59) and mean UCLA score of 8.2 were followed prospectively. A 28mm head and HXLPE liner was used in all cases. At last follow-up, 77 patients (98 hips) were available for review. We compared these patients to a matched historical control group comprising 35 patients (43 hips) who underwent primary THA using a conventional polyethylene liner. Wear was calculated using Roman V1.70 software. Wear rates for each patient were calculated using regression analysis. Radiographs were analyzed for osteolysis and acetabular component position.

Results: At a mean of 10.9 years, the wear rate in the HXLPE group (0.042 mm/yr [SD 30.046]) is significantly lower than the control group (0.126 mm/yr [SD 30.049]) ($p < 0.0001$). There were no revisions for wear-related complications in the HXLPE group compared to four in the control group. The survivorship for wear-related revisions at 10 years was 93.1 % in the control group and 100% in the HXLPE group. No osteolysis was observed in the HXLPE group compared to six hips in the control group.

Discussion: When compared to conventional polyethylene, this study confirms that a first-generation annealed HXLPE shows excellent wear characteristics at ten years and demonstrates a 66% reduction in femoral head penetration. No osteolysis was apparent radiographically. Oxidative degradation of an annealed HXPLE is not adversely affecting wear at ten years and shows no wear-related complications. These results are particularly significant as the patients in this study were all young and active.

Do Socket Position and Limb Length Discrepancy Improve with the Anterior Supine Approach using Fluoroscopy and a Fracture Table: A Comparison with the Posterolateral Approach

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Introduction: Reduction in limb length discrepancy (LLD) and improved cup positioning are purported benefits of using intraoperative fluoroscopy for total hip arthroplasty (THA) performed through an anterior approach on a fracture table. We compared LLD and cup position in patients treated with anterior and posterolateral approaches.

Methods: Postoperative LLD, inclination and anteversion were measured twice by an independent orthopaedic surgeon in 200 consecutive patients who underwent primary THA for osteoarthritis by two fellowship-trained surgeons. One hundred THAs were performed through a posterolateral approach in the lateral decubitus position (group I). One hundred patients received an anterior approach in the supine position with intraoperative fluoroscopy on a fracture table (group II). Each surgeon attempted to equalize LLD in all cases. Measurements were performed on calibrated, digital, postoperative radiographs when the implants were considered stable. T-test and chi-square tests were used where appropriate.

Results: Mean LLDs were 2.7 \pm 5.2 mm and 0.8 \pm 3.7mm for groups I and II, respectively ($p=0.002$). Seven percent of hips in group I had LLD > 1 cm compared to 3% in group II ($p=0.19$, with numbers available). Mean inclination measured 40.8 \pm 5.0° in group I and 43.4 \pm 5.6° in group II. Ninety-six percent of cups in group I exhibited inclination within 10° of the mean compared to 92% in group II ($p=0.24$, with numbers available). Mean anteversion measured 35.3 \pm 7.1° in group I and 25.9 \pm 8.2° in group II. Eighty-seven percent of hips in group I exhibited anteversion within 10° of the mean compared to 76% in group II ($p=0.045$).

Conclusion: While the anterior supine approach on a fracture table with fluoroscopy minimized LLD compared to a posterior approach, this difference is unlikely to be clinically significant. The influence on LLD and inclination outliers is unclear. Anteversion was more precise with the posterior approach.

Total Joint Arthroplasty can be Safe in the Super Morbidly Obese

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Introduction: Many studies have suggested that morbid obesity is associated with an increased complication rate following total joint arthroplasty (TJA). However, our institutional experience suggests that morbid obesity does not directly lead to increased complications. The purpose of this study is to compare the incidence of complications in super morbidly obese patients (BMI greater than 40) undergoing TJA to the rate of complications in non-morbidly obese patients (BMI less than 35).

Methods: We retrospectively reviewed 2056 primary TJA cases performed by two surgeons at our institution between January 2009 and January 2011. Medical records were reviewed to identify patient demographics, comorbidities, and complications. We recorded readmissions, venous thromboembolism (VTE), acute peri-prosthetic joint infections (PJI), inadequate pain control, and transfusions. All cardiovascular, pulmonary, neurovascular, gastrointestinal, and mechanical complications were recorded as well. Chi-square and t-test analyses were utilized to compare complication rates between the two groups.

Results: We identified 454 super morbidly obese and 1602 non-morbidly obese patients. Average BMI in the morbidly obese group was 44.7 and 31.6 in the non-morbidly obese group. Morbidly obese patients were significantly younger at time of surgery (61.5 vs 64.6 years) and had a greater drop from preoperative to postoperative hemoglobin (3.3 vs. 1.8 points) ($p < 0.05$). However, Charlson Comorbidity Index (CCI) and length of stay were not significantly different between the two groups ($p > 0.05$). Arthrofibrosis requiring manipulation under anesthesia was significantly more common in the non-morbidly obese group ($p < 0.001$). There was a higher incidence of pulmonary complications ($p=0.047$), inadequate pain control ($p=0.025$) and transfusions ($p < 0.001$) in the morbidly obese patient group. There was no significant difference in VTE or PJI.

Conclusion: TJA in the super morbidly obese can be safe in otherwise healthy patients with a low CCI. However, extra effort may be necessary to prevent pulmonary complications and minimize blood loss.

The Role of Experience Level in Inter- and Intra-Observer Reliability of Radiographic Evaluation of Femoroacetabular Impingement and Acetabular Dysplasia

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Introduction: Radiographic findings can overlap and accurate diagnosis can be difficult in conditions such as femoroacetabular impingement (FAI) and acetabular dysplasia (AD). This case-control study assesses the reliability and reproducibility of radiographic diagnosis based on experience level.

Materials & Methods: Four observers - an attending orthopaedic hip surgeon, an attending musculoskeletal radiologist, a fellow in orthopaedic sports medicine and a junior orthopaedic surgery resident, performed a blinded radiographic review of 55 patients identified from the principal investigator's database and diagnosed as FAI, dysplastic or normal. Observers assessed 14 radiographic parameters and an interpretation of a final diagnosis. A second radiographic evaluation of 20 preselected cases was completed 6 weeks after the initial reading to assess intraobserver reliability. Inter and intraobserver reliability were determined using Cohen's Kappa Coefficient (κ) and intraclass correlation coefficient (ICC) for continuous parameters in a four-rater design.

Results: Interobserver reliability was highest across experience level for lateral center edge angle (ICC = 0.92) and alpha angle (ICC = 0.90) and lowest ($\kappa < 0.3$, ICC < 0.3) for acetabular depth, detection of herniation pits, joint congruency and Tönnis grade. Intraobserver reliability across experience level was highest for acetabular depth, acetabular inclination and detection of herniation pits ($\kappa > 0.86$) and lowest for head-neck offset ratio and Tönnis grade ($\kappa = 0.48$, ICC = 0.48). The final radiographic diagnosis was consistent with the original blinded diagnosis ranging from 60%-75% across the four experience levels and was not statistically significant ($p = 0.68$).

Discussion: Many of the standard radiographic parameters used to diagnose FAI or acetabular dysplasia are not reproducible with varying levels of experience. Many subjective parameters are not reproducible while objective parameters, such as lateral center edge angle and alpha angle, can be measured reliably. In order to improve the reliability of an accurate diagnosis of FAI or dysplasia, more objective radiographic parameters must be redefined and further developed.

Risk Factors for Total Hip Arthroplasty Aseptic Revision

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Summary: Survival and risk of aseptic revision were assessed in 35960 primary total hip arthroplasties. Patient, implant, and surgical characteristics were assessed.

Introduction: The purpose of this study is to evaluate multiple risk factors associated with aseptic revision after primary total hip arthroplasty (THA).

Methods: All primary THA were identified using a Total Joint Replacement Registry. Revision risk factors include patient, surgical, implant characteristics, surgeon and hospital volume, and surgeons' training. Descriptive statistics, Kaplan Meier survival curves, and Cox proportional hazard models were used to evaluate risk factors (hazard ratios (HR) and 95% confidence intervals (CI) provided).

Results: 35960 primary THA cases followed for a median time of 2.9 years. Patients were predominantly female (57%), white (74%), with osteoarthritis (91%). 7% were diabetic and 39% of the patients were obese (body mass index (BMI) ≥ 30 kg/m²). The mean age was 65 years old (standard deviation=12) and 45% of the cohort is <65. The crude revision rate is 2.1% (N=749) and aseptic revision rate is 1.7% (N=601). The cumulative survival for all cause revisions at 8 years is 95.9% (95%CI 95.6%-96.2%), and for aseptic revisions only at 8 years is 96.7% (95%CI 96.4%-97.0%). The main reasons for revision among aseptic cases were instability (49.7%) and aseptic loosening (13.9%). Adjusted multivariable regression models revealed that females have a 1.37 (95%CI 1.16-1.62) higher risk of aseptic revision than males, $p < 0.001$. Hispanic (HR=0.50, 95%CI 0.31-0.79, $p = 0.003$) and Asian (HR=0.37, 95%CI 0.18-0.76, $p = 0.007$) patients have a lower risk of revision than white patients. Ceramic on ceramic (HR= 2.00, 95%CI 1.16-3.43, $p = 0.012$), ceramic on conventional polyethylene (HR=2.25, 95%CI 1.08-4.67, $p = 0.029$), and metal on conventional polyethylene (HR=1.84, 95%CI 1.36-2.84, $p < 0.001$) had a higher risk of aseptic revision than metal on highly crosslinked polyethylene. Age, BMI, general health status, diabetic status, diagnosis, fixation, surgical approach, bilateral procedures, head size, surgeon fellowship training, surgeon and hospital volume were not found to be associated with risk of aseptic revision.

Conclusion: THA cumulative survival at 8.2 years was 96.7%. Patient factors affecting THA aseptic revision included gender and race. Certain bearing surfaces were also found to be risk factors of aseptic revision.

Thrombosis Prevention using a Portable Compression Device in Total Hip Arthroplasty

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Introduction: The purpose of this study was to evaluate the effectiveness of a portable compression device with or without aspirin as the sole means of venous thromboembolism (VTE) prophylaxis, including both deep vein thrombosis (DVT) and/or pulmonary embolism (PE) in patients undergoing THA.

Methods: A multicenter registry was established to capture the rate of VTE occurring following elective primary unilateral THA; 1509 patients from ten sites were included in the registry. All patients were older than 18 years without known history of prior VTE, coagulation disorder, or major operation in the previous three months. The use of the compression device began intraoperatively and continued for a minimum of 10 days. Patients with clinical suspicion of DVT underwent duplex ultrasonography of both legs. Patients with clinical suspicion of PE were evaluated with spiral CT of the lungs. All patients were clinically evaluated three months after surgery documenting whether there was any evidence that a DVT or PE event had occurred postoperatively.

Results: Of 1509 patients, 8 (0.53%) had VTE (4 distal DVT, 1 proximal DVT, and 3PEs).

Conclusion: When compared to current pharmacologic protocols, the use of a portable compression device with or without aspirin for patients undergoing primary THA provides a non-inferior risk for developing VTE without the risk of bleeding.

XAMOS: Rivaroxaban versus Conventional Regimens for Thromboprophylaxis after Hip or Knee Surgery

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Introduction: Patients are at risk of venous thromboembolism (VTE) after major orthopaedic surgery of the hip or knee. In the RECORD program, oral rivaroxaban regimens had superior efficacy and a similar safety profile to enoxaparin regimens for the prevention of venous thromboembolic events in patients undergoing elective hip or knee arthroplasty. XAMOS assessed adverse events in patients receiving oral rivaroxaban or conventional thromboprophylaxis regimens in clinical practice.

Methods: XAMOS was an international, non-interventional, open-label cohort study in approximately 250 centers that performed > 50 total hip or knee replacement surgeries annually. Male and female patients, aged ≥ 18 years, undergoing elective hip or knee arthroplasty (or hip fracture surgery where included in the label) and receiving rivaroxaban or other pharmacological thromboprophylaxis were eligible. Primary hip or knee arthroplasty accounted for > 90% of all procedures. The type, duration, and dose of drug were determined by the attending physician. All adverse events, including symptomatic thromboembolic and bleeding events (as defined in RECORD), were documented by the investigators. Serious adverse events were followed-up until a final outcome was available.

Results: Between 2009 and 2011, 17,413 patients were included (rivaroxaban: n=8778, conventional thromboprophylaxis: n=8635 [low molecular weight heparin (LMWH), 81.7%]). The incidence of any symptomatic thromboembolic event was lower in patients treated with rivaroxaban compared with the group treated with conventional therapy (0.9% vs 1.4%, respectively; hazard ratio [HR] 0.61, 95% confidence interval [CI] 0.44-0.85) or compared with LMWH (0.9% vs 1.5%, respectively; HR=0.57, 95% CI 0.41-0.81). The rates of major bleeding were similar between the rivaroxaban and conventional therapy groups (0.4% vs 0.3%, respectively; HR=1.10, 95% CI 0.67-1.80).

Conclusion: XAMOS confirmed the clinical benefit of rivaroxaban for thromboprophylaxis in patients undergoing orthopaedic surgery in routine clinical practice and supported the results obtained previously in the RECORD program.

