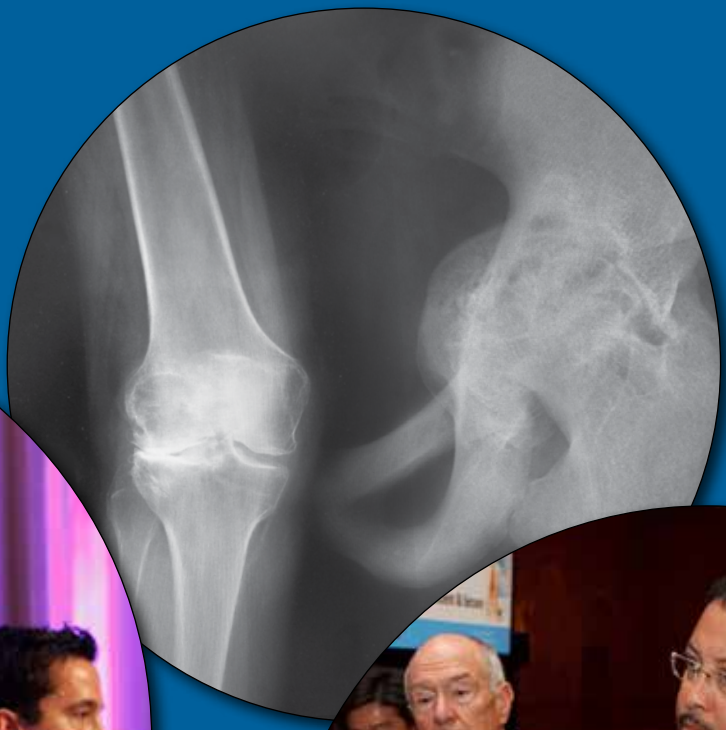
24TH

AAHKS
AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS

ANNUAL MEETING
NOVEMBER 6-9, 2014
DALLAS SHERATON HOTEL



final program

EDUCATION ADVOCACY RESEARCH

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GOALS AND OBJECTIVES

American Association of Hip and Knee Surgeons
24th Annual Meeting
November 6-9, 2014
Sheraton Dallas Hotel, Dallas, Texas

AAHKS
AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS

The AAHKS 24th Annual Meeting is designed to provide practicing orthopaedic surgeons with state-of-the-art information about the surgical applications and treatment protocols for the diagnosis and management of total hip and knee replacement, and to enhance the care of patients with arthritis and degenerative diseases. Both free paper presentations and interactive symposia will be utilized.

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

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

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

- Primary Total Knee Arthroplasty
- Primary Total Hip Arthroplasty
- Revision Total Knee Arthroplasty
- Revision Total Hip Arthroplasty
- Infection
- Joint Preservation
- Complications, Management and Avoidance

Symposia Topics include:

- Rapid Recovery Programs for THA and TKA
- Bearing Surface Issues in 2014: What's the Best for Your Patient?
- Contemporary Controversies in Treating the Young Hip Patient
- Audience Response – Practice Norm/Trends
- Bundled Payments: Whether and Why?
- Periprosthetic Joint Infection: An Algorithmic Approach
- Partial Knee Arthroplasty: State of the Art 2014
- Achieving Value in Knee and Hip Arthroplasty

FINAL PROGRAM

November 6-9, 2014

Sheraton Dallas Hotel, Dallas, Texas

(Note: times and topics subject to change)

THURSDAY, NOVEMBER 6, 2014

10:00 AM-5:00 PM **Onsite Registration**
Grand Hall

10:00 AM-8:00 PM **Pre-Registration**
Lone Star Foyer

*Please note that the Thursday/Friday pre-meeting optional satellite symposia are not part of the official program as planned by the AAHKS Annual Meeting Program Committee and do not offer AMA PRA Category 1 credits unless noted.

1:00–3:00 PM **Austin 1** — Maximizing Patient Potential Outcomes & Implant Survivorship
Sponsored by: Aesculap Implant Systems

1:00–3:00 PM **Austin 2** — Bundled Payment Symposium
Sponsored by: Stryker Performance Solutions

3:30–5:30 PM **Austin 2** — Future Success Strategies for Orthopedic Surgeons
Sponsored by: Stryker Performance Solutions

3:30–5:30 PM **Austin 3** — Venous Thromboembolism in Orthopedic Surgical Patients: Guideline-directed Prophylaxis Therapy
Jointly Provided by: The University of Cincinnati and Rockpointe for 2.0 AMA PRA Category 1 Credits
Supported by: Bristol-Myers Squibb and Pfizer, Inc. Alliance

3:30–5:00 PM **Pearl 1** — AAHKS Publications Committee Meeting

3:30–4:30 PM **Suite 1955** — AAHKS International Committee Meeting

5:30–8:00 PM **Majestic 1** — Board of Directors Meeting

FRIDAY, NOVEMBER 7, 2014

6:00 AM–NOON **Lone Star Foyer** — Poster Set up

6:00–8:00 AM **Dallas Ballroom** — Breakfast

6:55 AM–4:00 PM **Austin 2-3 Ballroom** — Orthopaedic Team Member Course

7:00 AM–3:00 PM **Houston Ballroom** — 6th Annual Resident Course

6:00 AM–2:50 PM **Grand Hall/Dallas Ballroom** — Exhibit Hall Open

6:00 AM–8:00 PM **Pre-Registration**
Lone Star Foyer

6:00 AM–8:00 PM **Onsite Registration**
Grand Hall

6:55 AM–4:00 PM **Austin 2-3 Ballroom** — Orthopaedic Team Member Course

7:00 AM–3:00 PM **Houston Ballroom** — 6th Annual Resident Course

7:00–9:00 AM **Dallas A3** — The Future is Bright: Advances in Postsurgical Multimodal Pain Management
Sponsored by: Pacira Pharmaceuticals, Inc.

7:00–9:00 AM **Dallas A2** — ATTUNE® Knee System: Clinical Outcomes and Patient Satisfaction
Sponsored by: DePuy Synthes

7:00–9:00 AM **Dallas A1** — 23 Hour Total Joint Arthroplasty: Is it the New Paradigm?
Sponsored by: OMNI

9:30–11:30 AM **Dallas A3** — PCA: The Future of Post-Operative Pain Management
Sponsored by: AcelRx Pharmaceuticals, Inc.

9:30–11:30 AM **Dallas A2** — Advances in Total Knee Arthroplasty: Reducing or Eliminating the Tourniquet
Sponsored by: Medtronic

9:30–11:30 AM **Dallas A1** — Customized Knee Implants: Unique Advantages that Enable Outpatient Surgery and Improve Outcomes, Satisfaction and Value
Sponsored by: ConforMIS

10:00 AM–NOON — Resident Course Breakout 1 **State Room 1**; Resident Course Breakout 2 **State Room 2**; Resident Course Breakout 3 **State Room 3**; Resident Course Breakout 4 **State Room 4**; Resident Course Breakout 5 **San Antonio A**; Resident Course Breakout 6 **San Antonio B**

11:30 AM–12:30 PM Lunch
Dallas Ballroom

NOON–1:00 PM **Houston Ballroom** — Resident Lunch

NOON–5:30 PM **Lone Star** — Speaker Ready Room

1:00–3:00 PM Resident Course Breakout 1
State Room 1
Resident Course Breakout 2
State Room 2
Resident Course Breakout 3
State Room 3
Resident Course Breakout 4
State Room 4
Resident Course Breakout 5
San Antonio A
Resident Course Breakout 6
San Antonio B

1:30–2:45 PM **Ask the Experts Case Session**
Dallas A1 **Primary Hip**
Panelists: David G. Lewallen, MD
Richard F. Santore, MD
John J. Callaghan, MD

1:30–2:45 PM **Ask the Experts Case Session**
Dallas A2 **Primary Knee**
Panelists: Michael P. Bolognesi, MD
Arthur L. Malkani, MD
William A. Jiranek, MD

1:30–2:45 PM **Ask the Experts Case Session**
Dallas A3 **Revision**
Panelists: Daniel J. Berry, MD
Thomas K. Fehring, MD
Wayne G. Paprosky, MD

2:55 PM **President's Welcome**
Lone Star Brian S. Parsley, MD

SESSION ONE **Primary Knee**
3:00–4:08 PM *MODERATORS: Mary I. O'Connor, MD and Stefano A. Bini, MD*

3:00 PM Paper #1 Does Bariatric Surgery Reduce Postoperative Complications Following Total Knee Arthroplasty?
Brian C. Werner, MD, Charlottesville, VA

3:06 PM Paper #2 Does Extended-Release Liposomal Bupivacaine Better Control Postoperative Knee Pain than Bupivacaine?
William C. Schroer, MD, St. Louis, MO

3:12 PM Paper #3 Tourniquet use During TKA and its Effect on Recovery of Quadriceps Strength and Lower Extremity Function: A Randomized, Double-Blind, Controlled Trial
Douglas A. Dennis MD, Denver, CO

3:18 PM Paper #4 Perioperative Complications in Patients with Inflammatory Arthropathy Undergoing Total Knee Replacement
Erik A. Schnaser, MD, Rancho Mirage, CA

3:24 PM **Discussion**

3:34 PM Paper #5 Custom Cutting Guides do not Improve Total Knee Arthroplasty Outcomes at 2 Year Follow-up
Denis Nam, MD, St. Louis, MO

3:40 PM Paper #6 Does Computer Navigation Improve Functional Outcomes after Total Knee Replacement?
Simon W. Young, FRACS, MD, New Zealand

3:46 PM Paper #7 To Cement or Not? Prospective, Randomized Study Comparing Cemented vs. Cementless Total Knee Arthroplasty
Kevin B. Fricka, MD, Alexandria, VA

3:52 PM Paper #8 Does the Medicare 3-day Rule Increase Length of Stay?
F*abio Orozco, MD, Egg Harbor Township, NJ*

3:58 PM **Discussion**

4:08-5:00 PM **KEYNOTE SPEAKER**
Introduction: Brian S. Parsley, MD
Jonathan Bush, President & CEO athenahealth

5:00 PM **AAHKS Humanitarian Award**
Presented by: William J. Robb, III, MD
Harpal S. Khanuja, MD

SYMPOSIUM I **Bearing Surface Issues in 2014: What's the**
5:04–6:04 PM **Best for Your Patient?**
MODERATOR: Jay R. Lieberman, MD
Management of Patients with Metal on Metal Bearing Surfaces
Joshua J. Jacobs, MD
Trunionosis – Is it an Impending Epidemic?
Craig J. Della Valle, MD
Highly Cross Linked Polyethylene and Ceramic on Ceramic Bearings: Do We Need Both?
R. Michael Meneghini, MD
Femoral Head Size Selection:
Does it Influence the Revision Rate?
Jay R. Lieberman, MD

6:04 PM **Health Policy Fellows Report**
Christine M. Pui, MD
Louis S. Stryker, MD

6:16–7:00 PM **AAHKS Business Meeting (Members only)**
Lone Star

7:00–9:00 PM **Welcome Reception (All Attendees Invited)**
Grand Hall/Dallas Ballroom

NOON–9:00 PM Poster Hall Open
Lone Star Foyer

7:00–9:00 PM Exhibit Hall Open
Grand Hall/Dallas Ballroom

SATURDAY, NOVEMBER 8, 2014

6:00 AM–6:00 PM **Pre-Registration**
Lone Star Foyer

6:00 AM–6:00 PM **Onsite Registration**
Grand Hall

6:00 AM–6:00 PM Speaker Ready Room
Lone Star Ballroom

6:00–7:00 AM Breakfast
Dallas Ballroom

6:00 AM–8:30 PM Poster Hall Open
Lone Star Foyer

6:00 AM–7:00 AM Exhibit Hall Open
Grand Hall/Dallas Ballroom

6:55–7:00 AM **Program Chair Welcome**–
Lone Star Javad Parvizi, MD, FRCS

SESSION TWO **Revision Knee**
7:00–7:56 AM *MODERATORS: Matthew S. Austin, MD and Mark J. Spanghel, MD*

7:00 AM Paper #9 Morbid Obesity: A Significant Risk Factor for Failure following Aseptic Revision TKA
Chad D. Watts, MD, Rochester, MN

7:06 AM Paper #10 Factors Associated with 20-year Cumulative Risk of Infection after Aseptic Revision TKA
O. Brant Nikolaus, MD, Rochester, MN

7:12 AM Paper #11 Tibial Stems in Revision Total Knee Arthoplasty: Is There an Anatomic Conflict?
Mohamed S. Gobba, MD, Egypt

7:18 AM **Discussion**

7:28 AM Paper #12 Antibiotic Cement Decreases Re-Revision Risk by 45% in 1154 Aseptic Revision Total Knee Arthroplasties
Stefano A. Bini, MD, Oakland, CA

7:34 AM Paper #13 The Use of Trabecular Metal Cones in Complex Primary and Revision Total Knee Arthroplasty
Nicholas M. Brown, MD, Chicago, IL

7:40 AM Paper #14 Varus-Valgus Constrained Knee Implants: Survivorship and Outcomes
Wael K. Barsoum, MD, Cleveland, OH

7:46 AM **Discussion**

SYMPOSIUM II **Contemporary Controversies in Treating the Young Hip Patient**
7:56–8:50 AM *MODERATOR: John C. Clohisy, MD*
Patient Evaluation and Arthroscopic Treatment of FAI
Asheesh Bedi, MD
Open Treatment of FAI: Indications and Surgical Technique
Paul E. Beaule', MD, FRCSC
Hip Dysplasia: Diagnosis and Treatment Options
John C. Clohisy, MD
Mild to Moderate Hip OA: Joint Preservation or Total Hip Arthroplasty?
Christopher L. Peters, MD

SESSION THREE **Primary Hip Arthroplasty**
8:50–9:46 AM *MODERATORS: David F. Dalury, MD and Scott M. Sporer, MD, MS*

8:50 AM Paper #15 Does Neuraxial Anesthesia Decrease the Rate of Postoperative Complications and Blood Transfusions? An Analysis of 29,452 Primary Total Hip Arthroplasty
Bryan D. Haughom, MD, Chicago, IL

8:56 AM Paper #16 Reliability of Ceramic Heads in over 5.7 Million Hip Replacements
Gwo-Chin Lee, MD, Horsham, PA

9:02 AM Paper #17 No Differences in Patient Function Six Weeks after Direct Anterior or Posterior THA: A Randomized Study
Cale Jacobs, PhD, Lexington, KY

9:08 AM **Discussion**

9:18 AM Paper #18 5 Year RSA Evaluation of Vitamin E Infused Polyethylene Wear and Stability of Acetabular and Femoral Components
Charles R. Bragdon, PhD, Boston, MA

9:24 AM Paper #19 5 Year Long-Term Multicenter Outcomes with Vitamin E Polyethylene Liners and Porous-Titanium Coated Shells
Roger H. Emerson, Jr., MD, Plano, TX

9:30 AM Paper #20 Delta Ceramic on Ceramic THA: Midterm Results
William G. Hamilton, MD, Alexandria, VA

9:36 AM **Discussion**

9:46–10:15 AM Break
Lone Star Foyer

SESSION FOUR **Revision Hip Arthroplasty**
10:15–11:11 AM *MODERATORS: Wayne G. Paprosky, MD and David G. Lewallen, MD*

10:15 AM Paper #21 Titanium Alloy Sleeves Do Not Prevent Fretting Corrosion in Modular THA
Daniel W. MacDonald, MS, Philadelphia, PA

10:21 AM Paper #22 Diagnosis and Management of Adverse Local Tissue Reactions Secondary to Corrosion at the Head-Neck Junction in Patients with Metal on Polyethylene Bearings
Darren R. Plummer, MBA, BBA, Indianapolis, IN

10:27 AM Paper #23 Will New Metal Heads Restore the Mechanical Integrity of Corroded Trunnions at Revision THR?
Aditya M. Derasari, MD, Houston, TX

10:33 AM **Discussion**

10:43 AM Paper #24 What Safe-Zone? The Majority of 224 Dislocated THA were within the Lewinnek Zone.
Matthew P. Abdel, MD, Rochester, MN

10:49 AM Paper #25 The Cumulative Risk of Re-dislocation After Revision THA Performed for Instability Increases to Close to 35% at 15 Years
Suenghwan Jo, MD, PhD, Australia

10:55 AM Paper #26 20-Year Results of Uncemented Jumbo Cups for Revision Total Hip
Philipp von Roth, MD, Germany

11:01 AM **Discussion**

SESSION FIVE **Infection**
11:11–12:07 AM *MODERATORS: Peter F. Sharkey, MD, and Gregory G. Polkowski II, MD*

11:11 AM Paper #27 Delaying Reimplantation following Resection Arthroplasty Does Not Improve Subsequent Outcome
Javad Parvizi, MD, FRCS, Philadelphia, PA

11:17 AM Paper #28 Alpha-defensin Accuracy to Diagnose Periprosthetic Joint Infection–Best Available Test?
Salvatore J. Frangiamore, MD, Cleveland, OH

11:23 AM Paper #29 Chronic Suppression with Oral Antibiotics Increases Infection-Free Survivorship in Periprosthetic Joint Infections
Marcelo B. Siqueira, MD, Cleveland, OH

11:29 AM **Discussion**

11:39 PM Paper #30 The Incidence of and Risk Factors for 30-day Surgical Site Infections following Primary and Revision Total Joint Arthroplasty
John J. Callaghan, MD, Iowa City, IA

11:45 AM Paper #31 Diagnosing Infection in the Setting of Periprosthetic Fractures
Roshan P. Shah, MD, JD, New York, NY

11:51 AM Paper #32 Premature Antibiotic Treatment can Potentially Compromise the Diagnosis of PJI
Ali Sina Shahi, MD, Philadelphia, PA

11:57 AM **Discussion**

12:07–1:00 PM Lunch & Exhibit Hall Open
Grand Hall/Dallas Ballroom

SYMPOSIUM III 1:00–1:30 PM **Audience Response – Practice Norms and Trends**
Daniel J. Berry, MD

SYMPOSIUM IV 1:30-2:30 PM **Rapid Recovery Programs for THA and TKA**
MODERATOR: William J. Hozack, MD
Intraoperative and Pain Management Solutions for Rapid Recovery
Mark W. Pagnano, MD
Hospital Programs for Rapid Recovery – Making the Stay Brief and Safe
Ryan M. Nunley, MD
Avoiding Readmissions – Support Systems Required after Discharge to Continue Rapid Recovery
C. Lowry Barnes, MD
Measuring Rapid Recovery Program Outcomes: Are all Patients Candidates for RR?
John J. Callaghan, MD
Financial Implications of Rapid Recovery Programs
Carlos J. Lavernia, MD

2:30–3:00 PM **AAHKS Award Papers**

2:30 PM **JAMES A. RAND AWARD**
Presentation of Award: James A. Rand, MD
Who Should Not Undergo Short Stay Hip and Knee Arthroplasty?
Risk Factors Associated with Major Medical Complications following Primary Total Joint Arthroplasty
Paul M. Courtney, MD, Philadelphia, PA

2:36 PM **Discussion**

2:40 PM **LAWRENCE D. DORR AWARD**
Presentation of Award: Lawrence D. Dorr, MD
Core Decompression with Autogenous Bone Marrow Stem Cells for the Treatment of the Femoral Head Osteonecrosis
Reza Mostafavi Tabatabaee, MD, Philadelphia, PA

2:46 PM **Discussion**

2:50 PM **AAHKS CLINICAL AWARD**
Presentation of Award:
A. Seth Greenwald, DPhil (Oxon)
Can the American College of Surgeons Risk Calculator Predict 30-day Complications after Knee and Hip Arthroplasty?
Adam I. Edelstein, MD, Chicago, IL

2:56 PM **Discussion**

3:00 - 3:15 PM Break

SYMPOSIUM V 3:15–4:45 PM **Bundled Payments: Whether and Why?**
MODERATOR: Kevin J. Bozic, MD, MBA
How to Get Started: Bringing the Stakeholders to the Table
Steven F. Schutzer, MD
Perioperative Management Strategies to Improve Outcomes and Reduce Cost in TJA
Mark I. Froimson, MD, MBA
Strategies and Tactics for Successful Implementation of Bundled Payments
Richard Iorio, MD
Results of BPI for Non-Medicare TJA at a Physician Owned Hospital, Private Bundles
Alan Beyer, MD
Results of BPI for Medicare and Non-Medicare TJA at a Community Hospital, Bundles in the Real World
Stephen J. Zabinski, MD

SESSION SIX 4:45–5:41 PM **Joint Preservation**
MODERATORS: Rafael J. Sierra MD and Richard F. Santore, MD

4:45 PM Paper #33 Clinical Outcomes of Hip Arthroscopy with Microfracture: A Matched-pair Controlled Study with Minimum 2-Year Follow-Up
Benjamin G. Domb, MD, Westmont, IL

4:51PM Paper #34 Differential Impact of Corticosteroids on Human Mesenchymal Stem Cells
Cody Wyles, BS, Rochester, MN

4:57 PM Paper #35 Cartilage Status at the Time of Hip Arthroscopy Predicts Failure in Patients with Hip Dysplasia
Joseph C. McCarthy, MD, Boston, MA

5:03 PM **Discussion**

5:13 PM Paper #36 Intermediate Term Results of the Bernese Periacetabular Osteotomy for the Treatment of Acetabular Dysplasia
Stephen T. Duncan, MD, Lexington, KY

5:19 PM Paper #37 Graduates of Joint Reconstruction Fellowship Training Programs are Increasingly Subspecialized
Patrick K. Horst, MD, San Francisco, CA

5:25 PM Paper #38 Cam Type Femoroacetabular Impingement Associated with Marker for Hyperandrogenism in Women
Andrew B. Wolff, MD, Washington, DC

5:31 PM **Discussion**

SYMPOSIUM VI 5:41–6:30 PM **Periprosthetic Joint Infection: An Algorithmic Approach**
MODERATOR: Thomas K. Fehring, MD
Prevention of PJI
Javad Parvizi, MD, FRCS
Diagnosis of PJI
Bryan D. Springer, MD
Surgical Treatment of PJI
William A. Jiranek, MD

6:30–8:30 PM **Grand Hall/ Dallas Ballroom** **"Welcome to Texas BBQ" (All Attendees Invited)**

6:30–8:30 PM Exhibit Hall open
Grand Hall/Dallas Ballroom

SUNDAY, NOVEMBER 9, 2014

6:00–10:00 AM **Registration**
Lone Star Foyer

6:00–10:00 AM Speaker Ready Room
Lone Star

6:00–7:00 AM Breakfast
Lone Star

SYMPOSIUM VII **Partial Knee Arthroplasty:**
7:00–8:00 AM **State of the Art 2014**
MODERATOR: Adolph V. Lombardi, Jr., MD, FACS
Patellofemoral Arthroplasty: An Evolving Science
Fred D. Cushner, MD
Medial Unicompartmental Knee Arthroplasty: Enhanced Indications that Improve Results
Adolph V. Lombardi, Jr., MD FACS
Lateral Unicompartmental Knee Arthroplasty: Different than Medial and Perhaps Better
Michael E. Berend, MD
ABC's of Outpatient Partial Knee Arthroplasty
Keith R. Berend, MD

SESSION SEVEN **Health Policy**
8:00–8:56 AM *MODERATORS:William J. Robb III, MD and Mark I. Froimson, MD, MBA*

8:00 AM Can Administrative Data be used to Analyze
Paper #39 Complications following Total Joint Arthroplasty?
Andrew J. Clair, BA, Shaker Heights, OH

8:06 AM What Incentives are Created by the
Paper #40 Medicare Payments for Total Hip and Knee Arthroplasty?
Michael M. Kheir, BS, Philadelphia, PA

8:12 AM Aspirin as Prophylaxis against Venous
Paper #41 Thromboembolism Results in Lower Incidence of Periprosthetic Joint Infection
James J. Purtill, MD, Philadelphia, PA

8:18 AM **Discussion**

8:28 AM Drivers of Total Knee and Total Hip Arthroplasty
Paper #42 Implant Purchase Prices
Kevin J. Bozic, MD, MBA, San Francisco, CA

8:34 AM Direct Costs of Aspirin Versus Coumadin for Venous
Paper #43 Thromboembolism Prophylaxis
Christina J. Gutowski, MD, MPH, Philadelphia, PA

8:40 AM Are Financial Conflicts of Interest for the Surgeon a
Paper #44 Source of Concern for the Patient?
Paul Hyunsoo Yi, MD, San Francisco, CA

8:46 AM **Discussion**

SESSION EIGHT **Complications: Management and Avoidance**
8:56–9:52 AM *MODERATORS: Stephen J. Incavo, MD, and Audrey K. Tsao, MD*

8:56 AM Manipulation under Anesthesia after Total Knee
Paper #45 Arthroplasty: Incidence, Risk Factors and Revision Surgery
James A. Browne, MD, Charlottesville, VA

9:02 AM Complications of Obesity in Total Joint Arthroplasty:
Paper #46 Risk Stratification Based on BMI
Derek T. Ward, MD, San Francisco, CA

9:08 AM Periprosthetic Joint Infection after Primary THA or
Paper #47 TKA in Patients with a History of prior PJI
Hany S. Bedair, MD, Boston, MA

9:14 AM **Discussion**

9:24 AM Does Surgical Approach to Total Hip Arthroplasty
Paper #48 Influence Socket Position and Limb Length Discrepancy?
A Comparison of the Anterior, Lateral, and Posterior Approaches
James I. Huddleston, MD, Redwood City, CA

9:30 AM Adverse Reactions to Metal-on-Metal are not
Paper #49 Exclusive to Large Heads in Total Hip Arthroplasty
Adolph V. Lombardi, Jr., MD, FACS, New Albany, OH

9:36 AM Total Joint Arthroplasty in Patients with Chronic
Paper #50 Renal Disease: Is it Worth the Risk?
Lucian C. Warth, MD, Iowa City, IA

9:42 AM **Discussion**

SYMPOSIUM VIII **Achieving Value in Knee and Hip**
9:52–10:52 AM **Arthroplasty**
MODERATOR: Jess Lonner, MD
Role of Algorithms and Protocols
Matthew S. Austin, MD
Specialty Hospitals vs General Hospitals vs ASCs
Peter F. Sharkey, MD
Electronic Medical Records – Fact and Fiction
Wael K. Barsoum, MD
Role of a National Arthroplasty Registry for Enhancing Value
David G. Lewallen, MD

SESSION NINE **Basic Science and Related Topics**
10:52–11:48 AM *MODERATORS: Nitin Goyal, MD and David C. Markel, MD*

10:52 AM A Heritable Predisposition for the Need to Undergo
Paper #51 Total Hip Arthroplasty
Christopher E. Pelt, MD, Salt Lake City, UT

10:58 AM Cobalt to Chromium Ratio is not a Key Marker for
Paper #52 Adverse Local Tissue Reaction in Metal on Metal Hips
Thomas K. Fehring, MD, Charlotte, NC

11:04 AM Accuracy of Fluoroscopic Guided Acetabular
Paper #53 Component Positioning during Direct Anterior Total Hip Arthroplasty
Eric M. Slotkin, DO, West Reading, PA

11:10 AM **Discussion**

11:20 AM Bacterial Suture Adherence and Biofilm Formation in
Paper #54 an in-Vivo Contaminated Wound Model
David C. Markel, MD, Southfield, MI

11:26 AM Trends of Synovial Fluid Cytokines in Non-arthritic,
Paper #55 Arthritic and Painful Hip and Knee Arthroplasty
Carlos A. Higuera, MD, Cleveland, OH

11:32 AM Antibacterial and Biocompatible Titanium-copper-
Paper #56 oxide Nanofilm Coating
German A. Norambuena, MD

11:38 AM **Discussion**

11:48 AM Concluding Remarks

12:00 PM **Adjourn**

HUMANITARIAN AWARD

AAHKS is proud to award the first annual Humanitarian Award to Harpal (Paul) S. Khanuja, MD for his humanitarian efforts as the Co-Founder and Medical Director of Operation Walk Maryland. Dr. Khanuja serves as an Assistant Professor, and the Chief of Adult Reconstruction, with the Department of Orthopaedic Surgery, at Johns Hopkins University School of Medicine.

Operation Walk Maryland is a private, not-for-profit volunteer medical service organization providing free hip and knee replacement surgeries in developing countries and the United States. Operation Walk Maryland has changed the lives of more than 300 patients in countries including Ecuador, Peru, India and El Salvador.

During his Knee Society traveling fellowship, Dr. Khanuja met Lawrence D. Dorr, MD, founder of Operation Walk. Subsequently, he and his wife Maria traveled with an Operation Walk team. Both Paul and Maria were so inspired that they started Operation Walk Maryland. While Dr. Khanuja serves as the Director, Maria heads the logistics for travel, patients, hospitals and volunteers. Dr. Khanuja credits his success to the many committed volunteers and generous donations from individuals and corporate supporters

On their missions, Operation Walk Maryland team members educate orthopedic surgeons and other health care professionals about advanced surgical techniques, disease treatments and recovery procedures for hip and knee joint conditions. The most significant changes have been made at Dayanand Medical College & Hospital in northern India, where they visit regularly. Operation Walk Maryland activities have influenced the culture of the institution not only in how the surgeons practice, but also in how they continue to provide free joint replacement surgery throughout the year.

Dr. Khanuja's ability to inspire others is why Operation Walk Maryland can help so many.

Please join us in congratulating Dr. Khanuja and by taking time to stop by the humanitarian section of the exhibit hall - Booth 601.

The Humanitarian Award was established to recognize AAHKS members who have distinguished themselves through providing humanitarian medical services and programs with a significant focus on musculoskeletal diseases and trauma including the hip and knee in the United States or abroad.

Paper #1

Does Bariatric Surgery Reduce Postoperative Complications Following Total Knee Arthroplasty?

James A. Browne, MD, **Brian C. Werner, MD,**
Gregory M. Kurkis, Frank W. Gwathmey, MD

Introduction: Previous studies have failed to clearly demonstrate a significant reduction in postoperative TKA complication rates in patients who have had bariatric surgery (BS), potentially due to low patient numbers. The purpose of this study was to utilize a national database to evaluate the complication rates after TKA in patients who have had BS. The hypothesis was that BS prior to TKA would be associated with improved outcomes.

Methods: Patients who underwent TKA were identified using the PearlDiver (www.pearldiverinc.com) database. Three cohorts were identified: 1) non-obese TKA patients, 2) morbidly obese TKA patients who did not have BS, and 3) patients who underwent BS for weight loss prior to TKA. Each cohort was assessed for major and minor complications within 90 days postoperatively. Odds Ratios (OR), 95% confidence intervals (CI) and chi square tests were calculated using SPSS. $p< 0.05$ was considered significant.

Results: 78,036 unique TKA patients were identified from 2005-2011. 11,294 patients (14.5%) were coded as morbidly obese. 219 of the obese patients underwent BS prior to TKA. Morbidly obese patients had a major complication rate of 16.7% and minor complication rate of 23.7% (major: OR 4.03, 95% CI 3.79 – 4.28, $p < 0.0001$; minor: OR 2.25, 95% CI 2.14 - 2.36, $p < 0.0001$). In patients who underwent TKA after BS, the major complication rate (9.1%) and minor complication rate (16.4%) was significantly lower compared to morbidly obese patients who did not have BS (major: ORw 0.50, 95% CI 0.32 – 0.80, $p = 0.004$; minor, OR 0.63, 95% CI 0.44 – 0.91, $p = 0.016$). Obese patients who had BS still had significantly higher major complication rates than non-obese patients ($p = 0.004$), but there was no statistically significant difference in minor complication rates ($p = 0.065$).

Conclusion: Obesity and its associated medical comorbidities place patients undergoing TKA at a significantly increased risk for both major and minor postoperative complications. Patients who underwent bariatric surgery prior to TKA appear to have a lower risk than morbidly obese patients, although still remain at higher risk than non-obese patients.

Paper #2

Does Extended-release Liposomal Bupivacaine Better Control Postoperative Knee Pain than Bupivacaine?

William C. Schroer, MD, Paul Diesfeld, PA-C, Angela LeMarr, RN, Diane J. Morton, MS, Mary Reedy, RN

Introduction: Purpose: Multimodal pain management for total knee arthroplasty (TKA) modulates pain in the peripheral and central nervous systems. A new liposomal bupivacaine injectable offers sustained release of bupivacaine, [1-4] and has been compared with peripheral nerve blocks, IV narcotics, or limited multimodal management prescription. In this study, liposomal bupivacaine was incorporated into a robust multimodal pain management protocol and randomized against bupivacaine alone.