Modular Femoral Stem Failures: A Cause for Concern

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Modular femoral implants in total hip arthroplasty are increasingly being used to address problems with femoral offset, version, length, and instability. Previous clinical studies have demonstrated excellent restoration of offset, version, and leg length with modular femoral components. However, reports have also demonstrated implant failures at the modular junction, especially when using modular femoral necks. Modular femoral neck fractures have been demonstrated to occur in patients with high offset, high varus, and a large body mass index. Between May 2005 and October 2011, one senior fellowship trained surgeon performed 546 total hip arthroplasty procedures using a stem-sleeve modular femoral stem. A retrospective review of these cases was conducted. Results: 5 patients (0.9%) experienced a femoral implant failure with a characteristic fracture at the stem-sleeve modular junction. The mean patient age with femoral failures was 61 (51 to 71). The mean BMI was 39 (33 to 50). The mean time to failure was 26 months (13 months to 48 months). The mean femoral stem size was 12 mm (9 to 15). The femoral offset varied among patients with femoral stem failures. Femoral head size also varied ranging from 32 mm to 52 mm. Bearings also varied among patients and included cobalt chrome with XLPE, oxinium with XLPE, and metal on metal. To our knowledge, no published clinical study has demonstrated modular femoral stem fractures using this specific stem-sleeve modular femoral implant. With the characteristic failure pattern at the stem-sleeve modular interface, varied femoral offset, different femoral head sizes and articulations, different time to failures, and varied patient age, we believe that further biomechanical evaluation of this femoral stem needs to be performed and is a cause for concern.

Pre-operative Emotional Health affects Post-Operative Patient Function after Primary Total Hip Arthroplasty

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Introduction: Total hip (THA) and knee (TKA) arthroplasty are successful treatments for end-stage arthritis. However, a subset of patients experience suboptimal post-operative gain in function. Previous studies have shown that pre-operative emotional health influences outcomes after TKA, but there is limited evidence on THA patients. We hypothesized that pre-operative emotional health affects post-operative physical function and emotional health in THA patients.

Methods: A secondary analysis of an existing registry at a single academic institution of primary THA patients between 2008 and 2011 was conducted. Baseline demographic, clinical, emotional health (SF-36 MCS), and physical health (SF-36 PCS) data were collected electronically at the pre-operative visit. Post-operative SF-36 MCS and SF-36 PCS scores were collected electronically between 6 months through 2 years follow-up. Bivariate analyses and multivariate logistic regression models were used.

Results: The analysis included 316 primary THA patients with mean age 62.31 years, 55% female, mean BMI 30.35, mean PCS 31.38, and mean MCS 51.31. Patients with lower baseline emotional health scores reported significantly reduced mean post-operative physical function and emotional health ($p < 0.001$). Multivariate regression revealed that decreased age and increased baseline MCS and PCS were significantly correlated with higher post-operative MCS and PCS ($p < 0.05$). Patients with baseline MCS < 50 had a mean 13.39 point increase in post-operative PCS, and showed a significantly different bimodal variation in post-operative PCS with 46% of these patients reporting PCS > 45 ; whereas patients with baseline MCS ≥ 50 had a mean 17.31 point increase in post-operative PCS and showed a uniformly high post-operative PCS distribution with 71% reporting PCS > 45 ($p < 0.001$).

Conclusion: In THA patients, post-operative emotional health and physical health are positively correlated with baseline emotional health. A bimodal variation in post-operative physical function was found in THA patients with below average baseline emotional health, which is similar to results found in prior TKA studies.

Incidence of Heterotopic Ossification in Direct Anterior Total Hip Arthroplasty: A Retrospective Radiographic Review

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Background: The direct anterior approach (DAA) has become a popular approach for total hip arthroplasty (THA). Heterotopic ossification (HO) is a known complication following THA using traditional approaches. Currently, there is no data regarding the development of HO in the DAA THA. The purpose of this study is to determine the incidence of HO in patients who have undergone a DAA THA.

Methods: This retrospective radiographic review assessed the incidence of HO in 236 patients who underwent DAA THA at two different institutions. Hospital 1 included two surgeons, OSI Hana table, and Aspirin 325 mg bid or Lovenox for DVT prophylaxis. Hospital 2 included 1 surgeon, a regular OR table, and Coumadin for DVT prophylaxis. Preoperative and postoperative AP radiographs of at least 6 months follow-up were reviewed for the presence of HO and classified according to the Brooker classification.

Results: In hospital 1, 36/109 (33%) of the patients developed HO, compared with 62/127 (48.8%) in hospital 2. The average incidence of HO according to the Brooker classification included Class 0, 62.1%; Class 1, 21.2%; Class 2, 7.4%; Class 3, 8.1%; and Class 4, 1.3%. There were significantly more males affected (60/123, 48.8%) than females (38/113, 33.6%), ($p=0.02$). There also appears to be a tendency for increased HO formation in older age groups (46/97, 47.4% in > 65 yo), but the results do not reach significance ($p=0.09$). There was no statistical difference in the formation of HO between the different BMI groups ($p=0.18$), or types of arthritis ($p=0.53$). There was a significant reduction in risk in the patients who took aspirin (RR 0.53, $p=0.001$) compared to patients who took Coumadin (RR 1.35, $p=0.52$) or Lovenox (RR 1.20, $p=0.33$).

Conclusions: This investigation was undertaken to assess the incidence of HO in patients undergoing DAA THA. The incidence of HO was 41.5%, which fell well within the reported range of 28-61% with traditional approaches to THA. Thus, this study does not demonstrate a decreased incidence of HO with DAA THA when compared to common approaches.

The Impact of Depression following Total Joint Arthroplasty: A Nationwide Database Study

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Background: Total joint arthroplasty is major surgery, and therefore is a major life event in terms of physical and mental stress on the patient. The impact of psychological distress on the outcomes of TJA has been explored more in recent years. Studies have shown that patients pre-operative expectations are a significant predictor for improvement in physical health and functional outcome after TJA. Other studies have focused on the impact of decreased mental well-being on outcomes after TJA compared to those with a better mental state pre-operatively. The purpose of this study was to assess the incidence of the diagnosis of depression and determine the impact of this diagnosis on outcomes following TJA.

Methods: The Nationwide Inpatient Sample (NIS) database was used to identify patients undergoing total hip or total knee arthroplasty from 1998 through 2008. Multivariate regression analysis was performed to compare the incidence of depression, mortality associated with depression, and outcomes following TJA. Length of stay and hospital charges were also examined.

Results: The rate of diagnosis of depression has increased steadily from 2.8% in 1998 to 11.1% 2008. Patients with depression had significantly higher hospital charges (\$35,419 vs. \$38,133, $p < 0.001$), more diagnoses per patient (7.66 vs. 5.33, $p < 0.001$), more procedures per patient (1.79 vs. 1.70; $p < 0.001$), and were younger (63.8 years vs. 66.9 years, $p < 0.001$) than patients without depression. In multivariate analysis, people with depression also were significantly more likely to be white (odds ratio=1.31, 95% CI=1.10-1.47), female (OR=2.37, 95% CI=2.33 to 2.40), and have Medicaid as a primary payer (odds ratio=2.11, 95% CI=1.96-2.30). There was a greater risk of post-operative psychosis (odds ratio=1.61, 95% CI=1.54-1.68), post-operative anemia (odds ratio=1.21, 95% CI=1.19-1.23) and post-operative infections (odds ratio=1.20, 95% CI=1.07-1.33) in the depressed patients compared to the patients without depression. There was no significant relationship between the diagnosis of depression and in-hospital mortality or length of stay.

Conclusions: Depression is a serious comorbidity that can impact outcomes after TJA. The rate of diagnosis has increased markedly over the last ten years, and adequate treatment for these disorders prior to surgery could improve the chances of good outcomes post-surgically. In addition, assessing patients' mental health, social support, and expectations for surgery should be a regular part of preparing patients for surgery.

Prevalence of Pseudotumors in Asymptomatic Patients with Modular Metal-on-Metal Total Hip Arthroplasties

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Introduction: The key to successful management of the metal-on-metal patient is to diagnose adverse tissue reactions before they occur. Management of a patient with a painful metal-on-metal bearing includes a careful physical examination, ion levels and a MARS MRI. While the presence of pain has been used as a harbinger of bearing related problems, pseudotumors have recently been described in asymptomatic resurfacing patients in three different studies, 5%, 30%, and 61% respectively. Whether this concerning finding applies to modular metal-on-metal total hips is unknown. The cost of routine screening of all metal-on-metal patients for asymptomatic pseudotumors would be significant and should not be recommended without supporting data. The purpose of this study is to determine the prevalence of pseudotumors in asymptomatic patients with modular metal-on-metal total hips.

Methods: 53 MoM patients were evaluated with MARS MRI. Pseudotumor incidence was compared between 29 asymptomatic patients and 24 patients who were either symptomatic or had a one-piece acetabular components. Ion levels, lesion size and cup abduction angles were analyzed. The average follow-up for the asymptomatic cohort was 49 months (28-93 months).

Results: Of the 29 asymptomatic patients, 7 had periarticular fluid collections (24%) averaging 6 x 4 x 4 cm. In the symptomatic/one-piece group 7 of 24 patients had periarticular fluid collections (29%). Cup abduction angles in the asymptomatic group averaged 42 degrees (37-45 degrees). Cobalt levels averaged 3.9 (0-9.7), chromium levels averaged 2.3 (0-4.1).

Conclusion: A 24% incidence of pseudotumors in asymptomatic patients with average ion levels below reported thresholds is alarming. Whether routine MRI screening of asymptomatic modular metal-on-metal patients is required remains to be determined with a larger cohort of patients. We will continue to scan our asymptomatic patients to this end. At this time, relying on the presence of pain is insufficient to identify patients at risk for ALTR.

Aspirin is an Effective Alternative Prophylaxis for Prevention of Pulmonary Embolism following Joint Arthroplasty

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Introduction: Warfarin and other aggressive chemical prophylaxis have been associated with serious complications such as increased bleeding, readmission rate, and infection. Furthermore, warfarin needs monitoring. The AAOS and ACCP guidelines both endorse aspirin as an option for prophylaxis against VTE following TJA, but there is paucity of literature comparing these two methods. Our study aims to compare the outcomes of a consecutive group of patients undergoing TJA between aspirin and warfarin prophylaxis.

Methods: We reviewed 26,415 TJA performed at our institution from 2000 to 2011. 1,824 patients received aspirin (325 mg BID) as prophylaxis against VTE while 24,567 received warfarin aiming for an INR between 1.5 and 1.8. Both drugs were administered for six weeks. In addition 24 patients received heparin or heparin derivatives and were excluded. The clinical records of patients were evaluated to determine the incidence of PE up to 90 days postoperatively. Bleeding and wound complications were also collected up to 90 days postoperatively. Propensity scores accounting for all comorbid and demographic variables were utilized to match patients.

Results: Overall PE rate in the ASA cases (0.2%; 4 of 1,824) was significantly lower than the overall PE rate in the matched warfarin cases (1.0%; 92/9028) ($p < 0.001$). Hematoma and seroma formation ($p=0.19$), wound problems ($p=0.24$), DVT ($p=0.21$), acute infection ($p=0.65$), and 90 day mortality ($p=0.70$) rates were not significantly different between the ASA cases and warfarin controls.

Discussion: Conventional prophylaxis for pulmonary embolism has focused on chemical prophylaxis with warfarin being a popular agent. Following publication of AAOS guidelines, some surgeons at our institution have utilized aspirin as a prophylaxis following TJA. Based on the findings of this study, it appears that ASA is as effective as warfarin in prevention of pulmonary embolus following joint replacement in healthy patients, with a lower rate of bleeding and wound complications.

Risk of Complications, Revision, and Cancer for Metal-on-Metal Patients in the Medicare Population

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This study compared the risk of complications, revision THA, and cancer in Medicare THA patients with different bearings.

The 100% Medicare inpatient and outpatient database (2005- 2010) was used to evaluate the risk of complication, revision THA, and cancer for primary THA patients. A matched cohort analysis (1-to-3 case-control ratio) was performed for metal-on-polyethylene (MoP), metal-on-metal (MoM), ceramic-on-polyethylene (CoP), and ceramic-on-ceramic (CoC) patients, matched by age, gender, and census region. Multivariate Cox regression models were used to compare the risk of dislocation, periprosthetic joint infection, mechanical loosening, mechanical complications, revision THA, and solid organ tumors (bladder, kidney, liver), adjusting for patient and hospital factors.

The MoM cohort (n=55,141) was associated with a 15% higher adjusted infection risk (p=0.003) and 13% higher adjusted loosening risk (p=0.031), but 11% lower adjusted dislocation risk (p=0.004) than the MoP cohort (n=165,423). The CoC cohort (n=5,527) was associated with a 32% lower adjusted infection risk (p=0.021) and 40% lower adjusted loosening risk (p=0.008) than the MoM cohort (n=16,581). The MoM cohort had a 30% lower adjusted renal cancer risk relative to the MoP cohort (p=0.021). There were no other statistically significant differences in complications, revision THA, or cancer risk between MoM and the other bearing cohorts.

With up to 5.25 years follow-up, revision risk did not vary significantly among Medicare THA patient cohorts with different bearing types, in contrast with recent revision data from the UK and Australian registries after a similar time period. The higher infection risk for the MoM Medicare cohort may represent local soft tissue reactions that were misdiagnosed as infection. This study describing the outcomes for a large MOM patient cohort will be useful in the design of future postmarket surveillance studies. The 2005-2010 Medicare dataset does not demonstrate an elevated risk of solid organ tumors for patients implanted with a MoM bearing.

Should Prophylactic Antibiotics be withheld Prior to Revision Surgery to Obtain Appropriate Cultures?