Methods: 111 primary TKAs were randomized to receive liposomal bupivacaine or bupivacaine. Acetaminophen, celecoxib, oxycontin, and topical scopolamine were administered before surgery. Zofran, dexamethasone, and tranexamic acid were given during surgery. Before implantation, the periarticular soft tissues were infiltrated with either 20 mg liposomal bupivacaine mixed with 30cc 0.25% bupivacaine or 60cc 0.25% bupivacaine using a 22 gauge spinal needle. After surgery, celecoxib was given and patients were provided prn narcotics. Visual analog scale pain scores were obtained twice daily. Morphine equivalents were determined for the hospital duration and the first two weeks at home.

Results: 58 patients received liposomal bupivacaine, 53 received bupivacaine. No difference was seen between study and control patients for Day 1 pain scores: 4.5 vs. 4.6 ($p=0.73$); Day 2: 4.4 vs 4.8 ($p=0.26$); or Day 3: 3.5 vs 3.7 ($p=0.58$). Narcotic use was similar during hospitalization, 51.8 vs. 54.2 ($p=0.34$), but was higher in study drug patients at home, 107.0 vs 87.7 ($p=0.045$).

Conclusion: No improvement in pain scores or narcotic use occurred with use of liposomal bupivacaine. Narcotic use actually increased in study patients after discharge, which may represent a rebound phenomenon. The study medication costs $285, the control $2.80. This study does not justify the routine use and cost of liposomal bupivacaine as part of a multimodal pain management program. References: 1. Bagsby DT, Ireland PH, Meneghini RM. Liposomal bupivacaine versus traditional periarticular injection for pain control after total knee arthroplasty. J Arthroplasty 2014;29:1687. 2. Bramlett K, Onel E, Viscusi ER, Jones K. A randomized, double-blind, dose-ranging study comparing wound infiltration of DepoFoam bupivacaine, an extended-release liposomal bupivacaine, to bupivacaine HCl for postsurgical analgesia in total knee arthroplasty. Knee 2012;19(5):530. 3. Lambrechts M, et al. Liposomal extended release bupivacaine for postsurgical analgesia. Patient Prefer Adherence 2013;6(7):886. 4. Lonner J. Role of liposomal bupivacaine in pain management after total joint arthroplasty. J Surg Orthop Adv 2014;23(1):37.

Paper #3

Tourniquet use during TKA and Its Effect on Recovery of Quadriceps Strength and Lower Extremity Function: A Randomized, Double-blind, Control Trial

Douglas A. Dennis, MD, Andrew J. Kittelson, PT, DPT, Todd M. Miner, MD, Charlie C. Yang, MD, Raymond H. Kim, MD, Jennifer Stevens-Lapsley, PhD, PT

Introduction: Limited information exists on the impact of tourniquet use on muscle strength and lower extremity functioning. The purpose was to examine differences in quadriceps strength, pain and range of motion (ROM) in a group of patients undergoing simultaneous bilateral TKA with a tourniquet used on one limb.

Methods: Twenty-seven patients (54 lower extremities; 61.4±6.1 years; 15 male) participated. Patients were randomized to receive tourniquet-assisted TKA (TQT) on one limb while the contralateral limb underwent TKA without tourniquet use (NOTQT). Tourniquets were inflated to 250 mmHg in the TQT until released at wound closure and were only used in the NOTQT group during component cementation. Quadriceps strength, assessed by a maximal voluntary isometric contraction, resting pain levels, and knee ROM were assessed preoperatively, the second postoperative day, one month and three months following TKA. Paired t-tests were used to compare differences between limbs.

Results: Average tourniquet times were 50.81±11.53 minutes for the TQT group and 8.65±5.67 minutes for the NOTQT group. Average blood loss was 84.29 ml (intraoperatively) and 202.44 ml (postoperatively) in the TQT group compared to 152.00 ml (intraoperatively) and 255.94 ml (postoperatively) for the NOTQT group. No significant difference in quadriceps strength was observed on postoperative day two. At one and three months following surgery, NOTQT limbs demonstrated significantly greater quadriceps strength [1 month quad strength: NOTQT=88.98±43.19N-m; TQT=77.71±35.08N-m ($p=0.0005$); 3 month quad strength: NOTQT=139.31±49.77N-m; TQT=128.96±45.92N-m ($p=0.03$)]. On the second post-operative day, resting pain scores trended significantly lower in NOTQT vs. TQT ($p=0.09$). One month after TKA, resting pain scores were significantly lower in NOTQT vs. TQT ($p=0.02$), but were similar at 3 months ($p>0.05$). No differences in knee ROM were observed ($p>0.05$).

Conclusion: Tourniquet use during TKA surgery negatively impacted quadriceps strength and affected patients' pain reports, even one month following surgery.

Paper #4

Perioperative Complications in Patients with Inflammatory Arthropathy Undergoing Total Knee Replacement

Erik A. Schnaser, MD, James A. Browne, MD, Douglas E. Padgett, MD
Mark P. Figgie, MD, Michele R. D'Apuzzo, MD

Introduction: Despite recent improvements in the medical treatment of various inflammatory arthropathies (IA), patients suffering from these conditions often go on to require a total knee replacement (TKR). Little information exists comparing the short-term surgical complications of the different inflammatory arthropathies and osteoarthritis (OA) after TKR. Our objectives were (1) to compare perioperative complications and (2) determine the most common complications between the different IA subtypes compared with patients with osteoarthritis (OA) undergoing primary TKA.

Methods: The Nationwide Inpatient Sample was used to identify 6,894,641 patients undergoing elective unilateral TKR between 2002-2011. Of this number 278,844 (4%) had an IA, including rheumatoid arthritis (RA), psoriatic arthritis (PA), juvenile idiopathic arthritis (JIA), ankylosing spondylitis (AS), systemic lupus erythematosus (SLE). The prevalence of inpatient medical and orthopaedic complications were compared between patients with IA and OA. Multivariate logistic regression was used to control for age, gender and comorbidities.

Results: When compared to patients with OA, patients with RA, JIA, AS, SLE, PA had significantly more inpatient medical and orthopaedic complications immediately following TKR ($p<0.01$). The highest medical complication rate was seen in patient with AS (26%) whereas RA, JIA, AS, SLE had more orthopaedic complications. Specific orthopaedic complications by subtype included hematomas for RA (OR: 1.3; 95% CI: 1.2-1.3), periprosthetic fractures for JIA, SLE and PA (OR: 6.8; 95% CI: 3.9-12, OR: 2.3; 95% CI: 1.6-3.3 and OR: 2.3; 95% CI: 1.6-3.3, respectively) and increased mortality for AS patients (OR: 1.9; 95% CI: 1.0-3.7).

Conclusion: Differences exist in postoperative inpatient medical and orthopaedic complications in patients with certain types of inflammatory arthropathies following TKR. There is an increased risk for important complications such as periprosthetic fractures and mortality. Our results point out the importance of preoperative optimization in patients with IA as well as monitoring for selective postoperative complications.

Paper #5

Custom Cutting Guides do not Improve Total Knee Arthroplasty Outcomes at 2 Year Follow-up

Denis Nam, MD, Andrew Park, MD, Jeffrey B. Stambough, MD, Staci R. Johnson, MEd, Ryan M. Nunley, MD, Robert L. Barrack, MD

Introduction: To date, small cohorts and short follow-up have limited reports studying clinical outcomes of custom cutting guides (CCGs) versus standard intramedullary and extramedullary instrumentation. The purpose of this study was to determine if CCGs improve clinical outcomes following TKA at a mean of 2 years postoperatively.

Methods: This was a prospective cohort study of patients undergoing primary TKA using the same cruciate-retaining, cemented TKA system. Patients were offered the option of receiving a preoperative MRI and TKA with CCGs, and each patient self-selected for either the CCG or standard instrument group. The first 95 consecutive patients in each cohort were included. Alignment goals for all TKAs were a neutral, hip-knee-ankle (HKA) angle of 0°. University of California at Los Angeles (UCLA), SF-12, and Oxford Knee scores were collected preoperatively. These scores, along with the Forgotten Joint score and a patient satisfaction survey were administered at each patient's most recent follow-up visit. Postoperatively, rotationally controlled coronal scout CT scans were used to measure the HKA angle. Comparisons of the two cohorts were performed using independent samples t-tests and Chi-square tests, with a p-value < 0.05 considered significant.

Results: At a mean follow-up of 2.3 years, no differences were present for range of motion, UCLA, SF-12, Oxford Knee, or Forgotten Joint scores between the two cohorts (p=0.09 to 0.76). In addition, no differences were present for the incremental improvement in these scores from preoperatively to postoperatively (p=0.1 to 0.9). Patient satisfaction and the presence of residual symptoms were similar between the two cohorts (p=0.1 to 0.8). In addition, there was no difference in mean tourniquet time (59.1 + 13.2 mins in CCG vs. 59.7 + 14.7 mins in standard cohort; p=0.75) or percentage of outliers for overall mechanical alignment (31% in CCG versus 23% in standard cohort with HKA outside of 0° + 3°; p=0.2).

Conclusion: At two years follow-up, custom cutting guides fail to demonstrate any advantages in clinical outcomes versus the use of standard instrumentation in total knee arthroplasty. The benefit of CCGs must be proven prior to continued implementation of this technology.

Paper #6

Does Computer Navigation Improve Functional Outcomes after Total Knee Replacement?

Simon W. Young, FRACS, MD, Chris Frampton,
Tim Roberts, MBChB, Mark Clatworthy, MD

Introduction: Computer navigation in total knee replacement improves accuracy in component positioning and limb alignment in total knee arthroplasty (TKA). In addition, a recent meta-analysis of level 1 randomised trials found significantly better functional outcomes in TKAs performed with computer navigation compared to TKAs performed with conventional instruments. The aim of this study was to use a large national database to test the hypothesis that computer navigation improves functional outcome following TKA.

Methods: We analysed 9054 primary TKA procedures performed between 2006-2012 from the New Zealand National Joint Registry performed for a diagnosis of osteoarthritis using a single, modern design TKA implant. Of these, 3329 TKAs were implanted using computer navigation and 5725 using conventional instruments. Functional outcomes were compared using oxford knee score questionnaires sent at 6 months and 5 years post operatively. The effect of surgical duration on functional outcome and revision rates was analysed using a multivariate model adjusted for surgeon experience, age, sex, comorbidities, patella resurfacing, cementation, approach, implant type (cruciate retaining or posterior stabilised), theatre ventilation, bearing type and hospital (public versus private).

Results: On univariate analysis the mean 6 month oxford score was higher in the navigation group versus the conventional group (39.0 vs 38.1, p=0.006), however on multivariate analysis this difference was not statistically significant (p=0.54). There was no difference in mean oxford scores at 5 years between groups (42.2 vs 42.0, p=0.76). Lower oxford scores were seen in lower volume surgeons compared to higher volume surgeons, but the use of navigation did not improve functional outcome in either high or low volume surgeons (Figure 1.) At current follow up, there was no difference in revision rates between navigated and non-navigated TKA (0.46 vs 0.43 revisions per 100 component years, p=0.8, Figure 2).

Conclusion: In this comprehensive analysis of 9054 TKA procedures the use of computer navigation did not improve functional outcomes following TKA. At current follow up, any benefit to implant durability from improved component alignment with navigation is yet to be demonstrated.

Paper #7

To Cement or Not? Prospective, Randomized Study Comparing Cemented vs. Cementless Total Knee Arthroplasty

Kevin B. Fricka, MD, Supatra Sritulanondha, MPH, Craig J. McAsey, MD

Introduction: The optimal mode of fixation in total knee arthroplasty (TKA) is a subject of debate with the majority of surgeons favoring cemented fixation. Previous reports indicate that clinical outcomes and long-term survival are inferior for cementless fixation, especially loosening on the tibial side. Does the new generation of cementless implants offer advantages over cemented TKA?

Methods: We enrolled 100 primary TKA patients randomized to cemented or cementless fixation in this prospective unblinded clinical trial. Knee Society scores (KSS) and Oxford scores were collected preoperatively and at 1 and 2 years. A visual analog scale (VAS) for pain was given preoperatively, at 4 weeks and 4 months. A power analysis to detect a 5-point difference in KSS required 42 knees in each group. Post-operative complications were recorded.

Results: Two-year followup was obtained for 93 patients. The mean VAS trended higher for the cementless group at 4 months (p=0.06). At 2 years, the KSS scores were equivalent for function but the cemented group had higher clinical scores (96.3 vs 92.3, p=0.02). Oxford scores and self-reported questions for satisfaction, less pain and better function were equivalent between the two groups. Surgical time was less for the cementless group (74 vs 81min). There was no difference in blood loss. The cementless group had 1 revision for instability. The cemented group had 1 revision for infection and 2 manipulations.

Conclusion: At 2 year follow up cementless TKA showed similar outcomes with excellent satisfaction scores compared to cemented TKA. The cementless group had faster surgical times but had higher pain scores in the early recovery period. Given these results, cementless fixation is non-inferior to cemented TKA and longer term follow up is needed to evaluate if there is an advantage with overall survivorship.

Paper #8

Does Medicare 3-day Rule Increase Length of Stay?

Victor H. Hernandez, MD, MS, Alvin Ong, MD,
Zachary D. Post, MD, **Fabio Orozco, MD**

Introduction: Medicare will only cover transfer to a skilled nursing facility (SNF) if it follows a hospital inpatient stay of at least 3 days. The 3-day stay rule was instituted in 1965 to prevent improper and excessive utilization of the SNF benefits. The purpose of this study was to evaluate if this rule increase length of stay after total knee arthroplasty.

Methods: From a consecutive cohort of 800 TKA done during 2011 we analyzed patients who were discharged to SNF after surgery. Medicare recipients were matched with those who were privately insured.

Results: A total of 322 patients were discharged directly to SNF after surgery. There were 209 Medicare patients and 113 Private patients. The LOS was 2.3 days for privately insured patients and 3.02 for Medicare recipients ($p<0.05$). No difference was found with regards to age, BMI, and ASA score.

Conclusion: Medicare 3 days rule increase the length of stay on patients that needs SNF by 0.72 days when compared to patients who were privately insured. In the current medical economic climate, we recommend that this outdated rule needs to be revised in order to decrease the cost of TKA.

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Paper #9

Morbid Obesity: A Significant Risk Factor for Failure following Aseptic Revision TKA

Chad D. Watts, MD, Eric R. Wagner, MD, Matthew T. Houdek, MD, David G. Lewallen, MD, Tad M. Mabry, MD

Introduction: Obese patients are known to have a higher risk of complications following primary total knee arthroplasty (TKA). However, there is a paucity of data on the effects of obesity in revision TKA.

Questions/Purposes: The aims of this study were to assess the incidence and risk factors for subsequent revision, reoperation, and periprosthetic joint infection in morbidly obese (BMI ≥ 40 kg/m2) patients who underwent a first-time revision TKA for aseptic reasons, compared to a matched cohort of non-obese patients (BMI <30 kg/m2).

Methods: We analyzed all patients undergoing both-component aseptic revision TKA at a single institution over a 15-year period (1992-2007) with minimum follow-up of five years. All patients with a BMI ≥40 were identified (n=93, average follow-up 7.9 years), and compared to a cohort of non-obese (BMI ≤30) patients (n=93, average follow-up 7.3 years) matched by sex, age (+/- 3 years), and date of surgery (+/- 1 year). Medical records were examined for details regarding implant failure and clinical outcome scores.

Results: Overall, the morbidly obese patients had a statistically significant increased risk for re-revision surgery (HR 3.8 (1.2-16.5), p<0.02), prosthetic joint infection (HR 6.4 (1.2-119.7), p<0.03), and reoperation (HR 2.9 (1.3-7.4), p<0.02). Implant survival rates were 96% (92-100%) and 100% at five years and 81% (70-92%) and 93% (86-100%) at ten years for the morbidly obese and non-obese patients, respectively. Knee Society pain and function scores significantly improved postoperatively for both groups, but were higher in the non-obese patients at all time points.

Conclusion: Morbid obesity is associated with significantly increased rates of re-revision, reoperation, and prosthetic joint infection following aseptic revision TKA. The poorer outcomes in morbidly obese patients argue for increased attention to weight management strategies throughout the timeline of treatment for knee arthritis.

Paper #10

Factors Associated with 20-year Cumulative Risk of Infection after Aseptic Index Revision TKA

O. Brant Nikolaus, MD, Paul B. McLendon, MD, Cathy D. Schleck, BSc., Arlen D. Hanssen, MD, Tad M. Mabry, MD, Elie F. Berbari, MD, Rafael J. Sierra, MD

Introduction: The purpose of this study was to calculate the cumulative risk of PJI after aseptic index knee revisions and to identify the surgical, perioperative and medical comorbidity risk factors associated with deep infection.

Methods: We retrospectively reviewed all aseptic revision TKAs performed with condylar knee designs at our institution from 1970-2000 (n=2985). Using study criteria, 1183 knees were excluded due to previous infection, previous revision, or because a custom-type prosthesis was used to revise the failed TKA. This resulted in 1802 aseptic, index revision TKA (1615 patients) as the final cohort. The medical records of all patients were reviewed for index revision surgical information, medical comorbidities, medical and surgical complications and reasons for reoperation after index revision TKA.

Results: From these 1802 index knee revisions, there were 60 reoperations performed for deep infection. These infections occurred from 13 days to 18.6 years after index revision. Eighteen of the 60 infections (30%) had occurred within the first year after surgery, with 40 (67%) within 5 years, and 50 (83%) within 10 years. The cumulative risk of infection at 1, 5, 10 and 20 years after index revision was 1% (95% CI: 0.6-1.5), 2.4% (95% CI: 1.7-3.2), 3.3% (95% CI: 2.4-4.2), and 5.6% (95% CI: 3.7-7.4) respectively. Male gender (HR 2.28, p=<.01), increased constraint of the prosthesis being revised(HR 2.02, p=<.01), operative time greater than 3 hours (HR 1.73, p=0.04), and anesthesia time greater than 4 hours (HR 1.92, p=0.02) were associated with deep infection. The only medical co-morbidity at the time of index revision that showed statistically significant increased risk of infection was presence of liver disease (HR 3.12, p=0.01).

Conclusion: Following aseptic revision TKA, the cumulative risk of infection was 5.6% at 20 years. Male gender, history of liver disease and longer operative times were significantly associated with PJI.

Paper #11

Tibial Stems in Revision Total Knee Arthoplasty: Is There an Anatomic Conflict?

Newton K. Chan, BS, Stephen J. Incavo, MD, Philip C. Noble, PhD, Rikin Patel, MS, **Mohamed S. Gobba, MD**

Introduction: Proper alignment of the tibial component is crucial for implant function and long-term survivorship. In revision surgeries, the alignment of stemmed components depends upon the fit of the stem within the intramedullary canal. However, in the bowed tibia with valgus curvature, misalignment of the stem may occur. In this study we investigate the incidence and severity of valgus bowing of the tibial canal and its effect on the alignment of the stem and the position of the tray on the tibial metaphysis.

Methods: Thirty 3D reconstructed tibial models were classified according to the valgus bowing angle (angle between the proximal and distal canals). 13 tibiae were straight (0-1°), 10 mildly bowed (2-3°) and 7 moderately bowed (4-5°). CAD models of a popular design of tibial tray with 120 mm and 200 mm stem extensions were virtually implanted in each tibial model ensuring proper canal fit and fill. For each implantation, we measured the alignment of the stem and the mechanical axis and the position of the tray on the cut tibial surface.

Results: The angulation of the stem with respect to the mechanical axis was most pronounced with the 120mm stem ($p<0.0001$) and increased with the severity of tibial bowing from only 0.27°±0.39° valgus in straight tibiae to 2.36°±0.48° in cases of moderate bowing ($p<0.0001$). With the 200mm stem, these values were only 0.15°±0.56° varus and 0.71°±0.39° valgus, respectively ($p<0.0001$). Canal alignment displaced the tibial tray medially an average of 1.19of 1.19 to 4.9 mm from the ideal position and posteriorly an average of 6.89±2.72 mm.

Conclusion: There was high prevalence of valgus anatomic bowing in our specimens (57 %). In these tibiae, relatively short stems can cause up to 3° of valgus malalignment. Use of canal-fitting stems also causes medial and posterior displacement of the tray.

Paper #12

Antibiotic Cement Decreases Re-Revision Risk by 45% in 1154 Aseptic Revision Total Knee Arthroplasties

Stefano A. Bini, MD, Christopher F. Ake, PhD, Liz Paxton, Maria C. Inacio, PhD, Monti Khatod, MD

Introduction: The survivorship of revision total knee arthroplasty (rTKA) and the risk factors associated with re-revision are topics that are not well defined. Our aim is to use an institutional joint replacement registry to evaluate the survivorship of rTKA and identify patient, surgeon, and hospital risk factors associated with re-revision

Methods: A retrospective cohort study was conducted of patients who had aseptic rTKA from 2001 to 2010. The endpoint of interest was all cause re-revision TKA. The exposures were patient (age, gender, body mass index (BMI), race, general health status, diagnosis), implant (hinge vs. other, cement type), surgeon (yearly volume, total experience), and hospital (volume). Frequencies proportions, means and standard deviations were used for describe the study sample. A multivariable Cox regression model was used to adjust for confounders with adjustment for clustering by surgeon

Results: 1154 aseptic rTKAs were identified with 114 (9.9%) re-revisions with an infection rate of 2.9%. The average age was 65.1 (SD=9.8), most where white (64.2%) and female (61.4%). Antibiotic cement was used in 26.7% of revisions. The mean time to re-revision was 4.0 years. Infection (29.8%) and instability (28.1%) were the leading causes of re-revision. The Kaplan Meyer survivorship at 5 years was 80% and at 9 years 53%. In adjusted models, the use of antibiotic loaded cement was strongly protective of re-revision (HR=0.55, CI: 0.32-0.94). For every 5 case increase in surgeon annual volume the re-revision risk dropped (HR=0.92, CI: 0.66, 1.28) while for surgeon experience it increased (HR=1.10, CI:1.02,1.18). The use of a hinge increased the risk of re-revision (HR=1.23, CI: 0.32, 0.94)

Conclusion: Revision TKAs have a low (80%) survivorship at 5 years and a 2.9% risk of infection. Infection and instability account for 60% of re revision. Antibiotic cement can halve the risk of re-revision.

Paper #13

The Use of Trabecular Metal Cones in Complex Primary and Revision Total Knee Arthroplasty

Nicholas M. Brown, MD, H. John Cooper, MD, Edward Jung, MD, Scott M. Sporer, MD, MS, Wayne G. Paprosky, MD, Brett R. Levine, MD

Introduction: TKA in the setting of osseous defects has multiple management options, however, the optimal treatment strategy remains controversial. The purpose of this study is to report the clinical and radiographic results of trabecular metal cones in managing osseous defects in the setting of complex primary and revision TKA.

Methods: 129 consecutive TKAs utilizing trabecular metal cones were retrospectively reviewed for clinical and radiographic outcomes. 25 had less than 2 years of follow-up and 7 died, leaving 96 patients for evaluation. This cohort included 86 tibias with 11 type 1, 25 type 2a, 43 type 2b, and 7 type 3 defects, and 27 femurs with 1 type 1, 9 type 2a, 16 type 2b, and 1 type 3 defects based on the AORI classification. There were 28 males and 68 females, with an average age of 68 years, and average BMI of 35.0. Six were primary and 90 were revision TKAs. Continuous variables were evaluated using a t-test.

Results: Twelve patients required revision leaving 84 knees (87.5%) with the cones in place at an average of 31 months of follow-up (range 24-77.3 months). The mean KSS score increased from 51.0 pre-operatively to 80.2 post operatively ($p < 0.0001$). The mean KSS functional score increased from 32.9 pre-operatively to 47.8 post operatively, ($p=0.0002$). Including the 12 revisions, there were 22 knees requiring re-operation (22.9%), another 17 requiring manipulation under anesthesia, and 4 additional non-operative complications (1 foot drop, 1 stress fracture, 2 superficial infections). 83 of 84 (98.8%) unrevised knees were radiographically osseointegrated without signs of subsidence or migration.

Conclusion: Trabecular metal cones are an effective treatment strategy for osseous defects in the setting of TKA. While there was a relatively high rate of post-operative complications, in this difficult patient population, there were significant improvements in KSS scores with a high rate of osseointegration at an average of 31 months follow-up.

Paper #14

Varus-Valgus Constrained Knee Implants: Survivorship and Outcomes

Marcelo B. Siqueira, Paul B. Jacob, DO, John A. McLaughlin, MD, Alison K. Klika, MS, Robert M. Molloy, MD, **Wael K. Barsoum, MD,** Carlos A. Higuera, MD

Introduction: Varus-valgus constrained (VVC) knee implants provide coronal plane stability and are the implants of choice in severely deformed knees or cases with soft tissue deficiencies. The purpose of this study was to (1) estimate survivorship of VVC implant in primary, aseptic revision, and septic revision total knee arthroplasty (TKA), (2) determine functional outcomes; and (3) main modes of failure.

Methods: 685 consecutive cases of TKAs with VVC implants in 597 patients performed between 1999 and 2008 were identified and retrospectively reviewed using electronic medical records. Data collected included demographics, clinical and surgical variables, and preoperative modified Knee Society (KSS) and Function Scores (KFS). Patients were followed-up via telephone and assessed for further knee surgery, reason for further surgery, and postoperative KSS and KFS if the VVC implant was not removed. Revision for any reason was the primary end-point.

Results: Of the 597 patients, 465 (77.9%) had a minimum two-year follow-up. Mean follow-up was 6.5 years (range, 0.1-15.1). Of these, n=246 were primary TKAs, n=316 were aseptic revisions, and n=123 were septic revisions. A total of 23 (9.4%), 55 (17.4%), and 39 knees (31.7%), underwent further revision surgery (primary TKA, aseptic revision, and septic revision groups, respectively). Five-year survival was 92.8% (95% CI 91.9% – 97.7%) for primary TKAs, 83.7% (95% CI 79.4% – 88.2%) for aseptic revisions, and 71.2% (95% CI 63.2% – 80.2%) for septic revisions. KSS and KFS improvement were significant in primary TKAs and aseptic revisions ($p<0.0001$ all), and for septic revisions (KSS<0.0001; KFS=0.008). Infection was the main mode of failure in all 3 groups [primary 12/23 (52%); aseptic revision 12/55 (22%); septic revisions 28/39 (72%)].

Conclusion: VVC implant showed similar survivorship at 5 years to cruciate retaining and posterior stabilizing implants, and superior survivorship at 5 years to hinged implants. The main failure mode was infection for all three groups.

Paper #15

Does Neuraxial Anesthesia Decrease the Rate of Postoperative Complications and Blood Transfusions? An Analysis of 29,452 Primary Total Hip Arthroplasty

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Introduction: The impact of neuraxial anesthesia on postoperative complications and perioperative blood loss in THA is limited to small studies with variable results. Using a national database, we compared complications following THA using neuraxial and general anesthesia, and determined the independent risk factors for blood transfusions.

Methods: The National Surgical Quality Improvement Database includes prospectively collected perioperative lab, comorbidity, and post-operative complications data. THAs from 2005-2012 were analyzed. A propensity score model incorporated preoperative and perioperative variables to assess the conditional probability of receiving neuraxial versus general anesthesia. Univariate analysis was performed evaluating postoperative complications between neuraxial and general anesthesia. A multivariate analysis, utilizing the propensity score to balance the probability of receiving neuraxial anesthesia, determined independent risk factors for blood transfusion following THA.

Results: 29,452 primary THA (11,420 neuraxial) were included in this study. Propensity score balancing showed no preoperative differences between groups ($p>0.05$). Neuraxial anesthesia cases demonstrated shorter operative time (88.2 vs. 101.4 minutes; $p<0.001$) and length of stay (3.3 vs. 3.5 days; $p=0.03$), lower rates of overall (4.1% vs 4.8%; $p=0.006$) and medical complications (2.7 vs 3.5%; $p<0.001$), deep infection (0.23% vs. 0.37%; $p=0.04$), pneumonia (0.23% vs. 0.37%; $p=0.04$), unplanned intubation (0.16% vs. 0.29%; $p=0.015$), ventilation over 48 hours (0.04% vs. 0.13%; $p=0.03$), stroke (0.08% vs. 0.20%; $p=0.013$), and death (0.12% vs. 0.24%; $p=0.025$). Multivariate analysis demonstrated decreased risk of postoperative transfusion (OR=0.79; CI:0.69-0.91) using neuraxial anesthesia. Independent risk factors for transfusion included female sex (OR=1.90; CI:1.66-2.18), operative time (OR=1.23 per 30 minutes; CI:1.18-1.29), and a history of hypertension (OR=1.33; CI:1.16-1.51).

Conclusion: We present the largest series to date evaluating neuraxial versus general anesthesia in THA. Neuraxial anesthesia demonstrated fewer complications, and following multivariate regression, was a protective factor for blood transfusion. Independent risk factors for transfusion included female gender, prolonged operative time, and hypertension.

Paper #16

Reliability of Ceramic Heads in over 5.7 Million Hip Replacements

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Introduction: Because of improvements in ceramic materials and manufacturing the incidence of ceramic failures has decreased over time. Recent concerns with corrosion have contributed to an increase in ceramic ball head utilization. The purpose of this study is to report the incidence of modern alumina bearing failures from a single major ceramic manufacturer in over 5.7 million hip implants and to identify trends in the modes of failure of these implants.

Methods: Beginning in the year 2000, CeramTec AG (Plochingen, Germany) began a comprehensive program for reporting and gathering failure data on its products. From January 1, 2000 to December 31, 2013 3.2 million pure alumina and 2.52 million alumina matrix composite ceramic balls heads were implanted worldwide. During this period, there were 672 pure alumina and 26 alumina matrix composite femoral head fractures. The fractures were analyzed with respect to time to failure, head size, and implant factors.

Results: The incidence of clinical fractures of modern pure alumina femoral heads and alumina matrix composite femoral heads was 1 in 5000 (0.021%) and 1 in 100,000 (0.001%) respectively ($p<0.0001$). The majority of implant failures (80%) occurred within 48 months following surgery ($p<0.01$). Fractures were usually associated with specific events such as trauma, mismatched components, and dislocations. Large diameter heads were associated with a lower rate of fracture compared to smaller diameter femoral heads (0.030% for 28 mm heads vs 0.008% for heads 32mm or greater ($p<0.01$) for modern pure alumina and 0.004% for 28mm heads vs. 0.0004% for 32mm alumina matrix composite heads ($p<0.001$). The neck lengths of the femoral ball heads were also a factor: a short taper 28mm ball head was more likely to fracture compared to other neck lengths ($p<0.01$).

Conclusion: Modern alumina ceramic heads are reliable with extremely low risk of fracture. The reliability is even better with alumina matrix composite heads.

Paper #17

No Differences in Patient Function Six Weeks after Direct Anterior or Posterior THA: A Randomized Study

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Introduction: The direct anterior approach (DAA) has become an increasingly popular technique due in large part to the perceived improvements in early functional recovery. While improvements have been demonstrated when compared to lateral approaches, subjective and objective measures of postoperative function have not consistently demonstrated a clear benefit of the DAA over a posterior approach (PA). The purpose of this randomized study was to determine if functional recovery during the early postoperative period differs between DAA and PA THA.

Methods: Per our power analysis, 26 THAs per group was required. To date, 48/52 THAs have completed data collection. Patient-reported outcome tools included modified Harris Hip Scores (HHS), the Lower Extremity Function Scale (LEFS), Single Assessment Numeric Evaluation (SANE) and the SF-12. A dual force platform was used to collect force data of the involved and uninvolved limbs as patients performed a sit-to-stand maneuver, stair descent, and the timed-up-and-go test (TUG). Patient-reported outcomes, max force when rising from a chair, eccentric function when descending stairs, and TUG data were compared between groups using 2 x 2 ANOVAs. We also compared the duration of hospital stay and number of days to discontinued use of an assistive ambulatory device using independent t-tests.