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Introduction: Pre-operative antibiotics are known to be critical for decreasing the risk of periprosthetic joint infection (PJI) in primary total hip (THA) and knee arthroplasty (TKA). Antibiotics are oftentimes withheld, however, prior to revision surgery, as there is concern that even a single dose of prophylactic antibiotics may affect operative cultures. The purpose of this prospective randomized trial was to determine the effect of prophylactic antibiotics given prior to incision on cultures obtained at the time of revision.

Methods: We randomized 65 patients with known PJI following 37 TKA and 28 THA at three centers. Patients were included if they had a pre-operative culture-positive aspiration and had not taken antibiotics within two weeks of revision. Subjects were randomized to receive prophylactic antibiotics either prior to skin incision or after a minimum of three sets of intra-operative cultures. Preoperative and intraoperative cultures were then compared using an equivalence test for proportion differences with a 0.2 margin. Power analysis determined that 54 total patients would be required to determine a proportional difference of 15% between the groups.

Results: Intra-operative cultures were the same in 28 of 34 patients (82%) randomized to receive antibiotics prior to the skin incision compared to 25 of 31 patients (81%) randomized to receive antibiotics after obtainment of operative cultures (statistical equality $p=0.0290$). There were five cases where intra-operative cultures remained negative although preoperative cultures had grown an organism. These were equally distributed, with 3 in the antibiotics given group and 2 in the antibiotics held group (statistical equality, $p=0.0036$).

Conclusion: We found no effect on the results of cultures obtained intraoperatively when prophylactic antibiotics were administered prior to the skin incision. Given the known benefits of prophylactic antibiotics in preventing PJI, preoperative prophylaxis should not be withheld in revision surgery for fear of affecting culture results.

Optimal ESR and CRP Cut-off Values Based on New Criteria for Periprosthetic Joint Infection

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Introduction: Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are valuable inflammatory markers for the diagnosis of periprosthetic joint infection (PJI). Previous studies reporting cut-off values for these markers included small numbers of patients and were inconsistent in terms of PJI definition. This study aims to determine optimal thresholds for ESR and CRP based on recently defined criteria for PJI.

Methods and Materials: We retrospectively reviewed 1993 patients who underwent revision arthroplasty for either aseptic failure (1095 hips, 594 knees) or first onset PJI (112 hips, 192 knees) between 2000-2009. PJI diagnosis was independent of ESR and CRP. Exclusion criteria were comorbid conditions with confounding effect on inflammatory parameters. Receiver-operating characteristic (ROC) analysis was performed to determine optimal thresholds and test characteristics for ESR and CRP in hips and knees separately.

Results: Optimal thresholds for ESR were 48.5 mm/hr and 36.5 mm/hr in hips and knees, respectively. For CRP, thresholds were 1.35 mg/dL and 2.35 mg/dL in hips and knees, respectively. Combining ESR and CRP yielded well-performing ROC curves for hips and knees with area under the curve of 0.95 and 0.96, sensitivity of 87.6 and 88.1, and specificity of 92.1 and 96.4, respectively.

Discussion and Conclusion: This study confirms utility of ESR and CRP as a combination test in PJI diagnosis in a large cohort at a single institution. Our findings suggest while conventional thresholds for these inflammatory markers are still useful, they may need to be refined to improve the accuracy of these markers in diagnosing PJI.

The Aquacel Ag Hydrofiber Dressing Reduces Acute Prosthetic Joint Infection In Joint Arthroplasty

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Introduction: Periprosthetic joint infection (PJI) is one of the most challenging complications that occur after total joint arthroplasty (TJA). Among the many efforts invested to prevent the occurrence of PJI, optimization of wound healing and prevention of wound drainage are important initiatives. The Aquacel Ag Hydrofiber dressing is an antimicrobial dressing which has been postulated to support wound healing and possibly reduce the incidence of surgical site infection. The objective of this retrospective study was to evaluate its role in reducing the incidence of acute PJI in patients undergoing TJA.

Methods: After obtaining institutional review board approval, retrospective chart review was undertaken. The rate of acute PJI (occurring within 3 months postoperatively) in 946 consecutive patients who underwent TJA and received the Aquacel dressing (study group) was compared to that occurring in 946 consecutive patients who underwent TJA and received a standard dressing (control group). The Aquacel dressing was applied on the surgical site in sterile conditions in the operating room and kept for 5 days postoperatively. Standard dressing application consisted of sterile gauze applied over the incision site in the operating room and secured with adhesive tape. PJI was defined according to the new definition proposed by the workgroup of the Musculoskeletal Infection Society.

Results: The incidence of acute PJI was found to be significantly higher at 1.8% (17/946) in patients receiving standard gauze dressing compared to 0.4% (4/946) in patients who received the Aquacel dressing ($p = .007$).

Conclusion: PJI is a major healthcare concern with a mental, physical and monetary burden on affected patients. The Aquacel dressing appears to be effective in reducing the incidence of acute PJI by more than three quarters in patients undergoing TJA. Hence, its systematic use may represent a cost-effective measure to prevent the occurrence of acute PJI following TJA.

Pre-admission Cutaneous Chlorhexidine Preparation Reduces Surgical Site Infections in Total Hip Arthroplasty

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Introduction: Joint infections following total hip arthroplasty often requires multiple surgical procedures and impose a marked economic burden on the patient and hospital. Since it has been demonstrated that a majority of infections occur due to contamination from the patient's skin flora, efforts have targeted pre-operative methods to reduce this contamination. The primary purpose of this study was to evaluate the incidence of surgical site infections in total hip arthroplasty patients who used an advance at-home pre-admission cutaneous surgical preparation protocol and to compare these results to a cohort of patients who undergoing standard in-hospital peri-operative preparation only and did not use the protocol.

Methods: Patients scheduled for surgery were given two packets of 2% chlorhexidine gluconate-impregnated cloths, with instructions for use the evening before and morning of surgery. Compliance was confirmed during admission. Records between 2007 and 2010 were reviewed to identify deep incisional and periprosthetic infections in 2,458 patients. The Centers for Disease Control and Prevention and the Musculoskeletal Infection Society definitions were used for diagnosis. Patients were stratified by the National Healthcare Safety Network risk category, American Society of Anesthesiologists grade, surgical time, demographics, and co-morbidities.

Results: A statistically significant lower incidence of surgical site infections was found in the chlorhexidine preparation group. Three surgical site infections occurred in 557 patients (0.5%) of the chlorhexidine group compared to 32 of 1,901 patients (1.7%) who did not use the protocol and underwent standard in-hospital peri-operative skin preparation only.

Discussion and Conclusion: The use of an advance pre-admission chlorhexidine protocol significantly reduced the incidence of surgical site infections in total hip arthroplasty when compared to patients not using this protocol and undergoing in-hospital peri-operative skin preparation only. This study validates prior studies in orthopedics suggesting this an effective method to prevent periprosthetic infections.

Aseptic Protocol Decreases Surgical Site Infections after Total and Revision Hip Arthroplasty

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Introduction: Surgical site infections (SSI) are devastating complications and have been linked to several risk factors: (1) ASA > 3, (2) BMI > 30, (3) revision, (4) renal insufficiency, and (5) immunodeficiency. We predict a protocol including 3 phase antiseptic skin preparation (4% chlorhexidine-gluconate, 70% isopropyl-alcohol, 10% povidone) and perioperative vancomycin and cefazolin, significantly lowers SSI risk.

Methods: Medical records of consecutive primary and aseptic revision THA from 2005 to 2010 were reviewed by three blinded reviewers for SSI risk factors. ASA score was assessed pre-operatively by independent anesthesiologist and patients stratified low (≤ 1), medium (≤ 2), and high risk (≥ 3) based upon number of SSI risk factors. SSI was defined using CDC criteria. Chi squared statistic compared SSI rate and odds ratios compared incidence of risk factors and overall SSI to published data. Number needed to treat (NNT) was calculated using $NNT = (1 - (PEER * (1 - OR))) / (PEER * (1 - PEER) * (1 - OR))$. PEER = patient expected event rate.

Results: Our population was significantly higher risk than previous reports ($p < 0.04$). 79% of patients were ASA > 3 (OR 8.3-16.1), 47% BMI > 30 (OR 1.5-2.95 $p < 0.05$), 44% ≥ 10 pack-year smoking and 57% > 3 risk factors. We found 0.4% (2 / 467 patients) SSI using our aseptic protocol, which is among the lowest reported ($p < 0.05$). Two Infections (Pseudomonas and Enterobacter) successfully retained implant at > two years. No patients were lost to follow up. NNT indicates as few as 52 patients need to undergo THA to statistically significantly reduce SSI rates using our protocol.

Conclusion: In a high risk population undergoing total and revision THA, our aseptic protocol results in 0.4% SSI rate. NNT calculation suggests that our aseptic protocol could significantly reduce SSI in individual surgeon's practices.

Pulse Lavage is Inadequate at Complete Removal of Biofilm from the Cobalt Chrome Surface in Total Knee Arthroplasty Components

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Introduction: In acute periprosthetic infection, irrigation and debridement with component retention has a high failure rate (60-80%). This suggests the continued presence of biofilm after irrigation and debridement. We hypothesize that pulse lavage irrigation is ineffective at removing a majority of bacterial biofilm from TKA metal components.

Methods: A biofilm model was created by culturing cobalt chrome metal coupons in a *Staphylococcus aureus* broth. *S. aureus* was transfected with luciferase, a bioluminescent protein. To quantify biofilm mass and location on the cobalt chrome surface, a photon collection camera was used to measure bioluminescent signal. The mass of biofilm remaining after pulse lavage irrigation was determined by measuring the bioluminescent signal on metal coupons before and after irrigation with 3L of normal saline solution. Next, to determine if a small mass of undetected biofilm remained after irrigation, the metal coupons in both groups were cultured on agar plates for 24 hrs, and bioluminescent signal was again measured and compared.

Results: After culture, *S. aureus* biofilm was imaged on approximately 50% of the smooth polished surface of cobalt chrome. Immediately following pulse lavage irrigation, there was an absence of biofilm signal indicating a large removal of biofilm mass. After culturing irrigated and non-irrigated cobalt chrome surfaces on agar plates for 24 hrs, there was no difference in bioluminescent signal indicating comparable bacterial mass in each group.

Conclusion: Pulse lavage irrigation removes biofilm mass from the surface of cobalt chrome TKA components. However, the comparable bacterial mass between irrigated and non-irrigated groups after culture for 24 hrs indicates a small amount of the remaining bacterial biofilm is capable of reestablishment of the bacterial infection. This suggests that pulse lavage is ineffective at removing the necessary amount of biofilm to prevent recurrence of acute infection in total knee arthroplasty metal components.

Medial Gastrocnemius Flap for Soft Tissue Defects following Total Knee Arthroplasty: Functional Outcomes and Risk Factors for Failure

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Introduction: Soft tissue defects following total knee arthroplasty (TKA) are a potentially devastating complication. Medial gastrocnemius flaps are occasionally required to provide soft tissue coverage, most commonly in the setting of periprosthetic joint infection (PJI). The purpose of this study is to evaluate the outcomes of medial gastrocnemius flap reconstruction for soft tissue defects following TKA.

Methods: Thirty-six medial gastrocnemius flaps were performed in 20 men and 16 women with a mean age of 63 years at the time surgery (range 41 to 83). Failure was defined as any patient who could not undergo reimplantation of a TKA or recurrence of PJI.

Results: Fourteen patients (39%) were deemed failures including nine who underwent arthrodesis (25%) and two who underwent above the knee amputation (6%). Reimplantation was attempted in 31 patients of whom 14 had recurrence of PJI. Failure was associated with static as opposed to a mobile spacer (86% vs. 36%; $p = 0.004$), increased number of prior operative procedures (>4 ; 71% vs. 32%; $p = 0.023$) and coverage at the time of antibiotic spacer placement (50% vs. 14%; $p = 0.024$). For patients without recurrent PJI, the mean knee society score was 75.9 (range 20 to 97) and the SF-12 Physical and Mental scores were 38.3 and 51.8 (ranges 24.2 to 55.7 and 25 to 63.2, respectively). One complication was noted at the flap donor site.

Conclusions: The requirement of a gastrocnemius flap for treatment of PJI was associated with a high risk of failure. Risk factors for failure included an increased number of prior surgeries, placement of the flap at the time of the 1st stage and the use of a static spacer. Further studies are warranted to determine how to best manage patients with soft tissue defects in the course of treatment of PJI.

Intraoperative Swab Cultures are not as Good as Tissue Samples for Diagnosis of Periprosthetic Joint Infection

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Introduction: While it is accepted that accurate identification of the infecting organism is useful in guiding treatment of PJI, there remains no consensus regarding the optimal culture technique. The goal of this study was to compare the yield of intraoperative tissue samples versus swab cultures in diagnosing PJI.

Materials and Methods: Tissue and swab cultures (three each) were collected prospectively during 156 consecutive revision arthroplasty cases. The tissues and swabs were taken from the same representative regions of the joint. A total of 117 cases (74 hips and 43 knees; 30 septic and 87 aseptic) were included for analysis. Results from septic and aseptic cases were used to calculate sensitivity, specificity, PPV, and NPV for both tissues samples and swab cultures. The Fisher's exact test was used to estimate the strength of association of culture results with true PJI.

Results: Tissue cultures were positive in 57/90 samples for infected cases (yield= 63.3%), and swab cultures were positive in 49/90 (yield=54.4%) ($p < 0.005$). Tissue cultures were positive in 4/261 samples taken from aseptic cases (false positive rate =1.5%), while swab cultures were positive in 12/261 (false positive rate=4.6%) ($p < 0.005$). The sensitivity, specificity, PPV, and NPV were 63.3%, 100%, 100%, and 88.8% for tissue cultures, and 53.3%, 97.7%, 88.9%, and 85.9% for swab cultures, respectively. Positive tissue cultures (OR 108.5; 95% CI 36.7-435.2) were more strongly associated with true diagnosis of infection compared to positive swab culture (OR 24.4; 95% CI 11.6-55.0).