Results: The DAA group demonstrated significantly shorter length of hospital stay (1.4 days vs. 2.0 days, p=.02) with an earlier ability to discontinue use of an assistive device (32.2 days vs. 43.3 days, p=.04). Regardless of group, HHS, LEFS, and SANE scores as well as the force generated when rising from a chair and descending stairs significantly improved between the preoperative and 6-week time points. The DAA group demonstrated significantly greater changes in HHS and Pain Scores after surgery than the PA group; however, none of the other subjective or objective functional measures differed between groups.

Conclusion: The DAA resulted in an earlier hospital discharge, earlier ability to walk without an assistive device, and better pain relief at 6 weeks. However, contrary to our hypotheses, neither patient-reported nor objective functional measures differed between the 2 approaches.

Paper #18

5 Year RSA Evaluation of Vitamin E Infused Polyethylene Wear and Stability of Acetabular and Femoral Components

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Introduction: In vitro studies show the anti-oxidative properties of vitamin E UHMWPE stabilize free radicals while retaining the properties of UHMWPE. A porous-titanium coated surface for acetabular shells was developed for improved bone in-growth fixation. The purpose was to evaluate vitamin E infused polyethylene (VEPE) wear and stability of acetabular and femoral components using RSA.

Methods: 58 patients (64 hips), with osteoarthritis, consented to participate in a 5 year RSA study. Each patient received a VEPE liner, a PTC shell, and an uncemented stem. Tantalum beads were inserted into the VEPE, pelvic bone, and femoral bone to measure head penetration into the polyethylene, and shell and stem stability using RSA. The Wilcoxon signed-ranks test determined if changes in penetration or migration were significant.

Results: 47 hips were followed at 3 years and 18 at 5 years. The median± standard error (SE) superior head penetration into the polyethylene was 0.05±0.01mm at 3 years and 0.05±0.02 mm at 5 years. The acetabular components had a median± SE cup translation in the proximal direction of 0.04±0.04mm at 3 years and 0.06±0.06mm at 5 years. There were no significant differences in translation or head penetration. The median± SE stem distal migration was 0.05±0.23mm at 3 years, and 0.02±0.17mm at 5 years, with a significant difference between 6 months and 3 years (p=0.029).

Conclusion: The VEPE liners show low head penetration at 5 years. The early head penetration, probably due to creep, is lower relative to that reported for non-vitamin E stabilized UHMWPE measured by RSA. At 5 years, all acetabular components were stable. This study documents the longest-term evaluation of in vivo wear performance of vitamin E stabilized UHMWPE. The stability of the Regenerex™ shell and femoral stem shows promise for long-term survivorship.

Paper #19

5 Year Long-Term Multicenter Outcomes with Vitamin E Polyethylene Liners and Porous-Titanium Coated Shells

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Introduction: Monitoring clinical outcomes of new materials through multicenter-collaborations and registries is important to document effects in vivo. The purpose of this registry-based observational multicenter THA study is to prospectively monitor vitamin E diffused polyethylene (VEPE) liners and porous-titanium coated (PTC) acetabular shells compared to non-diffused medium cross-linked polyethylene (XLPE) liners and plasma sprayed (PS) shells.

Methods: In this prospective study, patients received either a PTC or PS shell with either VEPE or XLPE liners. All femoral heads were 32mm. Examination were preoperative and biannual for 10-years. At each interval, radiographs and surveys were obtained. All postop complications and revisions were collected. Radiographs were measured for implant position, radiolucencies, and polyethylene wear.

Results: Seventeen centers enrolled 977 patients with osteoarthritis. The average age at surgery was 62±9 years, 50% male, and 90% white. Eleven percent of cases had an anterior approach, 32%-anterolateral, and 56%-posterolateral. There were 15 dislocations (11 patients) and 13 revisions. Average follow-up is 3.9±1.1 years.

Forty-four percent of cups fell within 30° and 45° abduction and 5° and 25° anteversion. At postop, 1, 3, and 5 years, 22%, 27%, 24%, and 21% of the PTC shells had radiolucencies, respectively. At the same intervals, 28%, 13%, 5%, and 5% of the PS shells had radiolucencies, respectively. Head penetration was 0.02 mm/year for XLPE and -0.04 mm/year for VEPE ($p=0.23$). All surveys improved from pre- to post-op ($p<0.0001$).

Conclusion: Five-year follow-up of VEPE liners provides encouraging results regardless of the shell type. PTC shells had more radiolucencies than the PS shells, but none of the cups appeared loose and there were no signs of osteolysis in either group. Improvement was seen in physical function, activity, and health-related quality of life after treatment. Continued follow-up is required to determine if the use of these implants will result in less osteolysis and improved longevity.

Paper #20

Delta Ceramic on Ceramic THA - Midterm Results

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Introduction: Little data exists on the Delta ceramic on ceramic (COC) ceramic bearing. The purpose of this study is to report the mid-term results of the 28mm and 36mm Delta COC articulations.

Methods: From 2003-2007, 345 subjects received a Delta COC THA in a prospective multicenter IRB approved study with either 28mm (n=177) or 36mm (n=168) articulations. Mean age was 56.9 (range 20 to 75), mean BMI was 29.5 (range 18.4 to 53.1). Annual clinical and radiographic evaluations were performed. Kaplan-Meier survivorship estimates were calculated. Patients were asked if they heard noises from their hip, and positive responses were recorded. The incidence of squeaking was calculated, and several factors were evaluated for possible association with squeaking: age, sex, BMI, cup abduction angle, cup size, head size, and 2+ year Harris Hip score.

Results: At mean follow-up of 5.1 years (range 1.9 to 7.9) the latest average Harris Hip score was 94.4 (range 47 to 100). There were 3 (0.9%) postoperative liner fractures and no femoral head fractures. Nine revisions were performed (28 mm: 1 liner fracture, 2 stem loosening, 1 deep infection; 36mm: 1 liner fracture, 2 stem loosening, 2 deep infection). Kaplan-Meier survivorship at 6 years was 96.8% (93.7-98.4) for the entire cohort; 28 mm 97.7% (93.9-99.1), 36 mm 95.9% (89.9-98.3). Twenty-six (7.5%) subjects reported squeaking; there was no difference in average Harris Hip score (93.3) between this cohort and the remaining patients, and none of these patients were revised. Two (0.6%) subjects were able to reproduce a sound in clinic. Of the variables described above, only head size was statistically associated with squeaking (28mm: 7/177, 36mm: 19/168, $p = 0.013$).

Conclusion: The 6-year survivorship is 97% with the Delta COC bearing. A low incidence (<1%) of liner fractures and reproducible squeaking was observed.

Paper #21

Titanium Alloy Sleeves do not Prevent Fretting Corrosion in Modular THA

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Introduction: During revision surgery with a well-fixed stem, a titanium sleeve is used in conjunction with a ceramic head to achieve better stress distribution. In vitro testing suggests that corrosion is not a concern in sleeved ceramic heads[1]; however, little is known about the in vivo fretting corrosion of the sleeves. The purpose of this study was to investigate fretting corrosion in sleeved ceramic heads.

Methods: Thirty-five sleeved ceramic heads were collected during revision surgery as part of a multi-center retrieval program. The sleeves were all fabricated from titanium alloy and manufactured by 4 companies (CeramTec (n=14), Smith & Nephew (Richards, n=11), Stryker (n=5), and Zimmer (n=5)). The femoral heads were made from 3 ceramics (Alumina (n=7), Zirconia (n=11), and Zirconia-toughened Alumina (n=17)). Sleeve dimensions were measured using calibrated calipers. Fretting corrosion was scored using a 4-point, semi-quantitative scoring system[2]. Five sleeves could not be extracted; thus the external surface was not scored.

Results: Moderate-to-severe fretting corrosion scores (Score≥2) were observed in 97% (34/35) of internal tapers (sleeve-femoral stem contact), 57% (17/30) of external tapers (sleeve-femoral head contact), and 65% (11/17) of the stems. The internal sleeve had higher fretting corrosion scores than the external taper ($p=0.001$) and stem ($p=0.016$). Fretting corrosion scores were correlated with implantation time at all surfaces ($Rho\geq0.53$; $p\leq0.015$). Fretting corrosion scores of the external sleeve correlated directly with activity level ($p=0.005$).

Conclusion: The retrieval data shows that fretting corrosion occurs in sleeves, particularly on the internal surface. The corrosion scores were similar to levels observed in prior studies of CoCr heads[3]. Implantation time was the main predictor of increased fretting corrosion. The impact of ceramic material and sleeve design currently remain unclear as the analyses were confounded with implantation time. Thus, quantitative analyses are required to determine the factors that influence fretting corrosion of sleeved ceramic heads.

Paper # 22

Diagnosis and Management of Adverse Local Tissue Reactions Secondary to Corrosion at the Head-Neck Junction in Patients with Metal on Polyethylene Bearings

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Introduction: Adverse local tissue reactions (ALTR) related to corrosion at the head-neck junction in metal-on-polyethylene (MOP) bearings have been described with increasing frequency. Diagnosis and appropriate management, however, is not well understood. The purpose of this report is to describe our experience with the diagnosis and management of this complication.

Methods: We identified 27 patients who were revised for an ALTR secondary to corrosion at the modular femoral head-neck taper with a MOP bearing. Patients presented at a mean of 4.3 years (range, 0.4 to 25 years) after their index procedure. Patients were treated with debridement and a modular bearing exchange, with use of a ceramic femoral head with a titanium sleeve in 23 of the 27 cases. Student's t-test was used to compare pre and postoperative metal ion levels with significance set at a p-value of < 0.05.

Results: Preoperative serum cobalt levels were elevated to a greater degree than were chromium levels in all cases, with a mean cobalt of 11.2 ppb (range, 1.1 to 49.8) and chromium of 2.2 ppb (range, 0.2 to 9.8). Repeat metal ions (measured in 16 of 18 patients with > 2 year follow up) showed a significant decrease in serum cobalt to a mean of 0.33 ppb (range 0.18 to 0.6) ($p = 0.004$), and chromium to a mean of 0.51 ppb (range 0.1 to 1.4) ($p = 0.001$). Recurrent ALTR was noted in one case where a metal as opposed to a ceramic head was used.

Conclusion: The diagnosis of ALTR secondary to corrosion at the head-neck taper in patients with a MOP bearing is associated with serum cobalt levels of > 1 ppb with cobalt levels consistently elevated above chromium. Retention of a well-fixed stem and modular exchange to a ceramic head leads to resolution of symptoms and decreases in metal ion levels.

Paper #23

Will New Metal Heads Restore the Mechanical Integrity of Corroded Trunnions at Revision THR?

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Introduction: Mechanically-assisted corrosion at the head-neck junction can be seen at revision THA. Many surgeons exchange the femoral head to avoid the morbidity of revising a well-functioning femoral stem. Our study asks: 1. Will new metal heads on corroded tapers restore the mechanical integrity of the original junction? 2. Which variables affect the stability of the new interface created at revision THR?

Methods: Twenty-two tapers (CoCr, n=12; TiAlV, n=10) were obtained for use in this study from our retrieval collection. Ten stems were in pristine condition, while 12 stems were with corroded trunnions (Goldberg scale 4). Twenty-two new matching metal heads were obtained for use in the study. The following test states were performed using a MTS Machine: 1. Assembly, 2. Disassembly, 3. Assembly, 4. Toggling and 5. Disassembly. During loading, 3D motion of the head-trunnion junction was measured using a custom jig. Relative displacement of the head was continuously monitored using 6 high resolution displacement transducers with an accuracy of ±0.6μm.

Results: The average micromotion was greatest at initial loading and stabilized after approximately 50 loading cycles at an average of 30.6±3.2μm. For CoCr couples, interface motion dropped by 17% with a pristine head on a corroded stem compared to a new stem (25.7±2.7μm (pristine stem), vs. 30.1±4.6μm (corroded stem), p= 0.4023). However, a new CoCr head on a corroded titanium stem led to an 73% increase in interface motion (Corroded: 43.4±9.8μm, Pristine: 25.2±7.0μm, p=0.1661). Resistance to head-neck disruption was 15% higher in TIALV/CoCr couples compared to CoCr/CoCr (TiAlV: 2558 ±63N, CoCr: 2226±99N, p=0.0111) and was not affected by trunnion corrosion.

Conclusion: Trunnion corrosion does not disrupt the mechanical integrity of the junction when a CoCr head is replaced on a CoCr taper. We are less sure about TiAlV tapers as demonstrated by a trend towards increased micromotion at the head-neck junction.

Paper #24

What safe-zone? The Majority of 224 Dislocated THA were within the Lewinnek Zone

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Introduction: One long held tenet is that cup inclination and anteversion should be 40±10° and 15±10°, respectively, to minimize dislocations after primary total hip arthroplasty (THA). Recent interest in navigation, robotics and advanced 3-D imaging has focused on those classic targets defined by Lewinnek in 1978. In contemporary THA practice (characterized by multiple femoral heads size options, multiple liner options, and the predominance of uncemented femoral fixation) whether those target values accurately predict dislocation remains poorly understood.

Methods: From a consecutive cohort of 11,246 primary THAs done at our institution between 2003 and 2012, we retrospectively identified 224 THAs (1.9%) which subsequently dislocated. Clinical demographics including age, gender, and BMI, as well as radiographic parameters including inclination, anteversion, center of rotation, and limb length discrepancy were analyzed. The mean age was 64 years, mean was BMI 29 kg/m2, and mean time to first dislocation was 18 months. Minimum follow-up was 2 years.

Results: The majority (58%) of these dislocated THAs had an acetabular socket position that was within the Lewinnek safe-zone. Mean cup inclination was 44±8° (95% CI = 42-45°), with 84% within the safe zone. The mean anteversion was 15±9° (95% CI = 13-16°), with 69% within the safe zone. The mean lateralization of the center of rotation was 6 ±4mm from the native center of rotation, and the mean limb length difference was 4±7 mm longer.

Conclusion: The historical target values for cup inclination and anteversion defined by Lewinnek may be useful, but should not be considered a safe-zone given that the majority of these contemporary THAs which dislocated were in fact within those target values. It is likely that the ideal cup position for some patients lies outside the Lewinnek zone and that more advanced analysis is required to identify the right target in that subgroup.

Paper #25

The Cumulative Risk of Re-dislocation After Revision THA Performed for Instability Increases to Close to 35% at 15 Years

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Introduction: The purpose of this study is to 1) report the cumulative risk of re-dislocation and subsequent revision in a large series of revision THA performed for instability and 2.) to identify the patient and surgical related variables that are associated with redislocation and re-revision THA.

Methods: A retrospective analysis was conducted on 539 hips (528 patients) undergoing revision THA done for instability between 1995 and 2005. Patient demographics, etiology for instability, and surgical strategies aimed at treating the instability were identified from medical records. The cumulative risk of re-dislocation and revision was calculated using Kaplan-Meier method and risk factors were identified using Cox proportional-hazard regression.

Results: The cumulative risk of dislocation at 1, 5, 10, and 15 years was 6.8%, 15.4%, 23.7, and 34.5% respectively and the cumulative risk of re-revision at 1, 5, 10, and 15 years was 5.1%, 17.9%, 33.2%, and 45.9% respectively. In the multiple variable analyses, history of 2 or more revisions was a risk factor for re-dislocation (HR 1.936) and revision (HR 1.801); while the use of head size 36 or greater (HR 0.388, 0.376) and acetabular component revision (HR 0.454, 0.675) were identified as protective factors against subsequent dislocation and revision. The use of a constrained liner was protective against re-dislocation (HR 0.299) but was associated with subsequent revision.

Conclusion: The cumulative risk of dislocation after a revision of an unstable THA is close to 7% during the first year and rises constantly during the life of the arthroplasty to an incredibly high rate of almost 35% at 15 years. Use of a head size 36 or larger, cup revision and constrained liners were protective strategies against re-dislocation, however use of a constrained liner was associated with need for revision when dislocation occurred.

Paper #26

20-Year Results of Uncemented Jumbo Cups for Revision Total Hip Arthroplasty

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Introduction: Uncemented jumbo cups are the most common method of acetabular revision because they are technically straightforward and provide good mid-term results. Because this method is common and because jumbo cups do not provide notable bone stock restoration, understanding long-term survival is essential. The hypothesis of this study was that the 20-year results of uncemented jumbo cups would show good clinical outcomes, radiographic results, and survivorship.