Conclusion: Tissue cultures are better for isolation of infecting organisms than swabs and demonstrated higher sensitivity, specificity, PPV, and NPV for diagnosing PJI. Swab cultures had a lower yield than tissue culture in infected cases and demonstrated a higher false positive rate. Because swab cultures pose the risk of imperfect identification of infecting organism in PJI, their use in obtaining intraoperative culture specimens should be discouraged.

Identifying the Microorganism in Infected Hip and Knee Arthroplasties

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Introduction: Identifying the microorganism in a prosthetic joint infection is important for targeted antimicrobial treatment. The aims of this study were to compare three different intraoperative sampling techniques and to assess the role of sample enrichment in prosthetic joint infections.

Methods: We retrospectively reviewed 33 revision arthroplasties for infection and a control group of 113 revision arthroplasties for causes other than infection. The different sampling techniques included fluid in a sterile container, fluid in blood culture bottles and multiple tissue samples. All samples were grown for five days and underwent enrichment.

Results: The fluid in culture bottles had the highest sensitivity (0.67) and specificity (1), compared to fluid in sterile containers (0.26 and 0.98) and tissues samples (0.39 and 0.96) respectively. Enrichment did not significantly affect the results of intraoperative fluid samples. With tissue samples there was not a statistically significant increase in sensitivity but there was a decrease in specificity of 0.37 ($p = 0.000$).

Conclusion: Fluid in culture bottles had the best profile for the correct identification of microorganisms. This technique should be used intraoperatively in revision arthroplasty. Care should be taken when interpreting the relevance of samples grown by enrichment as the risk of contaminants being cultured may outweigh any potential increase in sensitivity.

Descriptive Epidemiology of Femoroacetabular Impingement: A North American Cohort

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Introduction: Symptomatic femoroacetabular impingement (FAI) is associated with hip pain, functional limitations and secondary osteoarthritis. There is limited information from large patient cohorts defining the specific population affected by FAI. Establishing a large cohort will facilitate identification of “at risk” patients, and will provide a population for ongoing clinical research initiatives. Therefore, we have established a multicenter, prospective, longitudinal cohort of patients undergoing surgery for symptomatic FAI. The purpose of this study is to report the descriptive epidemiology and contemporary surgical treatment trends for patients with symptomatic FAI.

Methods: Upon approval of the Institutional Review Boards at seven institutions, nine surgeons enrolled patients undergoing surgical intervention for symptomatic FAI from 2008-2011. Patient demographics, physical exam, radiographic data, diagnoses, operative data, and standardized patient reported outcome measures are collected. The first 1130 cases are analyzed in this study.

Results: 1076 consecutive patients (1130 hips) are enrolled. 55% are female, 45% male, the average age is 28.5 years, and the average BMI is 25.1. Patients of the Caucasian race (91%) are predominantly treated for FAI. 21% reported a family history of hip surgery. 3.2% reported disability due to hip pain at time of surgery. 47.6% of hips had a diagnosis of cam FAI, 6.4% pincer FAI, 44.5% combined FAI 15% had previous surgery. Surgical interventions were arthroscopy (56%), surgical dislocation (34%), limited open (18%) and reverse PAO (3%). 92% of cases included a femoral head neck osteochondroplasty and 36% an acetabular rim osteoplasty. 48% had a labral repair, 16% labral debridement and 39% acetabular chondroplasty.

Conclusion: This multicenter, prospective, longitudinal cohort is one of the largest FAI cohorts to date. These data indicate that FAI occurs predominantly in young, Caucasian patients with normal BMI, and there is a higher rate of occurrence in women. A combined (cam/pincer) FAI disease pattern is most common. Contemporary treatment is predominantly arthroscopic followed by surgical hip dislocation.

Mobile Compression Devices are Efficacious for VTE Prophylaxis following Total Joint Arthroplasty

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Introduction: Venous thromboembolic events (VTE) are the most common complication following total joint replacements. Recent literature shows use of a mobile compression device (MCD) is effective for VTE prevention, but efficacy is dependent on patient compliance. The purpose was to prospectively assess patient compliance with prescribed use of an MCD for VTE prophylaxis.

Methods: Adults undergoing elective primary or revision knee/hip arthroplasty were prospectively enrolled. Patients were ineligible if they had prior surgery within three months, current deep vein thrombosis, history of pulmonary embolism, on chronic anticoagulation, or required prolonged immobilization post-operatively. Patients were stratified to standard or high risk anticoagulation therapy by hospital protocol. Standard risk patients were instructed to wear an MCD 23 hours/day for 10 days post-operatively. Compliance was measured two ways: objectively from the MCD hard drive which records usage and patient reported compliance two weeks post-operatively.

Results: 747 joint replacements were enrolled (263 knees/484 hips). Four patients were missing compliance data due to malfunction/loss of MCD. Average daily use was 83% (19.92 hours). Patient compliance rates based on hourly usage were: 1.5% (11) used the device < 12 hours/day (considered non-compliant); 14% (104) used the MCD > 12 but < 18 hours/day (considered somewhat compliant); 84.5% (628) used the device \geq 18 hours/day (considered compliant). There was no difference in compliance based on gender ($p=0.710$) or primary/revision surgery ($p=0.505$). Hip replacement patients were more compliant than knee replacement patients ($p=0.003$). 655 patients completed two week follow-up; 96% (629) reported compliance. Patient-reported compliance was higher than compliance captured on the MCD ($p<0.0001$). Incidence of VTE was very low ($n=3$; 0.4%). All 3 patients who experienced a VTE were compliant.

Conclusion: Use of an MCD is excellent for VTE prophylaxis in primary and revision total joint arthroplasty, and is associated with high efficacy and patient compliance.

Pulmonary Embolus Following Total Joint Arthroplasty: Identification and Stratification of Risk Factors

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Introduction: Prophylaxis of venous thromboembolism (VTE) following total joint arthroplasty (TJA) presents the clinical dilemma of balancing risk of postoperative thrombosis and anticoagulation-related complications (bleeding, hematoma formation, infection...). Pulmonary embolism (PE) risk stratification of patients undergoing TJA is needed to tailor prophylaxis based on thrombotic and bleeding risk. The purpose of this study is to identify preoperative co-morbid conditions that can predict increased risk of PE following arthroplasty.

Methods and Materials: Between January 2000 and April 2011, 24,567 patients received warfarin prophylaxis for six weeks (targeted INR of 1.5 to 1.8) and 1,824 patients received aspirin 325mg twice daily. 24 patients receiving heparin and heparin derivatives were excluded. Cases of symptomatic PE were identified from our prospective database and confirmed by reviewing all chest CT and VQ scans performed. Backwards stepwise logistic regression was utilized to identify independent predictors of PE up to 90 days postoperatively following TJA, and a nomogram was created to predict the risk of PE.

Results: Incidence of PE following primary and revision TJA at our institution was 1.1% (281/26,391). Incidence of fatal PE was 0.02% (4/26,391). Multivariate analysis identified elevated BMI ($p < 0.035$), knee procedures ($p < 0.006$), higher Charlson Comorbidity Index (CCI) ($p < 0.015$), COPD ($p=0.006$), atrial fibrillation ($p < 0.001$), anemia ($p < 0.001$), presence of DVT ($p < 0.001$), and depression ($p=0.012$) as independent risk factors for PE. Based on these risk factors and derived scoring criteria, patients can be classified into low (0.35%), medium (1.4%) and high (9.3%) risk categories.

Conclusion: Patients that are obese, undergo knee procedures, have an elevated CCI, COPD, atrial fibrillation, anemia, depression, and postoperative DVT are at a higher risk of developing a postoperative pulmonary embolism. These risks factors should be considered when deciding upon postoperative anticoagulation prophylaxis. This study provides data that allows division of patients into different risk categories for development of VTE.

Symptomatic Femoroacetabular Impingement: Are There Gender-Specific Disease Characteristics?

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Introduction: Femoroacetabular impingement (FAI) is increasingly recognized as a cause of hip pain in young adults. Cam-type FAI is commonly thought to occur more in males, with pincer-type FAI occurring more in females. Our experience suggests that this generalization may be inaccurate. The purpose of this study was to compare the clinical, radiographic and intraoperative characteristics of symptomatic FAI to determine gender-specific differences in FAI presentation.

Methods: We retrospectively identified consecutive cohorts of 50 male and 50 female patients treated for symptomatic FAI by a single surgeon. Established clinical and radiographic methods were used for disease characterization. Statistical analysis was performed to identify significant differences in clinical, radiographic, and intraoperative findings between males and females.

Results: Statistical differences in age, BMI, and pain chronicity by gender were not detected. Modified Harris Hip scores and UCLA activity scores were lower in females (p 0.005 and p 0.014, respectively). Females were more likely to have lateral hip pain (p 0.047), anterior/groin pain and more internal rotation in flexion than males (p <0.001). Only 58.0% of females had less than 20° of internal rotation in flexion compared to 86.0% of males (p 0.002). Males were more likely to have an elevated alpha angle (p 0.002), a decreased head-neck offset (p 0.007) and elevated alpha angles on the AP pelvis radiographs (p <0.001). A crossover sign greater than 10 mm from the acetabular sourcil (p 0.001) and acetabular articular cartilage cleavage or defects (p 0.001) were significantly more common in males. The distribution of labral lesions was not significantly different (82% vs 80% detachment).

Discussion: Significant differences in disease characteristics exist between males and females with FAI. Female patients have greater disability at presentation and are less active than males with FAI at presentation, despite less advanced acetabular cartilage pathology. Female patients generally had milder cam-type deformities and less acetabular retroversion than males.

Pulmonary Embolism in a Community Arthroplasty Registry: 6564 Patients with VTE Prophylaxis Utilizing ACCP Guidelines and Strict Blood Sugar Control

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Introduction: Prevention of VTE in the Total Joint population continues to be controversial, with some conflicting guidelines and practices. In our community four hospital system we have a robust registry and 36 orthopaedic surgeons practicing TJA surgery that follow guidelines together and evaluate results objectively. In the case of VTE prophylaxis, we use ACCP guidelines. Strict blood sugar control is utilized. This study evaluates 7 years of data relative to venous thromboembolism and risk factors associated with PE in this specific population.

Methods: TKA and THA patients, primaries and revisions, were evaluated from 1/1/04 to 12/31/10 in a retrospective review of a total joint registry. The data evaluated included year of surgery, surgery type, demographics, BMI, DVT prophylaxis, OR time, PE rates, complications, returns to the OR, anesthesia methods and comorbidities. All diabetics were required to have a HgA1C of less than 8.0 or their surgeries were postponed. Coumadin was managed by pharmacy specialists, and tight blood sugar control was used. One-way ANOVA and Chi-square analyses were performed.

Results: There were 27 PE's in a total population of 6564 patients evaluated (0.41%). There were 50 deep infections (0.76%), and 14 hematomas required return to the OR (0.21%) The following factors were statistically significant in comparing the PE group with the non-PE group: BMI of 32 or more ($p=0.035$), female gender ($p=0.023$), and primary total knee replacement (vs. THA) ($p=0.031$).

Conclusions: PE rates in this study were relatively low compared to published literature in a large population of patients operated on by a large cohort of surgeons in a community hospital setting utilizing ACCP Guidelines, consistent with SCIP, with strict diabetic control. Those who developed PE's were more likely to be female, obese, and TKA patients. Consideration of additional measures may need to be considered in these groups of patients.

Revision Osteochondral Allografts: Do They Work?

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Introduction: Fresh osteochondral allografts (OCA) transplantation is a useful treatment option for knee osteochondral diseases. OCA clinical failure may require further surgery, including secondary (revision) OCA. No studies have analyzed outcomes of secondary OCA. This study's purpose was to evaluate outcomes of patients who have undergone secondary OCA of the knee.

Methods: Of 534 patients (597 knees) who underwent knee osteochondral allografting, 33 patients (33 knees) underwent subsequent secondary OCA. Mean age at the time of primary OCA was 33 years (range, 16 - 64), 52% were male. Osteochondritis dissecans was the most common original diagnosis. Indication for secondary OCA included allograft failure (64%), progression of cartilage disease (27%) and traumatic injury (9%). Clinical evaluation included the IKDC pain and function scores, 18-point scale, and Knee Society function (KS-F) scores. OCA failure was defined as conversion to knee arthroplasty. Predictors of OCA failure were assessed.

Results: Mean follow-up after secondary OCA was 10.6 years (range, 1.5-27) with 70% having more than five years follow-up. Mean time from primary to secondary OCA was 35 months (range, 6-145). Average revision graft area was 9.5 cm² (range, 1.5-30), with most common graft site medial femoral condyle. Thirteen patients (39%) were considered failures following secondary OCA (mean time to failure 5.5 years, range, 1-11.5). Main predictors of failure were original diagnosis of osteoarthritis and progression of cartilage disease at time of secondary OCA. Of failed patients, 46% had over five years secondary OCA survival. Average age at time of failure was 45 years (range, 26-73). Mean graft survival for remaining 20 patients (61%) with secondary grafts in situ was 10 years (range, 2.5-26). Mean pain and function scores at last follow-up were improved. Graft survivorship at ten years was 49%.

Conclusions: Secondary OCA of the knee demonstrated acceptable clinical outcome and should be considered an option for patients with failed primary OCA.