Methods: We retrospectively reviewed 89 patients with uncemented jumbo cups implanted prior to 1993 with a single design (Harris-Galante). The median cup diameters were 68 mm in males and 62 mm in females. Harris hip scores (HHS), radiographic results and Kaplan-Meier survivorship curves were evaluated. Mean age was 74 years. Mean follow-up was 20 years.

Results: The mean postoperative HHS was 71, increased from 53 (p=0.001). A total of 5 jumbo cups were revised for aseptic loosening, 1 for infection, and 1 for recurrent dislocation. Eight liners were revised with metal shell retention: 6 during femoral revisions, 1 for wear, and 1 for recurrent dislocations. One unrevised patient had radiographic acetabular loosening, and 3 had radiographic acetabular osteolysis; none of these implants had evidence of migration or screw breakage. The 20-year survivorship free from aseptic loosening of the metal acetabular component was 88%, free from aseptic loosening or radiographic evidence of definite loosening of the metal acetabular component was 85%, and free from acetabular metal shell revision for any reason was 83%.

Conclusion: The 20 year results of uncemented jumbo acetabular components demonstrate acceptable clinical outcomes and radiographic stability. Concerns regarding the lack of bone restoration with jumbo cups are mitigated by the excellent long-term survivorship. These results justify the use of jumbo cups as a common method of acetabular revision and also leave room for improved results with highly porous versions, which may provide even better long-term fixation.

Paper #27

Delaying Reimplantation following Resection Arthroplasty Does Not Improve Subsequent Outcome

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Introduction: In North America, the preferred surgical treatment of chronic periprosthetic joint infection (PJI) is two-stage exchange arthroplasty. Although reimplantation usually occurs 6-8 weeks after the resection arthroplasty, the optimal timing for reimplantation is unknown. This study aims to determine if the timing between the first and second stages of a two-stage exchange influences the rate of infection control.

Methods: We used data from two high volume centers to identify all PJI cases treated with two-stage exchange arthroplasty between 2002 and 2012. The time between resection and reimplantation was determined. Failure was defined as the need for further surgical interventions for treatment of PJI. Multivariate logistic regression and Cox proportional hazard test were used to determine predictors of subsequent failure of the prosthesis due to infection.

Results: The final cohort consisted of 433 patients. Mean duration of follow up from the time of reimplantation was 2.4 ± 1.9 years. Ninety-seven patients (22.4%) developed a recurrent infection. Logistic regression analysis indicated that PJI of the knee ($p = 0.02$; Odds Ratio (OR) = 2.08), need for an interim spacer exchange ($p < 0.001$; OR = 12.21), and polymicrobial PJI ($p = 0.008$; OR = 9.48) but not the time to reimplantation were predicators of failure. The Cox proportional hazards model showed that higher BMI ($p = 0.01$; OR = 1.04), PJI of the knee ($p = 0.009$; OR = 1.95) and interim spacer exchange ($p < 0.001$; OR = 2.56) were predictors of failure at any time.

Conclusion: It is a commonly held belief that reimplantation for patients with "severe" infection should be delayed. Based on our findings, it appears that the timing between first and second stage does not influence the outcome of two-stage exchange arthroplasty. Conversely, PJI of the knee, polymicrobial PJI, the need for a spacer exchange and higher BMI were associated with a higher risk of failure.

Paper #28

Alpha-defensin Accuracy to Diagnose Periprosthetic Joint Infection – Best Available Test?

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Introduction: Despite efforts of the Musculoskeletal Infection Society (MSIS) to define criteria to improve accuracy and standardize PJI definition, current tests are deficient in making a reliable diagnosis. There is a clear need for a test capable of improving diagnostic accuracy. The purpose of this study was to measure the accuracy of a single synovial fluid biomarker, alpha-defensin, to diagnose PJI in revision total hip (rTHA) and knee arthroplasty (rTKA).

Methods: A prospective consecutive series of 102 patients comprising 111 rTHA and rTKA procedures performed for any indication between May 2013 and March 2014 was identified. Demographics, cause of revision, laboratory tests including inflammatory markers and synovial fluid information were collected. Patients were excluded if viable index joint synovial fluid or preoperative laboratory data were not obtained. MSIS criteria were used to categorize cases as non-infected and infected. Synovial fluid was obtained preoperatively or intraoperatively and tested for alpha-defensin using a commercially available kit. The assay defines 5.2 ug/ml as a positive result. The test was evaluated using sensitivities, specificities, and likelihood ratios, and values reported with 95% confidence intervals (CI)

Results: Alpha-defensin test had a sensitivity of 96.4% (CI 81.6%-99.4%) and a specificity of 98.8% (CI 93.4%-99.8%). Likelihood ratio for a positive test result was estimated at 80.04 (CI 11.4-562.2) and likelihood ratio for a negative test result at 0.04 (CI 0.01-0.25). The positive predictive value was 96% (CI 81.6-99.4) and negative predictive value 99% (CI 93.4-99.8).

Conclusion: A positive alpha-defensin test result significantly increased the estimation of the odds of infection and a negative test result significantly decreased the estimate of the odds of infection with accuracy (sensitivity and specificity) higher than what is reported for current available PJI diagnostic tests. Synovial fluid alpha-defensin is a valid and very accurate option to diagnose infection.

Paper #29

Chronic Suppression with Oral Antibiotics Increases Infection-Free Survivorship in Periprosthetic Joint Infections

Marcelo B. Siqueira, MD, Anas Saleh, MD, Alison K. Klika, MS, Wael K. Barsoum, MD, Carlos A. Higuera, MD

Introduction: There is no consensus regarding indications for chronic suppression with oral anitibiotics for hip and knee periprosthetic joint infections (PJI). The purpose of this study was to evaluate patients who underwent incision and débridement with polyethylene exchange (I&D) or two-stage revisions and (1) compare infection-free survivorship for patients with and without subsequent chronic oral antibiotic treatment and (2) analyze infection-free survivorship stratified by type of surgery and infecting organism.

Methods: A retrospective cohort of consecutive cases performed between 1996 and 2000 of I&D and two-stage revisions that met criteria for hip and knee PJI were reviewed. Of these, n=92 patients were treated with chronic oral antibiotic suppression (minimum 6 months). A control cohort (ratio 1:3) who did not receive chronic oral antibiotics was matched based on age, gender, BMI, number of previous surgeries, hip versus knee procedures, I&D versus two-stage procedures, presence/absence of Staphylococcus aureus, and CCI, to manage inherent selection bias.

Results: Ninety-two cases were compared to 276 controls. Follow-up was 5.8 years for cases (range, 1.4-14) and 3.5 years for controls (range, 0.1-15.3). Mean duration of chronic antibiotics was 5.3 years (range, 0.5-13.8). Five-year infection-free survivorship was 61% (95% CI 51.9%-70.1%) for cases and 38% (95% CI 32.7%-44.5%) for controls (hazards ratio 0.63, p=0.008). Stratification analysis showed higher 5-year survival in cases that underwent I&D (56.3%) compared to controls that underwent I&D (25%, p< 0.0001), and higher survival in cases with S. aureus infection (48.6%) compared to controls with S. aureus infection (32.4%, p=0.047). Within the 92 cases, 32 (34.7%) failed antibiotic treatment. Knee infection (p=0.012), as opposed to hip, and higher number of previous revisions (p=0.02) were associated with treatment failure.

Conclusion: Chronic antibiotics significantly increased infection-free survival following surgical treatment for PJI. Patients undergoing I&D and patients with S. aureus infection were the groups that had greatest benefit.

Paper #30

The Incidence of and Risk Factors for 30-day Surgical Site Infections following Primary and Revision Total Joint Arthroplasty

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Introduction: Infection after TJA is a devastating and costly complication. In this study we have used the ACS NSQIP to analyze the incidence of and risk factors for 30-day surgical site infection following TKA or THA.

Methods: We queried the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database between 2005 and 2010 for all patients undergoing either primary (p) or revision (r) TKA or THA using CPT codes. Thirty-day Surgical Site Infections (SSIs) were analyzed in aggregate for all TJAs and sub-analyzed as primary and revision cohorts. Patient characteristics, 30-day complications, and mortality were compared using univariate methods. Multivariate logistic regression identified predictors of 30-day SSI.

Results: 25,235 patients underwent TJA: 23,128 primary and 2,170 revision. Patient age was similar among all cohorts, but BMI was higher in the pTKA/rTKA vs pTHA/rTHA cohort (32.9/33.4 vs 30.0/29.3, $p < 0.01$). Thirty-day mortality was 0.21% after pTJA and 0.65% after rTJA ($p < 0.01$). The overall 30-day incidence of SSI was 1.23% after TJA; lower in pTKA, 1.10%, and pTHA, 1.18%. SSI rates were higher in rTKA, 1.68% and highest in rTHA, 2.90% ($p< 0.01$). In pTJA, patient BMI, especially greater than 40 (OR 1.9, 95% CI: 1.3-2.9), hypertension (OR 1.5, 95% CI: 1.1-2.0), previous wound infection (OR 5.0, 95% CI: 2.3-10.9), prolonged operative time >2 hours (OR 1.9, 95% CI: 1.5-2.6), and electrolyte disturbance (OR 2.4, 95% CI: 1.0-6.0) were independent risk factors for SSI. Risk factors for SSI in revision arthroplasty include pre-op dyspnea (OR 2.2, 95% CI: 1.0-4.7) and a bleeding disorder (OR 2.5, 95% CI: 1.0-6.1). In the rTJA cohort, other risk factors such as smoking, prolonged operative time > 2 hours, dependent functional status, and increased BMI all neared statistical significance (p values < 0.1). All models demonstrated excellent discrimination (c-index: 0.65-0.77) and calibration (all HL ratios >0.42).

Conclusion: Short-term, 30-day SSIs occur in more than 1% of patients undergoing TJA. The incidence of SSI following TJA is highest among revision procedures, especially of the hip. Patient characteristics, especially morbid obesity, were associated with a dramatically increased infection risk.

Paper #31

Diagnosing Infection in the Setting of Periprosthetic Fractures

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Introduction: Currently, no guidelines exist to diagnose periprosthetic joint infection (PJI) in patients who have periprosthetic fractures, and there is a concern that the commonly used tests may be unreliable. The purpose of this study is to investigate the utility of commonly used diagnostic tests for PJI in patients with periprosthetic fractures.

Methods: We reviewed 121 patients (97 hips, 24 knees) with periprosthetic fractures treated operatively (mean interval before fracture, 4.8 years; range, 7 days to 30.2 years). The cohort's mean age was 72.9 years-old and included 93 females (77%). ESR, CRP, synovial WBC, and differential were compared between patients who did and did not meet MSIS criteria for PJI. Student's t-test was used to compare means, and ROC curves were generated to determine optimal cut-off values and evaluate testing performance.

Results: 14 (11.2%) patients met MSIS criteria for PJI. Mean ESR, CRP, cell count, and differential were significantly higher among infections (each $p < 0.05$). Synovial WBC and differential were the best diagnostic tests, each with an AUC of 84% (good test performance). A synovial WBC cut-off of 2,707 resulted in sensitivity of 100% and specificity of 65%. A differential polymorphonuclear cell cut-off of 77% resulted in sensitivity of 100% and specificity of 63%. The AUC values for CRP and ESR were 63% (poor test performance) and 76% (fair test performance), respectively. ESR of 30 mm/hr resulted in an 85% sensitivity and 40% specificity; CRP of 8 mg/L resulted in an 86% sensitivity and 36% specificity.

Conclusion: The diagnosis of PJI in the setting of a periprosthetic fracture can be challenging. Specifically the ESR and CRP have overall lower test performance but still remain relatively sensitive. The synovial fluid WBC count and differential are the best tests with optimal cut-off values (3,000 WBC/μL and 80%) that are similar to those used for patients without fracture.

Paper #32

Premature Antibiotic Treatment can Potentially Compromise the Diagnosis of PJI

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Introduction: The diagnosis of PJI has been a challenge to orthopaedic surgeons due to often ambiguous or discordant laboratory results. When antibiotic treatment has been initiated before testing for PJI, there is additional concern that the laboratory results could be misleading. In the current study we aimed to determine if antibiotic treatment before laboratory testing for PJI affects laboratory values.

Methods: A retrospective multi-institutional study was conducted to evaluate the synovial fluid (SF) and serum analysis of PJI patients (MSIS classification), comparing patients who did and did not receive antibiotics prior to testing. The SF PMN%, and serum ESR and CRP, and culture results were compared. The one-tailed Fisher's exact test was used to determine if antibiotic administration is associated with higher rates of false positive.

Results: 50 PJI patients treated with antibiotics prior to laboratory testing were compared with 110 PJI cases that did not receive antibiotics. Our results demonstrated that the rate of positive SF and tissue cultures was significantly lower in PJI patients treated with antibiotics (73% vs. 87%; p=0.033). Although underpowered, PJI cases on antibiotics trended toward higher rates of false negative in ESR (6% vs. 12.5%; p=0.17), CRP (10% vs. 14.63%; p=0.30), and PMN% (9% vs. 18.37%; p=0.093) in comparison with those who did not received antibiotics.

Conclusion: The standard synovial fluid and serum tests for PJI can be affected by premature antibiotic treatment. Patients treated with antibiotics before appropriate testing demonstrated a statistically significant increase in false-negative cultures, and a trend toward increased false-negative results for other laboratory results. In conclusion Antibiotic use prior to lab analysis can increase the likelihood of overlooking patients with PJI. Future studies with greater number of patients are suggested.

James A. Rand Award

Who Should Not Undergo Short Stay Hip and Knee Arthroplasty? Risk Factors Associated with Major Medical Complications following Primary Total Joint Arthroplasty

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Introduction: Improvements in anesthesia, pain, and rehabilitation protocols have made short stay and outpatient total joint arthroplasty a possibility. Concerns exist, however, with regards to patient safety and the penalties associated with hospital readmission. The purpose of this study is to define the incidence and timing of perioperative medical complications following primary joint arthroplasty and identify the independent risk factors associated with these complications.

Methods: We retrospectively reviewed prospectively collected data on a consecutive series of 1012 patients undergoing primary THA/TKA over a 10-month period. Medical comorbidities, demographics, and postoperative in-hospital complications were recorded for each patient. We defined and classified complications according the validated system published by Sink et al (CORR 2012). Additionally, a subgroup of patients who experienced a medical complication greater than 24 hours following surgery was identified. Univariate and multivariate logistic regression analysis was performed to identify independent risk factors and to generate a model to best determine the patient best suited for a short stay primary TJA.

Results: Of the 1012 unselected patients, 70 patients (6.9%) experienced a medical complication while 59 (84%) of these complications occurred after 24 hours postoperatively. Independent risk factors included COPD (adjusted OR 4.16, 95% CI 1.86 – 9.32), CHF (adjusted OR 9.71, 95% CI 4.55 – 20.71), CAD (adjusted OR 2.80, 95% CI 1.38 – 5.69), and cirrhosis (adjusted OR 8.43, 95% CI 1.63 – 43.59). A model based on these comorbidites with a 6 point score was developed to identify the ideal candidate for short stay TJA. Patients with a score of zero had a probability of complications after 24 hours postoperatively of 3.1%.

Conclusion: Most postoperative medical complications occurred past 24 hours after surgery. While medical economics is the principal driver for decreasing length of stay, patients with a history of COPD, CHF, CAD, and cirrhosis should not undergo short stay primary THA or TKA.

Lawrence D. Dorr Award

Core Decompression with Autogenous Bone Marrow Stem Cells for the Treatment of the Femoral Head Osteonecrosis

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Introduction: Using stem cells has been shown to reduce pain and delay the development of early-stage osteonecrosis of the femoral head (ONFH). The aim of the present study was to evaluate the effects of core decompression and autologous bone marrow containing mononuclear cell (MNC) implantation on ONFH.

Methods: This was a randomized controlled clinical trial evaluating 28 femoral heads with non-traumatic osteonecrosis in stages I, II, or III according to Association Research Circulation Osseous classification. Patients were randomly assigned into two groups to be treated with core decompression combined with autologous bone marrow MNC implantation as the treatment group (group A) or decompression solely as the control group (group B). Patients were evaluated for two years using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire, Visual Analogue Scale (VAS) index, and magnetic resonance imaging (MRI) of the femoral head.