Interpretation of Culture Results in the Setting of Presumed Aseptic Hip and Knee Revision

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Introduction: It is common to screen for occult bacterial infection during presumed aseptic revision. When such cultures are positive, treatment is dictated by whether they represent a false or true positive. We seek to investigate whether the number of positive cultures influences the risk of subsequent surgery for periprosthetic infection (PPI) and to determine the number of cultures that is adequate for predicting false positive results.

Methods: Bacterial culture results from 1168 consecutive presumed aseptic revisions were collected and used to calculate the rate of culture positivity. We determined the number of specimens sent and the number of positive bacterial cultures per case. Medical records were reviewed to determine whether culture positive patients were treated with antibiotics and to determine whether the patients showed signs of or required subsequent surgical treatment for PPI. With this data, we investigated whether multiple positive cultures increased the risk of subsequent surgery for PPI and to determine whether 3 specimens are adequate for predicting false positive results.

Results: Of 1074 patients with 0 positive cultures, 77 (7.2%) required subsequent surgery for PPI. 94/1168 (8%) cases showed at least 1 positive bacterial culture. 19 patients showed multiple positive cultures with 4 (21.1%) requiring subsequent surgery for PPI. 31 patients showed 1/3 positive cultures and were not treated with antibiotics, with only 1 patient (3.2%) required subsequent surgery for PPI. Compared to patients with no positive cultures, having multiple positive cultures was significantly associated with the need for subsequent surgery for PPI ($p=0.047$). Compared to patients with no positive cultures, patients with 1/3 positive cultures showed a 4% lower rate of subsequent surgery for PPI with a 95% confidence interval of -4.1% to +12.0%.

Discussion: Our data confirms that having multiple positive cultures often represents a true positive result while 3 culture specimens are adequate for predicting false positive results.

Failed Unicompartmental Knee Arthroplasty: An Analysis of 471 Cases

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Introduction: Unicompartmental knee arthroplasty (UKA) has been shown to be a good and less invasive alternative in selected patients. Concern however remains regarding the main causes for early and late failures of UKA.

Methods: Between January 2000 and March 2012, all patients treated for a failed UKA in the authors' institution were enrolled in this retrospective study. A total of 471 patients (m=161; f=310) were recruited and causes for failure were analyzed based on the medical records and radiographs at the time of revision.

Results: The patient collective of failed UKA consist of 161 male and 310 female with a mean age of 67.7 years (42-91; SD=10.1) at time of revision. The patients had to be revised after a mean time of 6.1 years (0.1-27.9 years; SD=5.6) after primary implantation. The major reason for failure was contralateral arthritis in 39.5 %, followed by aseptic loosening in 25.4%, instability in 15.3%. Infection was found in only 1.5 %. Revision due to persistent pain and arthrofibrosis was performed in 1.8% and 2.5% respectively. Relevant polyethylene wear was noted in 14%.

Discussion and Conclusion: The mean reason for failure after UKA in our cohort was contralateral arthritis. Most interestingly, the mean time of failure after UKA occurred already after 6.1 years in our series.

Two-Stage Revision Total Knee Arthroplasty with an Articulating Spacer: Minimum 5 Year Review

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Introduction: The purpose of the current study is to review the minimum 5-year results of two-stage revision total knee arthroplasty (TKA) with articulating spacers for chronically infected TKA, and secondarily, compare these outcomes with those performed with non-articulating spacers.

Methods: We enrolled 106 patients presenting to a tertiary care arthroplasty service with an infected TKA that were treated with a two-stage revision arthroplasty. Patients were retrospectively reviewed based on the type of spacer used during their first-stage revision; 60 patients were treated with articulating spacers, 46 with non-articulating spacers. Prospective data was collected on each patient including demographic information, KSS, WOMAC and SF-12 scores. The scores were obtained preoperatively and annually as part of standard follow up clinical review. Data on re-operation was also collected on each patient.

Results: The articulating and non-articulating spacer groups were well matched on age, BMI, gender and side of surgery.

There were statistically significant improvements in all components of the KSS ($p < 0.001$), WOMAC pain ($p = 0.02$), stiffness ($p = 0.05$) and function ($p = 0.001$) when comparing post-operative to pre-operative scores. There were no differences in the SF-12 mental component score and was a trend towards significance on the physical component score. Survivorship of revision TKA that were initially treated with articulating spacers at 5 years for all causes and aseptic loosening was 88.1% and 91.3% respectively.

When comparing articulating and static spacers, knees treated with articulating spacers obtained an average range of motion of 100 degrees in comparison to 84 degrees for the static spacers ($p = 0.009$).

Conclusion: Two-stage revision arthroplasty with articulating spacers for chronically infected TKA resulted in successful eradication of infection in 91.3% of patients at five years. There were statistically significant improvements in post-operative KSS and WOMAC scores with articulating spacers. The use of articulating spacers result in an improved range of motion when compared to two-stage revision arthroplasty performed with static antibiotic spacers.

Revision Total Joint Arthroplasty: The Epidemiology of 63,143 Cases in New York State

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Summary: Trends in incidence, primary etiology, and potential complications of revision total joint arthroplasty (shoulder, knee, and hip) were identified over the past eighteen years in New York State.

Introduction: Recent evidence shows a substantial rise in the number of total joint arthroplasty (TJA) cases performed. With an aging population and the long-term mechanical strains placed on implants, a corresponding increase in revision TJA procedures is suspected. This study investigates cases of revision TJA (shoulder, knee, and hip) and identifies notable trends in incidence and demographics.

Methods: New York Statewide Planning and Research Cooperative System (SPARCS) inpatient database was utilized to identify revision total shoulder, knee, and hip arthroplasty procedures between 1993 and 2010 in patients greater than 21 years. The data was reviewed to determine yearly incidence of all procedures and was used to compare associated demographics, rates of primary diagnoses, and potential complications.

Results: Between 1993 and 2010, a total of 1,806 revision TSAs, 26,080 revision TKAs, and 35,254 revision THAs were performed in New York State. The population-based incidence of these procedures increased 288%, 246%, and 44% respectively ($p < 0.001$). Revision burden for hip arthroplasty decreased from 16.1% in 2001 to 11.5% in 2010 ($p < 0.001$). Implant-associated mechanical complications accounted for 53.1%, 58.6%, and 67.8% of primary diagnoses ($p < 0.001$), while infection accounted for 5.4%, 11.2%, and 4.5% respectively ($p < 0.001$). Crude mortality rates and pulmonary embolus were highest in revision THAs (0.87% and 0.44%). Mean hospital lengths of stay over the past 10 years were 3.6, 5.8, and 7.1 days for revision TSAs, TKAs, and THAs, respectively.

Conclusions: The rates of revision TSAs and TKAs are rising at a substantially faster rate than that of revision THAs. The percent of hip revisions, relative to all hip arthroplasty, has steadily decreased in incidence over the past decade. Of all three procedures, implant-associated mechanical complications are most prevalent in total hip arthroplasty, while rates of infection are most prevalent in total knee arthroplasty.

An Electronic Risk Calculator for Early Revision in Medicare TKA Patients

Kevin J. Bozic, MD, MBA, Edmund Lau, MS, Kevin L. Ong, Ph.D., Vanessa Chiu, MPH, Steven Kurtz, Thomas P. Vail, MD, Harry E. Rubash, MD, Daniel J. Berry, MD

Introduction: Although total knee arthroplasty (TKA) outcomes have been characterized at the population level for Medicare patients, little is known regarding a patient's individual risk of early failure following primary TKA. The purpose of this study was to develop an electronic risk calculator for estimating the risk of early revision following primary TKA in Medicare patients based on their individual demographic and clinical characteristics.

Methods: The Medicare 5% sample claims database was used to calculate the risk of revision TKA within 12 months following primary TKA for patients with and without specific comorbidities in 117,903 Medicare patients who underwent primary TKA between 1998 and 2010. Multivariate Cox regression using 29 comorbid conditions, age, gender, race, and socioeconomic status (SES) were used as inputs into an electronic risk calculator to estimate the patient-specific risk of early revision in Medicare TKA patients compared with the risk for the entire Medicare TKA population and patients with similar demographics.

Results: The overall risk of revision within 12 following primary TKA was 1.14%. White women aged 65-69 years with ischemic heart disease, peripheral vascular disease, cerebrovascular disease, hemiplegia/paraplegia, UTI, hypercholesterolemia, anemia, depression, psychoses, drug and alcohol abuse, hypothyroidism, and hypertension were at highest risk for early revision TKA (20.6% [95% CI: 8.24%-42.9%]).

Conclusion: This electronic risk calculator can be used to counsel Medicare patients regarding their patient-specific risk of early revision following primary TKA.

Stemmed femoral implants show lower failure rates in revision TKA

Maria Vanushkina, Thomas Bowen, Kaan Irgit, Kent Strohecker, MS, Charles Nelson

Introduction: The frequency of revision TKA is predicted to nearly double over the next 25 years with projected costs exceeding \$2 Billion by 2030. There has long been a debate of whether revision TKA stems should be cemented or not cemented. However, revision TKAs are often performed by low volume knee surgeons, and many revision TKAs are performed without any stems, potentially increasing the likelihood of costly re-revisions. The goal of this study was to compare the re-revision rates between revision TKA procedures performed with stemmed or stemless implants.

Methods: After IRB approval, the EHRs and x-rays of all knee revision cases (CPT 27486,27487) performed by 8 surgeons between 2004 and 2011 were retrospectively reviewed. 551 adult patients were identified. Clinical and Radiologic outcomes were accessed. Radiographswere examined for pre-revision severity of bone loss. Revisions with hinged constrained components, revisions for peri-prostheticinfection or fracture, revisions of unicompartmental knee replacement, isolated polyethylene exchange only, , and patients with less than two year follow up were excluded. Standard descriptive statistics, χ^2 analysis, independent t test for intergroup comparison, and risk ratios were calculated.

Results: The patients were divided into four subgroups based on implants used. There were significantly increased re-revision rates among the two groups revised without use of femoral stems ($p,0.01$). The group in which both the tibial and femoral components did not have stemshad the highest re-revision rate (60.71%), followed by the stemless femur-stemmed tibia group (46.67%), and the stemmed constrained condylar knee (14.29%). The fully stemmed group had the lowest re-revision rate (12.90%) which compares favorably with the other literature values.

Discussion and Conclusion: Stemmed femoral components significantly decreased re-revisions. We believe stemmed femoral implants should be implemented as a standard of care for all revisionTKAs to help reduce costly and painful re-revision procedures.

β-Catenin: A Marker with High Specificity for Arthrofibrosis after TKA

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Introduction: Arthrofibrosis remains one of the most severe complications after TKA. A clear histopathologic genesis has not been found yet. As β-catenin is an associated marker in fibromatosis, we wanted to define it's role in patients with clinical evidence of arthrofibrosis after TKA.

Methods: 262 intraoperative synovia biopsies of patients with clear clinical defined arthrofibrosis after TKA were graded semiquantitatively for fibroblast density using an own published grading system. All probes were stained with antibodies against β-catenin in immunohistological testings; compared with a reference group of 29 neosynovialitis type 4 specimen of patients without clinical signs of arthrofibrosis in TKA revision cases.

Results: In 85% of all specimen the histopathologic diagnosis revealed an arthrofibrosis. The distribution for the fibroblast density was in 30 % grade I, in 47 % grade II and in 23% grade III, according to our classification. The cellularity was significantly higher in every specimen compared to the reference group ($p < 0.05$ grade 1, < 0.001 grade 2, < 0.001 grade 3). 20 β-catenin positive fibroblasts per high power field were identified as a cut off value distinguishing arthrofibrosis from neosynovialitis type 4 with a sensitivity of 73 % and a specificity of 87 %.

Conclusion: A histopathologic diagnosis of arthrofibrosis after TKA can be defined as fibrotic synovial tissue with an increased cellularity of β-catenin staining fibroblasts. A cut off value can be defined at 20 β-catenin positive fibroblasts per high power field. This allows for a clear comparison between a neo-synovialitis and arthrofibrosis of the affected knee joint.

Causes of Instability after Total Knee Arthroplasty

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Introduction: Instability is a recognized mode of failure of TKA, and may result from multiple, distinct etiologic factors. We propose a new classification of instability that identifies specific etiologic factors and guides operative treatment.

Methods: We reviewed 82 revision TKAs (79 patients) performed for instability from 2003 to 2010. Revision was performed at an average of 3.533.6 years (range, 0.1-23 years) following 71 primary and 11 revision TKAs, in 48 women and 31 men with an average age of 66310.1 years (range, 45-88 years). There were 44 posterior-stabilized, 32 cruciate-retaining, 3 cruciate-sacrificing, and 3 constrained condylar prostheses revised. The type of revision surgery performed was dictated by the underlying etiology.

Results: We identified six categories for instability following TKA. Seventeen patients presented with multi-factorial instability classified in two or more categories. Gap mismatch was present in 26 knees (32%), 23 of which were treated by either femoral component or two-component revision. Global instability was present in 26 knees (32%), with underlying etiologies including chronic synovitis, recurrent hemarthrosis, or under-sizing of a modular insert. 13/26 (50%) of knees with global instability were treated by tibial insert exchange. We identified 17 knees (21%) with MCL, LCL, or PCL insufficiency. 13 knees (16%) with implant loosening and 7 knees (8.5%) with implant malposition presented with symptoms/signs of instability. There were 9 cases (11%) of extensor mechanism insufficiency. In the operating room, adequate coronal and sagittal plane stability was achieved in all cases. The level of inherent component constraint was increased in 61 knees (73%). A constrained condylar design was used in 48 knees (58%). 3 knees were revised to a rotating hinge. To our knowledge, there have been four failures: deep infection (2), residual instability (1), subsequent implant loosening (1).

Conclusion: The unstable TKA results from several distinct etiologies, which must be treated at the time of revision. In this series, revision TKA was tailored to the specific underlying etiology for instability, and included an increased level of component constraint in the majority of cases.

Radiographically Silent Loosening of the Acetabular Component in Total Hip Arthroplasty

Anay R. Patel, M.D., Geoffrey S. Marecek, MD, Lalit Puri, MD, MBA

Introduction: Radiographic definitions of acetabular component loosening include a concentric lucency at the entire bone-implant interface or the appearance of gross migration or rotation of the acetabular component on imaging. However without these findings there is no clear definition of what defines a loose or well-fixed component. In this study we evaluated the fixation of acetabular components during revision THA and if loosening was detected on plain radiographs or CT.

Methods: We evaluated all aseptic revision THA performed for osteolysis between 2007 and 2011 at one hospital. We compared the radiologic diagnosis of these patients to their intraoperative findings to determine if any components had loosening that was “radiographically silent.” Radiographically silent loosening (RSL) was defined as loss of fixation which was not or could not be definitively diagnosed utilizing plain radiographs or CT scans.

Results: At our institution 137 THA were revised between 2007 and 2011 for diagnosis other than infection. Need for revision was determined in 69 patients by plain radiographs alone. Of the remaining 68 patients who were diagnosed with osteolysis about the acetabular component, all had had a CT scan performed and only one report indicated a possibly loose acetabular component which was confirmed intraoperatively. Of the remaining 67 patients with negative imaging, 9 (13.4%) were found to have a loose cup intraoperatively.

Discussion: Adequate fixation of the acetabular component has not been clearly defined radiographically and no clear algorithm has been determined to assess component fixation. As a result, RSL can go undetected until time of revision arthroplasty as was seen with 9 of 67 patients in our study. Further work is needed to determine the radiographic findings on plain films and CT scans that can help characterize the relative fixation of acetabular components in THA.

Fixation Strength of a Dual-Mobility Acetabular Component Cemented into a Well-Fixed Metal-Back During Revision THA

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Cementation of polyethylene (PE) liners into well-fixed metal-backs has become a popular option during revision total hip arthroplasty (THA) particularly for older and frail patients. This technique provides a straightforward alternative to removal of a well-fixed metal-back due to a failed locking mechanism, the unavailability of matching liners or the need to slightly re-orientate the acetabular component. Although dramatic results were reported with the use of dual-mobility acetabular components to manage hip instability during revision THA, no study to date evaluated the fixation strength of the cementation of a stainless steel dual-mobility acetabular component into a well-fixed metal-back.

Eight stainless steel dual-mobility and eight all-PE acetabular components were cemented into a titanium metal-back with a uniform 2- to 3-mm cement mantle. The strength of the cemented fixation was evaluated using lever-out and torsion testing. The interface at which failure occurred was determined.

Lever-out testing showed that the cemented dual-mobility cups failed at significantly higher maximum moment than the cemented all-PE cups (103.55 \pm 8.27 N.m vs. 66.00 \pm 9.52 N.m; $p < 0.0001$). During torsion testing, the maximum moment of the cemented dual-mobility cups was 127.94 \pm 23.87 N.m. However, no direct comparison could be performed with cemented all-PE cups due to an early failure of the PE itself before failure of the cement fixation occurred. In addition, failure was always observed at the metal-back/cement interface whenever it did occur.

The maximum moments measured in this study were dramatically higher than the in-vivo frictional moment classically reported in metal-on-PE THA. Therefore, a dual-mobility acetabular component cemented into a well-fixed metal-back constitutes a reliable and biomechanically safe alternative to acetabular shell removal or to cementation of PE liners while simultaneously preventing instability of the THA revision.

Osteolysis and the Acetabular Component in Total Hip Arthroplasty: A Computed Tomography-Based Assessment of Stability

Anay R. Patel, M.D., Geoffrey S. Marecek, MD, Mary Kwasny, Lalit Puri, MD, MBA

Introduction: Polyethylene wear (PE) and osteolysis remain major obstacles to the long-term durability of total hip arthroplasty (THA) however the specific anatomic factors that determine component stability are poorly understood. In this study we sought to determine what patterns of bony ingrowth about the acetabular component as seen on computed tomography (CT) scan could predict acetabular component stability.

Methods: From an initial pool of 192 patients who underwent revision THA, we found 78 patients who were diagnosed with osteolysis without infection or gross component migration. All CT scans were then evaluated for the presence and size of bony ingrowth in one of 12 sectors. Sectors were determined by dividing the cup into 4 sections on coronal imaging as defined by Charnley-Delee (CD) and 3 sections on sagittal and axial imaging. Regression analysis was combined with Categorization and Regression Tree analysis to determine what sectors and what size of bony ingrowth was predictive of acetabular component stability.

Results: In the population of 78 patients, 68 patients had stable cups intraoperatively. Bony ingrowth of greater than 5x5mm in Sector CD1 Anterior ($p = 0.022$) and CD3 Middle (0.001) was associated with acetabular component stability as was ingrowth of 10x10mm in Sector CD3 Posterior ($p = 0.003$). Presence of bony ingrowth in Sector CD3 Middle and CD3 Posterior has 74% sensitivity and 100% specificity for cup stability. The combination of these two criteria combined with bony ingrowth in Sector CD1 Anterior is 94% sensitive and 70% specific for cup stability.

Discussion: CT imaging can be used to determine bony ingrowth and osteolysis about the acetabular component in THA. In our study, bony ingrowth along the posterior aspect of the cup was highly specific for cup stability while both anterior and posterior bony ingrowth was highly sensitive for cup stability. We believe this sector-based method may be useful for determining acetabular component stability in the setting of osteolysis.

Mid-Term Radiographic Analysis of Trabecular Metal Augments for Acetabular Bone Loss in Revision Hip Arthroplasty

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Introduction: Acetabular bone loss during revision total hip arthroplasty (THA) is challenging as segmental and cavitory defects require structural support to achieve stability. Trabecular metal (TM) acetabular augments can be used to structurally support hemispherical cups in these cases. Positive short-term results have been reported; however, mid- to long-term results are unknown. Our study investigated the mid-term efficacy of TM augments in THA revisions.

Methods: Radiographs and medical records of 50 patients who underwent THA revision with a TM augment were retrospectively reviewed. Acetabular defects were graded with the Paprosky classification, based on preoperative radiographs and operative findings. Loosening was defined radiographically as gross change in cup position, change in abduction angle ($>5^\circ$), or change in vertical position of acetabular component ($>8\text{mm}$) between postoperative and latest follow-up radiographs.

Results: Fourteen patients had incomplete records and were excluded. The study population included 14 men and 22 women, averaging 65.9 years (range, 47-91), with average radiographic follow-up of 17.5 months (range, 2-57). All patients underwent revision THA using a TM multi-hole revision acetabular cup and TM acetabular augment(s).

There were 29 Paprosky Type IIIA and seven Paprosky Type IIIB defects. One patient with Paprosky Type IIIB had catastrophic clinical failure three months postoperatively. The remaining 35 acetabular revisions demonstrated signs of bony ingrowth with no significant difference in abduction angle ($P=0.56$), vertical distance from superolateral edge of the cup to the trans-ischial reference line ($P=0.93$), or the vertical distance from the center of the femoral head to trans-ischial reference line ($P=0.67$) between postoperative and latest follow-up radiographs.

Conclusions: TM augments provide a modular structural system to achieve bony ingrowth without large structural allografts, cages, and custom implants. No evidence of loosening was noted at the most recent follow-up. Trabecular metal augments can be used for reconstruction of acetabular bone loss with good mid-term results.

Survival and Failure Mechanisms of Revision THA and Revision TKA in a Community Registry

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Summary: Mechanisms of failure and CSR results of revision THA and TKA from a community-based registry of 28,859 arthroplasties performed over a 20 year period are reported.

Introduction: There are few reports of survivorship and failure mechanisms of revision total hip arthroplasty (THA) and revision total knee arthroplasty (TKA) from community surgeons. We are reporting the results of revision THA and revision TKA from a community-based registry of 28,859 arthroplasties performed over a 20 year period.

Methods: THA revisions (n=449) and TKA revisions (n=456) performed between September 1, 1991 and September 30, 2011 were included. The reason for revision failure was determined and Kaplan Meier survival curves were calculated to determine cumulative survival rates (CSR).

Results: Dislocation (33%) and aseptic loosening (23%) were the most common reasons for THA revision failure. Infection and failure of bone ingrowth each represented 11% of THA revision failures. THA revision CSR was 84.6%. Patients originally revised for dislocation had a CSR of 83%, aseptic loosening had a CSR of 89%, and wear/osteolysis had a CSR of 91%.

Infection (40%), aseptic loosening (20%) and instability (20%) were the most common reasons for TKA revision failure. TKA revision CSR was 82%. Patients originally revised for infection had a CSR of 71%, aseptic loosening had a CSR of 85% and wear/osteolysis had a CSR of 95%. Patients with aseptic TKA revisions had a significantly higher CSR than patients with septic revisions (86% vs. 71%, $p < 0.0001$).

Discussion and Conclusion: Although there are several reports examining primary THA/TKA failure, there are few analyzing THA/TKA revision failure in the community. CSR's reported here compare favorably to recently reported THA/TKA revision survivorship in Medicare patients at 5 years. It is clear that TKA revision failure due to infection (40% of TKA revision failures) must be addressed. The above findings have resulted in initiatives to reduce the incidence of infection after revision TKA. The goals of revision THA continue to focus on reducing dislocation/instability. Although, originally envisioned as an implant database, the registry is now being utilized as a valuable quality improvement resource.

Results of the Use of a Wound Vac® for Persistently Draining Wounds Following Hip Arthroplasty

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Introduction: Persistent wound drainage following hip arthroplasty is a known risk factor for periprosthetic infection. Negative pressure wound therapy has been used successfully in other fields for closed wound management. The goal of our study was to determine the safety and success rate of the Wound Vac® (Vac®) in the management of postoperative incisional drainage after hip arthroplasty and to determine risk factors for failure.

Methods: Using our institutional database, we identified cases where a Vac® was used on closed wounds after hip arthroplasty for management of postoperative drainage. We defined failure as those patients requiring subsequent surgery for persistent drainage. A multivariate analysis was performed to determine predictors of failure.

Results: 122 cases were identified over a 4-year period with an average clinical follow up of 2 years. On average, the Vac® was placed on post-operative day 4 and applied for 2 days. 96 patients (79%) required no further surgery and 26 patients (21%) met our criteria for failure. Of these 26 patients, 11 underwent a superficial irrigation and debridement (I&D), 12 underwent a deep I&D, and 3 patients ultimately required a delayed 2 stage exchange. Predictors of Vac® failure included INR level greater than 2 ($p=0.04$), greater than 1 prior hip surgery ($p=0.01$), Vac® application for greater than 48 hours ($p=0.02$), and multiple Vac® applications ($p=0.04$).

Conclusion: Persistent incisional drainage following hip arthroplasty was successfully treated using the Vac® in 79% of patients. Of those that initially failed the Vac®, 89% were successfully treated with a subsequent I&D. Early surgical intervention, rather than Vac® application, may be indicated in patients with an INR > 2 or who have had multiple prior hip surgeries.

An Electronic Risk Calculator for Early Revision in Medicare THA Patients

Kevin J. Bozic, MD, MBA, Edmund Lau, MS, Kevin L. Ong, Ph.D., Vanessa Chiu, MPH, Steven Kurtz, Thomas P. Vail, MD, Harry E. Rubash, MD, Daniel J. Berry, MD

Introduction: Although total hip arthroplasty (THA) outcomes have been characterized at the population level for Medicare patients, little is known regarding a patient's individual risk of early failure following primary THA. The purpose of this study was to develop an electronic risk calculator for estimating the risk of early revision following primary THA in Medicare patients based on their individual demographic and clinical characteristics.

Methods: The Medicare 5% sample claims database was used to calculate the rate of revision THA within 12 months following primary THA for patients with and without specific comorbidities in 56,030 Medicare patients who underwent primary THA between 1998 and 2010. Multivariate Cox regression using 29 comorbid conditions, age, gender, race, and socioeconomic status (SES) were used as inputs into an electronic risk calculator to estimate the patient-specific risk of early revision in Medicare THA patients compared with the risk for the entire Medicare THA population and patients with similar demographics.

Results: The overall risk of revision within 12 months following primary THA was 2.03%. White men aged 65 to 69 years with renal comorbidities, hypercholesterolemia, depression, psychoses, and hypertension and white women aged of 65-69 years with congestive heart failure, peripheral vascular disease, cerebrovascular disease, COPD, diabetes, renal disease, malignancy, UTI, anemia, depression, psychoses, hypothyroidism, hypertension, and valvular disease were at highest risk for early revision THA (5.84% [95% CI: 4.50%-7.54%] and 5.76% [95% CI: 4.47%-7.39%], respectively).

Conclusion: This electronic risk calculator can be used to counsel Medicare patients regarding their patient-specific risk of early revision following primary THA.

Surgical Indications for Re-revision in Total Hip Replacement (THR) Patients Younger than Age Fifty

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Introduction: As the incidence of revision surgery is increasing and the mean age at surgery is decreasing, revision and re-revision is occurring in younger patients. Since these patients are at higher risk for failure and re-revision, understanding the surgical indications and emphasizing necessary surgical technique is crucial. This project studies the causes for re-revision in patients who have their second revision before age fifty.