Results: In both groups, the mean WOMAC and VAS scores reduced after 24 months. The changing trends of WOMAC and VAS were significant in group A ($p< 0.001$) and group B ($p< 0.001$) during 24 months; however, the trends in each group were significantly different ($p< 0.001$) showing more score reduction in group A. MRI findings showed improvement in the grafted group ($p=0.046$) and showed worsening in the control group ($p< 0.001$). 3 hips (21%) in the group A improved after implantation of stem cells (1 patient from stage III to II and 2 patients from stage II to I) and 3 hips (21%) in group B underwent hip arthroplasty later during follow-up.

Conclusion: Injection of concentrated bone marrow into the necrotic femoral head could be effective in the early stages of ONFH and result in reduced pain and joint discomfort, delayed deterioration, and even improvement of the disease.

AAHKS Clinical Award

Can the American College of Surgeons Risk Calculator Predict 30-day Complications after Knee and Hip Arthroplasty?

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Introduction: Accurate risk stratification of patients undergoing total hip (THA) and knee (TKA) arthroplasty is essential, and likely soon to be mandated, in the highly scrutinized world of pay-for-performance, value-driven healthcare.

Methods: We assessed the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) online surgical risk calculator's ability to predict 30-day complications using a series of publicly reported Medicare patients undergoing THA or TKA in 2009. Patient demographic and comorbidity data was retrospectively input and patient-specific risk probabilities recorded for the following complication/outcome categories: serious, any, urinary tract infection (UTI), venous thromboembolism (VTE), reoperation, death, and discharge to rehab facility. Occurrence or non-occurrence in a 30-day postoperative period was recorded for each complication/outcome category. Binomial logistic regression modeling was used to compute odds ratios (OR) for complication occurrence as well as c-statistic values (area under ROC curve) for risk probability predictive value.

Results: 206 patients (128 TKA and 78 THA) were evaluated. No patient was lost to follow-up. Mean age was 74 years. Total 30-day complications were: 20 serious, 32 any, 9 UTI, 9 VTE, 6 reoperation, 1 death, and 115 discharge to rehab facility. Risk estimates were significantly associated with event occurrence in the categories of serious complication (OR 2.0, p=0.007) and any complication (OR 1.3, p=0.039). However, event predictability was poor with c-statistics of 0.630 and 0.572 respectively. Risk estimates for discharge to rehab facility demonstrated both association and predictability (OR 1.1, p< 0.0001, c-statistic 0.743). There was neither association nor predictability in the categories of UTI (p=0.355), VTE (p=0.976), reoperation (p=0.624) or death (p=0.288).

Conclusion: The ACS-NSQIP risk calculator has poor predictive value for 30-day complications for THA and TKA. To facilitate the equitable provision and reimbursement of patient care, further research is needed to develop an accurate risk stratification tool in TKA and THA surgery.

Paper #33

Clinical Outcomes of Hip Arthroscopy with Microfracture: A Matched-pair Controlled Study with Minimum 2-year Follow-up

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Introduction: Microfracture in the setting of hip arthroscopy has limited follow-up data; no comparative studies have been performed to assess 2-year outcomes between microfracture and non-microfracture patients. The purpose of the study is to compare two-year clinical outcomes of patients who underwent hip arthroscopy with microfracture to a matched control group not receiving microfracture.

Methods: During the study period, June 2008 and July 2011, data was collected on all patients treated with microfracture during hip arthroscopy. All patients were assessed pre- and postoperatively with 4 patient-reported outcome (PRO) measures: the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score-Activities of Daily Living (HOS-ADL), and Hip Outcome Score-Sport Specific Subscales (HOS-SSS). Pain was estimated on the visual analog scale (VAS), and satisfaction was measured on a scale from 0 to 10. A matched-pair group of patients not receiving microfracture was selected on a 1:2 ratio. Matching criteria were age within 5 years, sex, surgical procedures, and radiographic findings.

Results: Forty-nine hips were included in the microfracture group and 98 in the non-microfracture group. There was no significant difference in PRO scores preoperatively between the groups. Both groups demonstrated statistically significant postoperative improvement in all scores, and the average amount of change from preoperative to postoperative scores between the 2 groups was not statistically significantly different for any PRO scores. Patient satisfaction was 6.9 for the microfracture group and 7.84 for the non-microfracture group and statistically significant ($p < 0.05$).

Conclusion: Our study demonstrated that patients receiving microfracture during hip arthroscopy did not show a statistically significant difference in PRO scores when compared to a matched-pair control group. Both groups demonstrated statistically significant postoperative improvement in all scores. These findings suggest that full-thickness chondral defects do not portend an inferior outcome in hip arthroscopy when microfracture is performed.

Paper #34

Differential Impact of Corticosteroids on Human Mesenchymal Stem Cells

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Introduction: Previous studies have shown the deleterious effects of corticosteroids on chondrocytes, suggesting a potentiation of degenerative joint disease. Mesenchymal stem cells (MSCs) are direct progenitors of chondrocytes and other musculoskeletal tissue and serve an important anti-inflammatory role. Further evaluation is needed on how corticosteroids interact with this regenerative and reparative cell population. This study assessed the cytotoxicity of corticosteroids on MSCs.

Methods: Human MSCs were isolated and cultured from adipose tissue obtained from 20 patients undergoing primary total hip arthroplasty (THA). MSCs were exposed for 60 minutes to one of the following corticosteroid preparations: betamethasone sodium phosphate-betamethasone acetate (6 mg/mL), dexamethasone sodium phosphate (4 mg/mL), methylprednisolone (40 mg/mL), or triamcinolone acetonide (40 mg/mL). In each treatment group, cells were exposed to 8 different titrations: 0%, 3.125%, 6.25%, 12.5%, 25%, 50%, 75%, and 100%. Cells were allowed to recover in standard culture media for 24 hours and then cell viability was measured using cellular proliferation assays and live-dead cell fluorescent immunostaining.

Results: Exposure to corticosteroids decreased MSC viability in a clear dose-response fashion. However, cell viability was statistically different at every tested concentration between the four corticosteroids ($p < 0.001$). Subsequent pairwise comparisons demonstrated that dexamethasone supported significantly greater cell viability than the other corticosteroids at every concentration ($p < 0.001$). At concentrations between 6.25% and 25%, betamethasone mediated a significant decrease in cell viability when compared to the remaining treatment modalities ($p < 0.001$). These outcomes were maintained after adjusting for age, gender or indication for THA. The cellular proliferation assays and live-dead cell fluorescent staining counts demonstrated positive correlation (r-squared = 0.90).

Conclusion: Intra-articular corticosteroids have a profound, yet differential impact on MSCs. Corticosteroids are frequently used to reduce inflammation in both the perioperative and outpatient setting, hindering innate regenerative capacity in exchange for temporary analgesia. Our study suggests that this risk is potentially mitigated with dexamethasone.

Paper # 35

Cartilage Status at Time of Hip Arthroscopy Predicts Failure in Patients with Hip Dysplasia

Maureen K. Dwyer, PhD, Jo Ann Lee, MS, **Joseph C. McCarthy, MD**

Introduction: Long-term survivorship following hip arthroscopy has been shown to be dependent upon the presence and severity of chondral damage at the time of surgery. However, it is unknown whether chondral damage at the time of arthroscopy can predict failure in patients with dysplasia. We examined whether chondral damage at the time of arthroscopy predicted conversion to THA) in patients with dysplasia.

Methods: Between 1991 and 2013, we identified 228 hips in 185 patients with dysplasia who underwent hip arthroscopy. The articular cartilage of the posterior, superior, lateral, and anterior regions of the acetabulum and femoral head were assessed for signs of chondral damage (absent, mild (grades I or II), or moderate to severe (grades III or IV)). Sixty-five patients went on to receive total hip arthroplasty at an average of 3.1±3.1 years after arthroscopy. A stepwise multivariable logistic regression analysis was conducted to determine predictors of the eventual need for THA following hip arthroscopy for patients with dysplasia.

Results: Logistic analysis revealed increasing age (p=0.019), presence of mild chondral changes on the posterior femoral head (p=0.001), and presence of moderate to severe chondral changes on the anterior acetabulum (p=0.007), made a significant contribution to the predictor. Older patients were 1.046 times (95%CI:1.007,1.086) more likely to convert to THA. Patients with mild arthritic changes of the posterior femoral head were 9.97 times (95%CI:2.62,37.99) more likely to convert to THA, while patients with moderate to severe arthritic changes of the superior acetabulum were 6.12 times (95%CI:1.66,22.58) more likely to convert to THA.

Conclusion: Our findings show that the presence of chondral damage on the posterior femoral head and anterior acetabulum are strong predictors of ultimate conversion to THA in patients with hip dysplasia. For those patients with advanced cartilage damage, specifically on the anterior acetabulum, open procedures may provide greater benefit.

Paper # 36

Intermediate Term Results of the Bernese Periacetabular Osteotomy for the Treatment of Acetabular Dysplasia

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Introduction: In patients with symptomatic acetabular dysplasia, periacetabular osteotomy (PAO) is an effective procedure for deformity correction and early relief of pain and hip dysfunction. There is a paucity of data regarding the intermediate term results of this procedure. The purpose of this study was to analyze the intermediate term clinical and radiographic results as well as determine the conversion to THA and potential predictors of clinical failure following PAO for the treatment of acetabular dysplasia in adolescent and young adult patients.

Methods: Retrospective review for patients who underwent PAO for acetabular dysplasia was performed. 246 hips (210 patients) were treated with periacetabular osteotomy from July 1994 through December 2008 for acetabular dysplasia had an average follow-up of 5.5 years (0.2 to 17.9). Clinical data including patient demographics, radiographic measurements, and patient-rated outcome scores were collected.

Results: 162 females and 48 males with average age of the patient at the time of surgery was 25 years (range, 10-60). There were an average improvements of 24.7° (from 5.8° to 30.5°, $p < 0.001$) in the lateral center-edge angle, 28.7° (from 4.1° to 32.8°, $p< 0.001$) in the anterior center-edge angle, and 20.0° (from 24.8° to 4.8°, $p< 0.001$) in Tönnis angle. The Harris Hip score improved 18.5 points (from 64.2 to 82.7, $p< 0.001$) and the UCLA score improved from 6.7 to 7.1 points. 3.7% of the hips had required conversion to total hip arthroplasty. Only BMI and a low pre-op HHS were predictive of clinical failure ($p< 0.05$). Age, pre-op radiographic deformity severity, and post-op deformity correction didn't correlate with clinical success ($p>0.05$).

Conclusion: The periacetabular osteotomy is an effective technique for surgical correction of a dysplastic acetabulum in adolescents and young adults. In this series, the intermediate term results were very good with a low conversion rate to total hip arthroplasty.

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Paper #37

Graduates of Joint Reconstruction Fellowship Training Programs are Increasingly Subspecialized

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Introduction: Recent trends in the practice patterns of Joint Reconstruction (JR) fellowship graduates are not well characterized. The aim of this study is to determine the proportion of cases JR fellowship graduates perform within their area of JR training. We hypothesize that fellowship-trained JR graduates are increasingly less likely to perform procedures outside their area of specialty training over the past decade.

Methods: The ABOS Part II database was used to analyze all the procedures performed by JR fellowship-trained candidates from 2003 to 2013. Procedures were classified into one of two groups: within or outside of JR specialty training, based on whether or not one would gain exposure to a procedure during a JR fellowship. The number of procedures per JR-trained candidate and the percentage of procedures performed within the JR specialty were analyzed. Linear regression was used to determine trend, and statistical significance was defined as $p< 0.05$.

Results: 767 JR trained candidates performed 120,456 procedures from 2003 to 2013. The number of procedures performed per candidate per year did not change (coefficient = -1.7, $p = 0.15$). The number of procedures performed within JR specialty increased by 2.3 procedures per candidate per year ($p=0.01$, $r2 = 0.53$) while the number of procedures performed outside the JR specialty decreased by 4.0 procedures per candidate per year ($p< 0.001$ $r2 = 0.79$). The percentage of procedures performed within the JR specialty training increased by 2.1% per year ($p< 0.001$, $r2 = 0.85$).

Conclusion: The number of procedures performed per JR trained candidate each year did not change from 2003 to 2013. The number and proportion of procedures performed within the area of JR training increased and the number performed outside of JR training decreased. JR fellowship-trained ABOS candidates are increasingly less likely to perform procedures outside their area of subspecialty training.

Paper #38

Cam Type Femoroacetabular Impingement Associated with Marker for Hyperandrogenism in Women

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Introduction: Cam type femoroacetabular impingement (FAI) is seen more commonly in men. Its etiology remains undefined, but is known to develop during puberty at the time of proximal femoral physeal closure. Polycystic Ovarian Syndrome (PCOS) is a condition seen in women with elevated androgenic hormones. Antral follicle count is a key marker in the diagnosis of PCOS. The objective of this study was to determine if androgenic hip morphology (defined as cam type FAI) was associated with androgenic gynecologic features such as polycystic ovaries (as defined by elevated antral follicle count).

Methods: Prospective cohort of reproductive aged women who were indicated for arthroscopic hip surgery were assessed. Presence or absence of cam morphology was determined by measurement of alpha angles on 45 degree Dunn lateral radiographs. Cam-type FAI was defined as an angle of >55 degrees. Antral follicles were assessed by MRI. As only one ovary was frequently seen on MRI, the average number of antral follicles per ovary were recorded. In a subset of patients, menstrual irregularity and clinical hyperandrogenism (acne/hirsuitism) was assessed by history and physical exam. Means were compared using students t test and correlations using Pearson's. All continuous data expressed as Mean+SD.

Results: Fifteen women with cam FAI and 13 without were found to have median alpha angle of 62 (range 56-72) and 46 (range 40-54), respectively (P< 0.0001). Average ages were similar between groups (27.7+7.2 vs 24.1+10.8, P=0.30). Antral follicle counts per ovary were significantly higher in women with cam FAI than controls, respectively (13.7+5.3 vs 8.5+2.9, P=0.004). Univariate analysis revealed a statistically significant correlation between alpha angle measurements and antral follicle counts per ovary (R=0.30, P=0.03), indicating that cam type FAI appears to be more consistent with a continuum rather than cut-point with respect to antral follicle counts.

Conclusion: Cam type FAI was found to be strongly associated with antral follicle numbers--a marker for PCOS and hyperandrogenism. Further study is needed to assess hormonal influence such as PCOS on hip development during puberty. Abnormal female hip development during puberty may be amenable to anti-androgenic treatments to prevent the development of cam type FAI.

Paper #39

Can Administrative Data be used to Analyze Complications following Total Joint Arthroplasty?

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Introduction: Theoretically, administrative database data may be used to analyze medical and surgical complications and lead to better understanding of re-operations, revisions, and re-admissions. We hypothesized that the Center for Medicare and Medicaid Services Limited Data Set (CMS-LDS) could be used to validate the complications and adverse events endorsed by the Hip Society and Knee Society.

Methods: The 2009 CMS-LDS was analyzed using SPSS statistical software to assess the incidence of 15 complications following total knee arthroplasty (TKA) and 16 complications following total hip arthroplasty (THA) which were developed by the Knee Society and Hip Society. Using ICD-9 procedure codes, cases were extracted from the first three quarters of 2009 to allow capture of all complications within 90 days for the year 2009. Using ICD-9 diagnosis codes, complications were identified and stratified to outpatient and inpatient diagnoses.

Results: The complications with the highest incidence among the 207,749 TKA were stiffness (15.98%; outpatient 15.8%; inpatient 0.2%), thromboembolic disease (4.54%; outpatient 4.15%, inpatient 0.39%), deep infection (2.54%; outpatient 1.44%, inpatient 1.33%), and bleeding (1.02%; outpatient 0.21%, inpatient 0.82%). The complications among the 91,569 THA with the highest incidence were thromboembolic disease (4.86%; outpatient 4.38%, inpatient 0.48%), dislocation/instability (3.86%; outpatient 1.70%, inpatient 2.16%), deep infection (3.15%; outpatient 1.59%, inpatient 1.56%), bleeding (1.35%; outpatient 0.23%, inpatient 1.12%), and leg length discrepancy (1.15%; outpatient 0.43%, inpatient 0.75%). All other complications had an incidence of < 1% and several had a 0% incidence including vascular and MCL injury.