Methods: This retrospective, IRB-approved review of our research database revealed 965 revision THRs performed between 1983 and 2011. Of this cohort, re-revisions in patients under age fifty were performed in forty cases in thirty-nine patients. Surgical indications were identified for the re-revision and compared to the indication for the first revision.

Results: The average time from first to second revision was 9.4 years (range, two weeks to twenty-one years). The indication for re-revision was the same as for the first revision in 19/40 (47.5%). The most common reason for re-revision was aseptic loosening in 19/40 (47.5%). There were fourteen loose femoral components and ten loose acetabular components. Other indications were isolated polyethylene wear(5), recurrent dislocation(4), femoral component fracture(3), periprosthetic fracture(3), sepsis(3), liner dissociation(2), and pelvic discontinuity(1). Polyethylene wear was detected in 25/40(62.5%).

Conclusion: The surgical indications for re-revision in this young patient cohort suggest increasingly complex challenges for surgical reconstruction. Introduction of highly cross-linked polyethylene, improved revision implant designs, and improved bone deficiency surgical techniques will hopefully reduce the prevalence of re-revision.

Magnetic Resonance Imaging is Predictive of Adverse Tissue Reaction in Failed Metal-on-Metal Hip Arthroplasty

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Introduction: Recently, there have been increasing reports of MOM failures secondary to adverse local tissue reactions (ALTR). Identifying these failures early is critical to preventing tissue damage and poor outcomes after revision. Serum metal ions are used as a screening test but have low sensitivity and specificity. Our aim was to develop an MRI classification to predict ALTR and the presence of intraoperative tissue damage.

Methods: 70 patients with failed MOM hip arthroplasties undergoing subsequent revision were included. Images were analyzed for osteolysis, synovitis, maximal synovial thickness, edema, low signal intensity deposits, pseudocapsule dehiscence, abductor disruption and neurovascular compression. These characteristics were correlated with histology and intraoperative tissue damage. The ALVAL score was used to grade the tissue samples, helping to identify a subset of patients with ALTR. Intraoperative tissue damage was graded using a four-point scale. A Random Forest Plot statistical model was used to determine the sensitivity and specificity of the proposed MRI grading system in detecting the presence of ALVAL (ALVAL score ≥ 5) and predicting tissue damage.

Results: The volume of synovitis and maximal synovial thickness were found to correlate with ALVAL score and intraoperative tissue damage ($p < 0.0001$). Patients with dehiscence of the pseudocapsule had a higher median ALVAL score ($p=0.0008$), as did those with low signal intensity metallic deposits ($p < 0.0001$) and soft tissue edema ($p < 0.0001$). An MRI predictive model demonstrated a sensitivity and specificity of 90% and 86% respectively for predicting the presence of ALVAL and 94% and 87% respectively for predicting intraoperative tissue damage.

Conclusion: MRI is highly sensitive and specific in identifying patients with failing MOM hips secondary to ALVAL and predicting intraoperative tissue damage. MRI remains the most comprehensive, non-invasive method of assessing patients with painful MOM hips. Our proposed MRI classification provides an objective tool to identify at-risk patients and aid the surgeon in proceeding towards timely revision.

Are there Systemic Sequelae in Patients with Ultra-High Serum Metal Ion Levels?

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Introduction: There are continued concerns regarding exposure to high levels of cobalt (Co) and chromium (Cr) ions. In the current study, patients with ultra-high metal ion levels were evaluated for systemic complications.

Methods: Patients with Co or Cr ion levels greater than 50 mcg/L were identified. The rate of clearance in the serum was followed with serial post-revision ion analysis. The urinary system was evaluated for neoplasia with 1) urine cytology, 2) a tumor marker (NMP-22), 3) chromosomal aberrations, and 4) renal ultrasound. The hematologic system was evaluated using flow cytometry. Evidence of cardiomyopathy was evaluated with echocardiography. Lastly, patients were given a questionnaire to screen for neurologic symptoms.

Results: 10 patients were identified with average pre-revision serum Co of 120 mcg/L (67-220 mcg/L) and Cr of 38 mcg/L (22-61 mcg/L). The time from initial metal exposure to latest follow-up was 60 months (42 - 86 months). Over the first 12 weeks post-revision, Co declined at a rate of 1.24% per day and Cr declined at 1.11% per day. Clearance of Cr was significantly slower ($p=0.012$), and as a consequence, Cr levels remained detectable even past one year after revision. All urologic tests were negative for malignant transformation. On average, patients demonstrated a relative B cell lymphopenia when compared to age and sex matched normals. T cell populations fell within the normal range. No patients developed new cardiomyopathy. Neurologic complaints were reported by 7 of the 10 patients prior to revision, but these symptoms either improved or entirely resolved in all patients after the revision.

Conclusion: At an average of 5 years after first exposure, these patients with previous ultra high levels of Co and Cr show no signs of cancer or cardiomyopathy. The group did demonstrate a relative B cell lymphopenia, but the clinical significance of this finding is still unclear.

Hip Replacement Readmission Rates: Observations in the State Of Florida

Carlos J. Lavernia, MD, Jesus Villa, MD

Introduction: With the recent focus on cost containment, readmitting patients after elective procedures has become the focus of interest for all payors. In all procedures, a certain fraction of patients will require rehospitalization after discharge following the procedure. Our objective was to study insurance, medical comorbidities, mental health, and discharge factors as they relate to readmission after hip replacement in the state of Florida.

Methods: In an effort to reduce needless readmissions, the Agency for Health Care Administrations and the Florida Hospital Association (FHA) teamed up with the Florida Orthopedic Society to study readmissions after THR. 27,019 patients who initially underwent hip replacement in the state of Florida were studied. All information was collated by the FHA. 10 centers were selected and asked to study 10 cases of readmissions.

Results: Five percent of patients (1,356) were readmitted to the hospital within 15 days. Among patients who were readmitted, the most common reasons were: infections (27.3%), hip replacement (11.4%), cardiovascular problems (9.1%), problems with the orthopedic device or procedure (7.0%), or anemia/blood disorders (6.8%). Readmission rates varied by type of insurance, as self-pay (5.8%), Medicaid (5.9%), and Medicare (5.8%) had higher readmission rates than individuals with commercial insurance (2.6%), commercial HMO (2.7%), or commercial PPO (2.5%). Patients discharged to SNFs had higher readmission rates (7.0%) than patients discharged home (3.2%) or to home health/home institutions (2.7%). Patients with a mental health issue (9.7%) were readmitted more frequently than patients without a mental health issue (4.9%).

Discussion: Multiple complex factors play a role in short-term readmission following THR. The most common cause for readmission is infection. Patients with discharge to a SNF, government-funded or self-pay insurance, or a mental health disorder are more frequently readmitted to the hospital. Our data shows that there are potential avenues to develop strategies that will prevent avoidable readmissions.

Explaining Differential Growth Rates in Total Knee and Hip Arthroplasty Volumes: A Study of Several Relevant Factors

Peter B. Derman, MD, MBA, Guy David

Introduction: The number of primary joint replacements performed in the US has increased rapidly over the past 20 years, but growth in total knee arthroplasties (TKAs) has exceeded that of total hip arthroplasties (THAs). The aim of this study was to describe and explain this differential growth rate.

Methods: We compiled annual data on volume, length of stay, and in-hospital mortality for TKA and THA from the Nationwide Inpatient Sample; calculated hospital and surgeon reimbursement using information available in the Federal Register; determined rates of obesity and overweight from Behavioral Risk Factor Surveillance System findings; and estimated the size of the surgical workforce based on American Academy of Orthopaedic Surgeons membership data. Data sources were analyzed and compared to identify supply-side and demand-side factors contributing to the more rapid growth observed in TKAs.

Results: TKA volume increased at a faster rate than THA volume – the TKA/THA ratio grew from 1.47 in 1993 to 2.18 in 2009. Increasing Body Mass Index (BMI), which has been more consistently associated with knee than hip arthritis, played the greatest role in increasing demand for TKA above that for THA, with younger individuals more affected. By 2009, individuals with BMI ≥ 25 comprised 90% of the difference between TKA and THA volumes – a disproportionately large proportion considering that they constituted only 64% of the US population. The surgical community responded to this added need primarily with increases in per-physician output. Financial incentives for suppliers (i.e., surgeons and hospitals) to induce disproportionate demand for TKA over THA were not identified and are therefore unlikely to explain the observed phenomena.

Conclusion: Rising BMI, especially among younger individuals, has contributed to the changing demographics of total joint replacement patients and the surge in TKA volume. These findings may prove instructive in understanding and planning for future arthroplasty trends, especially if obesity continues to increase in prevalence.

Barriers to Completion of Patient Reported Outcome Measure Surveys

Elizabeth M. Schamber, MA, Steven Takemoto, PhD, Kevin J. Bozic, MD, MBA

Introduction: Patient Reported Outcomes Measures (PROMs) are used extensively in Orthopaedic Surgery to assess the effectiveness of surgical interventions. However, certain patient populations may be under-represented due to lower survey completion rates. This study sought to identify patient characteristics and other factors associated with lower PROM survey completion rates among total joint arthroplasty (TJA) patients.

Methods: Disease specific (Harris Hip/Knee Society or HOOS/KOOS) and generic (SF-12, UCLA Activity or EQ-5D VAS) PROMs were collected using paper and electronic methods for 1976 hip/knee arthroplasty patients between 7/1/2007 and 12/31/2010. Survey completion rates were calculated based on patient age, comorbidities, primary language, mental disability, type of insurance and type of surgery, with significance tested using Pearson's chi-square. PROM participation by year was also compared with rates of electronic data capture usage.

Results: PROM survey completion was significantly lower for revision cases versus primary ($p < .001$), patients with ages below 50 or above 75 ($p < .001$), primary language other than English ($p < .005$) and Medicaid insurance ($p < .001$). PROM rates also declined with an increase in patient comorbidities ($p < .01$). Drug dependency, psychiatric diagnoses and altered mental status (e.g. dementia) did not affect outcomes reporting rates. The presence of multiple barriers further reduced participation ($P < .001$). During the time period studied, PROM participation increased proportionally with the increase in electronic data capture methods.

Conclusion: We identified certain patient characteristics and other factors that act as barriers to successful outcomes reporting. Certain patient populations may need extra assistance with PROM survey completion. Offering electronic data capture methods may be one effective strategy to increase PROM accessibility and participation. Further study is needed to find ways to increase PROM survey completion and reduce the reporting gap among patient populations so that all populations are well represented in TJA outcomes research.

The Economic Conundrum of Private Practice Orthopaedic Surgery

Alberto D. Cuellar, MD

Introduction: Financial pressures on orthopaedic practices are producing conditions which may threaten solvency. This study predicts the financial future of a multi-specialty orthopaedic group based on a detailed analysis of historical financial data.

Methods: Annual financial data, including revenue and costs, were obtained from a multi-specialty orthopaedic practice. Net income was calculated on a yearly basis starting in 1998 for professional services and 2000 for professional plus ancillary services. The data were normalized to annual practice volume derived from the total number of patient office visits. All data were adjusted for inflation and compared on a year to year basis. A statistical model of the variation in net annual income with time was created using linear and second order polynomial regression analysis.

Results: For the term of this study, 1998 to 2011, the total number of patient office visits was 659,562. Office visits per physician was 29.5% higher in 2011 than 1998. Inflation adjusted net income per patient visit declined 64% for professional services and 41% for professional plus ancillary services. Linear regression analysis showed a decrease in practice income of 4.6% per year for professional services and 4.7% per year for all services. Second order polynomial regression analysis shows the trend of decreasing net income may be leveling off at negative 70% for professional services and negative 50% for all services in comparison to the index years.

Conclusion: For the orthopaedic group in this study, the deteriorating financial conditions may be leveling off primarily because of a positive influence of ancillary services. The most concerning fact is net income from the core business of providing orthopaedic services continues to decline. If this model reflects the financial condition of other practices nationwide and the economic environment worsens, the future ability of orthopaedic surgeons to provide services may be profoundly and negatively impacted.

Predictors of Hospital-Acquired Conditions after Elective Joint Arthroplasty

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Introduction: Medicare and Medicaid require a reduction in Medicare Severity Diagnosis Related Group payments for certain hospital-acquired conditions (HAC). Some of those, including catheter-associated urinary tract infection (UTI), surgical site infections (SSI) and venous thromboembolism (VTE) are potential complications after elective total joint arthroplasty (TJA). These conditions are currently reported and drive payment and quality assessment regardless of age and comorbidities. A risk stratification system is needed for prevention and fair determination of quality and reimbursement. The purpose of this study is to identify predictors of HAC and quantify their risk in a large cohort of patients that underwent TJA in a tertiary health care center.

Materials and Methods: A cohort of 22,878 patients that underwent elective primary TJA was reviewed retrospectively. Demographics, body mass index (BMI) and comorbidities were identified using electronic medical records. Adjusted hierarchical stepwise multivariate regression models were used to analyze independent risk factors for HAC.

Results: Incidence of UTI, SSI, and VTE were 1.3%, 0.8%, and 2.1% respectively. Independent predictors of UTI within 90 days postoperatively were female sex, urinary incontinence, anemia, ischemic heart disease, hypertension and increased Charlson Comorbidity Index (CCI). Independent predictors of SSI within 1 year postoperatively were ischemic heart disease, congestive heart failure, valvulopathy, connective tissue disease, diabetes mellitus, and elevated BMI. Independent predictors for VTE within 90 days postoperatively were knee surgery, history of VTE, chronic obstructive pulmonary disease, atrial fibrillation, diabetes mellitus, anemia, depression, increased CCI, and increased BMI.

Conclusions: There was a significant difference between patients for the risk of developing HAC after TJA. There is a need for risk stratification when assessing quality and reimbursement of TJA procedures. The predictors identified for HAC maybe used to develop such risk stratification system.

Is Requiring Hemoglobin A1c Control a Significant Barrier to Total Joint Arthroplasty?

Nicholas J. Giori, MD, Alexander Harris

Introduction: Poorly controlled diabetics have elevated risk of complications and death following total joint arthroplasty (TJA). To mitigate this risk, some centers check patients' Hemoglobin A1c (HbA1c). It is unclear to what degree this screening limits access of diabetics to TJA surgery. We investigated the fate of diabetic patients at our institution who were screened and referred for diabetic control, as measured by HbA1c, prior to surgery. Specifically, we asked how many diabetic patients scheduled for primary TJA were delayed due to HbA1c > 7%, how many of these patients achieved this goal, and how much time it took to achieve it.

Methods: This was a IRB approved retrospective review of charts at one Department of Veterans Affairs medical center where HbA1c screening was done from October 2004 to September 2010. Patients with HbA1c > 7% were referred to their primary care providers (PCP's) for better diabetic control. Unless the PCP felt that reduction of the HbA1c to a level of 7% was medically inadvisable for the patient, surgery was to proceed only after patients returned with a HbA1c that was less than or equal to 7%.

Results: 406 diabetic patients were deemed candidates for TJA. 59 were delayed for an HbA1c > 7%. 35 of these eventually reduced their HbA1c to 7% while 24 failed to achieve this goal. For those who succeeded, the median time to achieve the goal was 141 days (approximately 5 months). HbA1c of 8% was achievable for all but 9 patients.

Discussion: When establishing goals for patients to reduce perioperative risks, there should be a reasonable expectation that the goals are achievable. In the case of HbA1c in diabetic candidates for joint arthroplasty, 7% is achievable for 94% of diabetic candidates for joint replacement. 8.0% is an achievable goal for 98% of diabetic patients.

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3B(Aston Medical); 3B(Medtronic); 9(International Orthopaedics)

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Bois Guillaume Cedex, France



Dustin T. Briggs, MD
Resident
Albuquerque, NM



C. Brandon Broome, MD
Candidate
Greer, SC



Corey F. Burak, MD
Fellow
Hawthorne, NY



Matthew R. Byington, DO
Resident
Canton, MI



Nathan L. Cafferky, MD
Resident
Danville, PA



Anthony T. Carter, MD
Fellow
Newport News, VA



Jacques H. Caton, MD
International
Lyon, France



Haleem N. Chaudhary, MD
Fellow
Cincinnati, OH



Su Hyun Cho, MD
International
Busan, Rep. of Korea



Jesse L. Chrastil, MD
Resident
Salt Lake City, UT



Timothy J. Clader, MD
Fellow
Rochester, NY



C. Dana Clark, MD
Fellow
Fort Collins, CO

AAHKS Welcomes New Members

September 2011 through August 2012



Russell G. Cohen, MD
Fellow
Tucson, AZ



Andres Correa, MD
International
Bogota, Columbia



Elizabeth A. Dailey, MD
Resident
Seattle, WA



Michele R. D'Apuzzo, MD
Resident
Charlottesville, VA



J. Joseph Davis, MD
Fellow
Duluth, MN



Jeffrey H. DeClaire, MD
Fellow
Lake Angelus, MI



Daniel Del Gaizo, MD
Candidate
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Steven M. Dellose, MD
Fellow
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Herman S. Dhotar, MD
Resident
Ontario, Canada



Mark W. Diehl, MD
Fellow
Woodstock, GA



Michael P. Dohm, MD
Fellow
Grand Junction, CO



Robert M. Duarte, MD
Resident
Gretna, LA



Sridhar M. Durbhakula, MD
Fellow
Rockville, MD



James P. Eberhardt, DO
Candidate
Northville, MI



Prouskh B. Ebrahimpour, MD
Candidate
Cooperstown, NY

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September 2011 through August 2012



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Candidate
Richmond, VA



Aidin Eslam Pour, MD
Resident
Atlanta, GA



John H. Franklin, MD
Fellow
Augusta, GA



Patricia D. Franklin, MD
Affiliate
Worcester, MA



Michael R. Fraser, Jr. MD
Candidate
San Diego, CA



Sean M. Gallagher, MD
Candidate
San Diego, CA



Paul K. Gilbert, MD
Fellow
Pasadena, CA



Robyn J. Hakanson, MD
Fellow
Mount Airy, GA



Victor N. Hakim, MD
Candidate
Frisco, TX



Brett J. Hampton, MD
Fellow
Rockville, MD



Erik N. Hansen, MD
Candidate
Philadelphia, PA



Benjamin L. Harper, MD
Resident
Grand Rapids, MI



Brant P. Harradine, MD
Fellow
Santa Clara, CA



Anthony K. Hedley, MD
Associate
Phoenix, AZ



Thomas A. Herschmiller, MD
Resident
Durham, NC

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September 2011 through August 2012



Derek L. Hill, DO
Fellow
Warren, MI



Jason K. Hofer, MD
Candidate
Ventura, CA



Craig A. Hogan, MD
Candidate
Aurora, CO



Jason M. Hurst, MD
Fellow
New Albany, OH



Yong In, MD
International
Seoul, Rep. of Korea



Yutaka Inaba, MD, PhD
International
Yokohama, Japan



Mark J. Isaacson, MD
Resident
Columbus, OH



Hiroshi Ito, MD
International
Asahikawa, Japan



Kenneth W. Jackson, MD
Fellow
Great Falls, VA



Paul B. Jacob, DO
Resident
Columbus, OH



Ajoy K. Jana, MD
Fellow
Omaha, NE



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Fellow
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Candidate
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Nashua, NH

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Champaign, IL



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St Louis, MO



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Recife-PE, Brazil

AAHKS Welcomes New Members

September 2011 through August 2012



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Lima, Peru



D. Craig Loucks, MD, MSc, FRCSC
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Stephen D. Lucey, MD
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Bryn Mawr, PA



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Marlon M. Mencia, MD
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Jeffrey P. Menzner, MD
Fellow
Boise, ID



James D. Mitchell, MD
Fellow
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Michael J. Morris, MD
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Joseph E. Mumford, MD
Fellow
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Candidate
Baltimore, MD



Yasuharu Nakashima, MD
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Fukuoka, Japan



Mohammad Namazian, DO
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Rancho Cucamonga, CA

AAHKS Welcomes New Members

September 2011 through August 2012



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Tigard, OR



Carlos A. Navarro Lozano, MD
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Fellow
Chicago, IL



Jason P. Norcross, MD
Fellow
Hickory, NC



Hirotugu Ohashi, MD
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Osaka, Japan



Fabio Orozco, MD
Fellow
Egg Harbor Township, NJ



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Kenneth P. Pohl, MD
Fellow
Dayton, OH



Adam J. Rana, MD
Candidate
New York, NY



Bradley J. Reddick, DO
Candidate
Oklahoma City, OK



J. Nicolas Restrepo, MD
International
Pasto, Columbia



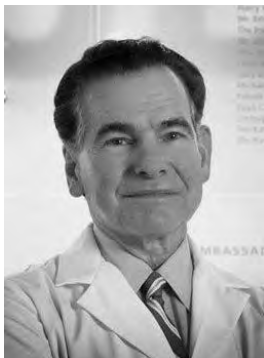
Miguel A. Riquelme, MD
International
Puerto Montt, Chile



Sebastian R. Rodriguez-Elizalde, MD
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Toronto, Canada



Lee E. Rubin, MD
Candidate
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Robert Ruggiero Sr., MD
Fellow
Malvern, PA



Jonathon K. Salava, MD
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Lewis Samuels, MD
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Robert L. Sanderson, MS, BS
Affiliate
Fayetteville, AR



Erik A. Schnaser, MD
Resident
Cleveland, OH

AAHKS Welcomes New Members

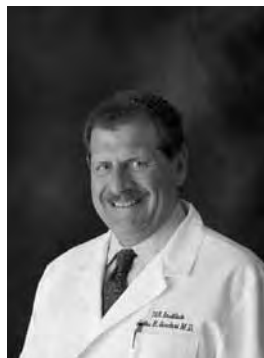
September 2011 through August 2012



David T. Schroder, MD
Fellow
Potomac, MD



Steven L. Schule, MD
Fellow
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Giles R. Scuderi, MD
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Lebanon, NH



Doo-Hoon Sun, PhD, MS, MD
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Jung-Gu Daejeon, Rep. of Korea



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Biloxi, MS



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Milan, Italy

AAHKS Welcomes New Members

September 2011 through August 2012



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Cava de'Tirreni, Italy



Veronica M. Wadey, MD
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Torrance A. Walker, MD
Fellow
Pine Bluff, AR



David A. Weimer, MD
Fellow
Boardman, OH



William W. Whang, MD
Fellow
Modesto, CA



Brent W. Whited, MD
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Iowa City, IA



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Resident
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Fellow
Kearney, NE



Takuaki Yamamoto, MD, PhD
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Paul F. Yau, MD
Resident
St. Louis, MO

AAHKS Welcomes New Members

(photos unavailable)

Gurpal S. Ahluwalia, MD
Candidate
Fairborn, OH

Vijay Borra, MD
Candidate
Houston, TX

William R. Boulden, MD
Fellow
Des Moines, IA

Craig S. Chertack, MD
Fellow
East Amherst, NY

Eric O. Eisemon, MD
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Brooklyn, NY

Mark P. Figgie, MD
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John G. Ginnetti, MD
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Carlos Gonzalez, MD
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Todd R. Grunander, MD
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Fellow
Atlanta, GA

Kelly J. Hendricks, MD
Fellow
Kansas City, KS

W. Bartley Hosick, MD
Fellow
Manassas, VA

Kevin K. Howe, MD
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Donald M. Knapke, MD, PC
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Michael J. Latteier, MD
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Mitchell A. McDowell, DO
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Airell L. Nygaard, MD
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Resident
Jackson, MS

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Charles H. Wilson IV, MD
Fellow
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Stephen L. Wilson, MD
Fellow
Ft. Worth, TX

Wendy W. Wong, MD
Resident
Loma Linda, CA



Co-Branded Specialty Day Programs at the 2013 AAOS Annual Meeting

Saturday, March 23, 2013

McCormick Place Convention Center South, Chicago, Illinois

The Hip Society, The Knee Society, and the American Association of Hip and Knee Surgeons (AAHKS) are proud to present co-branded scientific programs on Saturday, March 23, 2013, as part of the 2013 Annual Meeting of the American Academy of Orthopaedic Surgeons (AAOS) and Specialty Day, in Chicago, Illinois. These scientific programs are open to all orthopaedic surgeons, residents, and allied health professionals who are interested in the most current issues in adult hip and knee reconstructive surgery. The concurrent programs will be held from 8 am until 5 pm at the McCormick Place South.

Online registration at www.aaos.org/annual will open on **October 3, 2012 (for AAOS Members)** and on **October 10, 2012 (for Non-Members)**. Pre-registration deadline is **February 5, 2013**. With any registration questions, please contact AAOS at meeting@aaos.org; tel: (800)346-2267; or fax: (847)823-8031.

The Hip Society/AAHKS Specialty Day Program Highlights:

- Primary Total Hip Replacement
- Metal Corrosion of Modular Connections in THA: A Cause for Concern?
- Bearing Surfaces in THA
- Presidential Guest Speaker Prof. Carsten Perka, MD: *A European Perspective on the Future of Hip Arthroplasty*
- Highlights of Hip Research from the 2013 Annual Meeting of the Orthopaedic Research Society
- Highlights of Hip Papers Presented at the 2012 Annual Meeting of the American Association of Hip and Knee Surgeons
- The Hip Society Scientific Awards
- The Hip Society Lifetime Achievement Award
- *My Worst Case* Competition
- Revision Total Hip
- Replacement Technical Pearls and Video Vignettes
- Infection
- Complications of Total Hip Replacements
- Metal-on-Metal

The Knee Society/AAHKS Specialty Day Program Highlights:

- Non-Arthroplasty Options for the Middle Aged Patient with Degenerative Joint Disease: Case Presentation and Audience Response Questions
- Current Issues in Partial Knee Arthroplasty
- Lessons Learned from Long Term Follow-Up
- Assessing the Outcomes of Total Knee Arthroplasty
- The Knee Society Scientific Awards
- Bioengineering Advances in Total Knee Replacement
- Efficiency and Cost Considerations in Total Knee Arthroplasty
- Challenges in Total Knee Arthroplasty – Case Presentation and Audience Response Questions
- Achieving Alignment in Total Knee Arthroplasty
- Infection: The Enemy – What's New
- *My Most Difficult Case* Contest

The Hip Society/AAHKS Specialty Day Program has been designated as meeting the criteria for up to **7.25 AMA PRA Category 1 Credits**.

The Knee Society/AAHKS Specialty Day Program has been designated as meeting the criteria for up to **7.0 AMA PRA Category 1 Credits**.

The Hip Society President: **David G. Lewallen, MD**
Program Chair: **Robert T. Trousdale, MD**

The Knee Society President: **Giles R. Scuderi, MD**
Program Chair: **Adolph V. Lombardi, Jr., MD, FACS**

AAHKS President: **Thomas P. Vail, MD**
Program Chair: **Michael E. Berend, MD**