Conclusion: We were unable to validate the Hip and Knee Society complications using this administrative data set as we could not connect readmissions or outpatient visits to index admissions. Additionally, well-known complications were not detected, raising concern about coding accuracy. Furthermore, the stratification of outpatient and inpatient codes allows for duplication of complications and may falsely elevate the reported incidence.

Paper #40

What Incentives are Created by Medicare Payments for Total Hip and Knee Arthroplasty?

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Introduction: Differences in profitability and contribution margin (CM) between various patient populations may make certain patients particularly attractive (or unattractive) to providers. Such data typically is not available due to poor knowledge surrounding healthcare costs.

Methods: Purpose This research aims to identify patient characteristics associated with increased profit and CM among Medicare patients undergoing total knee and hip arthroplasty (TKA & THA). Methods All primary TKA & THA patients of Medicare-eligible age (65+) at an urban academic center over 24 months were included (n=1,416 & 612, respectively). Profit and CM were calculated as Medicare reimbursement less total and variable costs, respectively, with cost data derived from the hospital's cost accounting system which relies primarily on actual cost data rather than charges. Univariate & multivariate regressions were performed to determine associations between relevant demographic and clinic factors and profitability and CM.

Results: Increased profit and CM were associated with younger age ($p< 0.01$), more complicated patients (higher MS-DRG weight), and shorter LOS ($p< 0.01$) in the TKA and THA populations. Male gender was associated with higher profit & CM among TKA patients ($p< 0.01$). Lower CM was associated with black race for both procedures ($p=0.04$) and Asian race for THA ($p=0.04$). No association was found with BMI.

Conclusion: Delete Conclusion Discussion: If our results are generalizable, CMS payments do not adequately compensate hospitals for the increased costs associated with older patients and those requiring longer LOS, potentially incentivizing against their care. Our findings suggest that Medicare reimbursements effectively compensate for the burden of patients with greater comorbidities. Future research could be valuable to better understand the associations identified here between male gender and increased profit and CM among TKA patients, and between white race and increased CM among TKA and THA patients. CMS must continue to work to ensure reimbursement levels accurately match provider costs to avoid treatment prejudices against specific patient populations.

Paper #41

Aspirin as Prophylaxis Against Venous Thromboembolism Results in Lower Incidence of Periprosthetic Joint Infection

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Introduction: Periprosthetic joint inection (PJI) following total joint arthroplasty (TJA) is a devastating complication. At our institution, aspirin (ASA) has been used as the main prophylaxis against venous thromboembolism (VTE) following TJA. The hypothesis of this study was that ASA by reducing hematoma formation, wound drainage, and reoperations for the latter problems may result in a lower incidence of PJI.

Methods: The institutional database identified 18,072 consecutive primary TJA cases performed at our institution between January 2006 and December 2012. Cases of PJI requiring surgical treatment following primary TJA were identified from our prospective database and confirmed using the MSIS definition of PJI. Among the cohort, 13,344 patients received warfarin prophylaxis for six weeks following primary TJA and 4,728 patients received aspirin twice daily. Logistic regression was utilized to identify independent risk factors of PJI.

Results: The incidence of overall PJI following primary TJA at our institution was 1.1% (192 of 18,072 patients). Incidence of PJI was significantly higher at 1.3% in patients receiving warfarin compared to 0.4% in patients receiving ASA as prophylaxis against VTE ($p=0.003$). Multivariate analysis identified warfarin prophylaxis compared to ASA, elevated BMI, prolonged length of hospital stay, older age, and higher Charlson comorbidity index as independent risk factors for PJI following TJA ($p< 0.05$). Patients receiving warfarin for VTE prophylaxis were also at higher risk of infection with methicillin resistant organisms (0.2%) compared to those receiving ASA (0.08%)($p=0.10$).

Conclusion: Aggressive anticoagulation following primary TJA has been demonstrated as an important risk factor for developing PJI. Patients receiving ASA prophylaxis have fewer wound related complications following primary TJA, which theoretically explains its added benefits in reducing the incidence of PJI. The reason for a lower incidence of PJI caused by methicillin resistant organism in the ASA group may relate to the lower length of hospital stay that reduces the exposure to resistant organisms prevalent in the hospital setting. Our research suggests that the use of ASA compared to warfarin for VTE prophylaxis reduces the risk of PJI following TJA.

Paper # 42

Drivers of Total Knee and Total Hip Arthroplasty Implant Purchase Prices

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Introduction: The study purpose was to determine the drivers of the variation in prosthetic implant purchase prices across hospitals for primary TKA and THA (collectively, TJA) procedures.

Methods: The average purchase price for each type of implant was collected from twenty-seven high volume U.S. hospitals with similar patient demographics. Other variables collected included: whether the choice of implant vendors was primarily determined by surgeons or a joint committee of surgeons and hospital employees; whether contracts with implant vendors were entered into at the hospital or health system level; whether the purchasing decision for each type of implant was made separately or whether they were purchased as part of a package deal; whether an implant vendor rep would be present during surgery; whether the hospital is an academic medical center; TJA annual volume; and average number of TJA vendors. All variables were included in a multivariate linear regression to identify their percentage impact on price.

Results: There was a 2.1x [1.7x] range from the 90th to the 10th percentiles of purchase price for TKA [THA] implants. The multivariate regression explained 45% of the variation in prices. Use of a joint committee to select vendors resulted in a 19.8% lower purchase price (p=.001) relative to having only the surgeons select the vendors. Volume was also statistically significant, but an additional 100 TJA volume only resulted in a 1.6% lower price (p=.002). Two variables neared significance at the 5% level: contracting at the health system (as opposed to hospital) level resulted in a 11.4% lower price (p=.077), and each additional vendor resulted in a 2.6% higher price (p=.074). The other variables were not statistically significant.

Conclusion: The hospital characteristics and purchasing approaches studied explained 45% of the variation in implant prices. Hospital-physician alignment is a strong predictor of lower prices.

Paper #43

Direct Costs of Aspirin Versus Coumadin for Venous Thromboembolism Prophylaxis

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Introduction: Recent clinical evidence supports the utilization of aspirin as a safe and efficacious strategy to prevent venous thromboembolism (VTE) after total joint arthroplasty. This study aims to determine the financial implications of using aspirin instead of warfarin in terms of direct costs associated with the patient's episode of care.

Materials and Methods: The institutional arthroplasty database was utilized to analyze the preoperative, clinical, and financial data on 6,372 patients undergoing primary and revision total joint arthroplasty at our institution between January 2008 and March 2010. Mode of VTE prophylaxis (aspirin or warfarin) for each patient was recorded. Patients readmitted for postoperative complications related to VTE prophylaxis or infection were identified. Line-by-line charges were gathered for all patients in this cohort for their index arthroplasty admission, as well as any subsequent readmissions for related complications. Charges associated with the two groups were compared, and linear regression analysis was utilized to isolate the effect of anticoagulation on total charges.

Results: An episode of care associated with the aspirin cohort (n=1,213 patients) resulted in an average total cost of $54,181, compared to $63,718 for patients receiving warfarin (n=4,159). Twenty-five patients (2%) receiving aspirin experienced a post-operative complication related to VTE prophylaxis, resulting in 11 readmissions (0.9%), compared to 241 (5.8%) complications and 89 (2.1%) readmissions in warfarin patients. When adjusting for surgeon, day and year of surgery, Charlson index, joint, revision versus primary, BMI, and gender, aspirin was an independent predictor of decreased total charges and decreased cost of index hospitalization.

Conclusion: This study supports the cost-savings that can be achieved by using aspirin rather than warfarin in primary and revision arthroplasty settings. The use of aspirin compared to warfarin results in 11.75% cost saving for each total joint arthroplasty.

Paper #44

Are Financial Conflicts of Interest for the Surgeon a Source of Concern for the Patient?

Paul H. Yi, MD, Michael B. Cross, MD, Staci R. Johnson, MEd, Ryan M. Nunley, MD, Craig J. Della Valle, MD

Introduction: Conflict-of-interests (COI) resulting from financial relationships between orthopaedic surgeons and industry are a potential source of public distrust. The purpose of this study was to determine patients' attitudes towards financial relationships between orthopaedic surgeons and the orthopaedic industry.

Methods: 269 Consecutive patients were surveyed at two academic centers using an anonymous, self-administered questionnaire. The questionnaire was developed in conjunction with an expert in survey design using cognitive interviewing to ensure question clarity and patient comprehension; a 5-point Likert scale was utilized to assess patient attitudes. Financial relationships examined included 1) being paid as a consultant, 2) receiving research funding, and 3) receiving royalties for product design. Fisher's Exact Test was used to compare patient attitudes towards the three types of financial relationships.

Results: 218 patients completed the questionnaire (81% response rate). For all three potential COI, the majority of patients perceived these relationships favorably, with nearly 75% agreeing that such surgeons are the top experts in their fields. Further, two-thirds felt that surgeons engaged in such relationships to serve their patients better and felt that they would treat their patients the same as those not having a financial relationship. 87% Agreed that orthopaedic companies cannot make good products without working with surgeons, however, >80% believed that these relationships would result in the surgeon being more likely to use that company's products. Patients viewed surgeons who designed products more favorably than those who were consultants ($p = 0.03$). 74% Agreed that these relationships should be disclosed to patients and 62% expressed that patients should be at least somewhat concerned about these relationships.

Conclusion: Discussion and Conclusion The majority of patients view relationships between orthopaedic surgeons and industry favorably. Given patients' desires to be told about their surgeons' financial relationships and their favorable perceptions of these relationships, open and frank discussions about them is appropriate.

Paper #45

Manipulation under Anesthesia after Total Knee Arthroplasty: Incidence, Risk Factors and Revision Surgery

Brian C. Werner, MD, James B. Carr, II, MD, Winston F. Gwathmey,
James A. Browne, MD

Introduction: The incidence of postoperative stiffness after total knee arthroplasty (TKA) requiring manipulation under anesthesia (MUA) is not well characterized in the current literature. The goal of the present study is to comprehensively analyze the need for MUA after TKA utilizing a national database as well as investigate risk factors for requiring MUA and the relative risk for subsequent revision after MUA.

Methods: Patients who underwent TKA were identified using the PearlDiver database including both patients with private-payer insurance (age < 65) and Medicare (age >65). The database was queried for TKA patients who underwent MUA within 6 months postoperatively. The cohort requiring MUA and those who did not were compared to determine risk factors for MUA. The need for revision TKA within the database time period (between 1 and 7 years postoperatively) was also assessed for each cohort. Relative risks (RR), 95% confidence intervals (CI) and chi square tests were calculated using SPSS. $p< 0.05$ was considered significant.

Results: 141,016 unique TKA patients were identified from 2005-2011. The overall incidence of postoperative MUA was 4.24% within 6 months postoperatively. Of all assessed risk factors, age < 50 years (RR = 2.61, 95% CI [2.43-2.80], $p < 0.0001$) and age 50 – 65 years (RR = 1.99, 95% CI [1.87-2.07, $p < 0.0001$) were significant predictors of need for postoperative MUA. Among patients age < 65, smoking (RR = 1.43, 95% CI [1.28-1.59], $p < 0.0001$) was a significant predictor of need for MUA. Gender, obesity, diabetes, sleep apnea, peripheral vascular disease, heart disease, and chronic kidney disease were not significantly associated with postoperative MUA. The relative risk of revision TKA in patients who required MUA compared to those patients who did not was significant (RR = 2.25, 95% CI [1.91-2.79], $p < 0.0001$).

Conclusion: MUA after TKA is required in 4.2% of patients within 6 months postoperatively. Younger age appears to be the most significant risk factor for requiring MUA. Among patients under the age of 65, smoking is associated with an increased risk for requiring MUA. The consequences of MUA after TKA are substantial, as patients who require MUA within 6 months after TKA have a significantly increased risk of subsequent revision TKA.

Paper #46

Complications of Obesity in Total Joint Arthroplasty: Risk Stratification Based on BMI

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Introduction: The relationship of obesity and postoperative complications in total joint arthroplasty (TJA) has not been comprehensively described. This study quantifies and stratifies postoperative complication risk in a large population of TJA patients based on body mass index (BMI).

Methods: The Veterans Affairs Surgical Quality Improvement Program database was reviewed from 2006 to 2009 for primary TJA patients. Demographics, co-morbidities, operative time, transfusions, length of stay (LOS), disposition, and 30-day complications (deep infection, superficial infection, urinary tract infection, deep vein thrombosis, pulmonary embolism, reintubation, reoperation, myocardial infarction, cardiac arrest, cerebrovascular accident, pneumonia, and acute kidney injury (AKI)) were reviewed. Chi-squared analysis and one-way ANOVA were calculated. Univariate analysis was performed comparing patients in BMI categories. Odds Ratios were calculated and multivariable regression analysis performed.

Results: 22,826 patients were included (15,461 total knee (TKA) and 7,365 total hip (THA)). There was a statistically significant increase in overall complications as BMI increased (Pr=0.047). Specific complications showing a significant increase with BMI included AKI (Pr=0.000), cardiac arrest (Pr=0.001), reintubation (Pr=0.006), reoperation (Pr=0.043), and superficial infection (Pr=0.026). Univariate analysis for BMI > 40 revealed an increased rate of combined complications of 2.19% (15.21 vs 17.40%, p=0.021). There were significant increases for AKI (1.93 vs 3.87%, P=0.000), cardiac arrest (0.22 vs 0.57%, p=0.007), reintubation (0.47 vs 0.95% p=0.009), reoperation (2.36 vs 3.37%, p=0.013), and superficial infection (0.82 vs 1.65%, p=0.001). Multivariable regression analysis showed BMI > 40 to be an independent predictor for combined complications (OR 1.18), AKI (OR 1.79), cardiac arrest (OR 3.94), reintubation (OR 2.56), reoperation (OR 1.44), and superficial infection (OR 2.11).

Conclusion: Increased BMI confers increased risk for postoperative complications in TJA, however the absolute risk difference is relatively small. Patients should be counseled and the decision to undertake TJA approached with caution in the morbidly obese population.

Paper #47

Periprosthetic Joint Infection after Primary THA or TKA in Patients with a History of Prior PJI

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Introduction: After the successful treatment of periprosthetic joint infection (PJI), patients may present with end-stage DJD in another joint requiring arthroplasty. The objective of this study is to determine whether patients with a history of treated PJI at one site will have the same or increased risk of PJI in a second arthroplasty site.

Methods: A retrospective case control study was performed to identify all patients at four high-volume arthroplasty centers that had undergone treatment for periprosthetic joint infection and who then underwent a primary THA or TKA of another joint. Patients were matched (1:1) to controls who had no history of PJI after their first arthroplasty. The demographics and incidence of PJI at the of the second joint arthroplasty was compared. Multivariate logistic regression was used to identify risk factors for developing an infection at the second arthroplasty, both between groups and within the group with a history of PJI.

Results: The 90 patients identified with a history of successfully treated PJI who underwent a second primary arthroplasty had an infection rate of the second joint of 11.1% (10/90) compared to 0% ($p < 0.01$) in controls. There were no differences in age (64yo), gender (53% F), BMI (32), ASA (2.6), Charlson comorbidity index (3.5), or prevalence of diabetes (17%) between groups. The only risk factor for PJI at the second arthroplasty site was a history of PJI at the first site. There were no identifiable factors to predict a second infection in patients with a PJI history.

Conclusion: The rate of PJI in a subsequent primary THA or TKA in patients with a history of PJI was 11% in this study. Patients and surgeons must be aware of the alarmingly high rate of this devastating complication prior to proceeding with a second arthroplasty.

Paper #48

Does Surgical Approach in Total Hip Arthroplasty Influence Socket Position and Limb Length Discrepancy? A Comparison of the Anterior, Lateral, and Posterior Approaches

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Introduction: It is unknown if surgical approach influences socket position and limb length discrepancy. Optimization of these variables will improve outcomes and enhance survivorship. We hypothesized that the anterior approach with fluoroscopy would enable more accurate socket positioning and equalization of limb lengths.

Methods: Radiographs of 977 patients with osteoarthritis enrolled in an international, multicenter, prospective, cohort study were analyzed. Ninety-nine patients were added to the anterior approach cohort to optimize sample size. The number of patients who received the anterior (I), lateral (II), and posterior (III) approaches were 208, 318, and 550, respectively. Target zones were set at 30-50° abduction and 5-35° anteversion. Data were collected via a web-based registry and analyzed in Excel and Stata.

Results: Proportions of sockets in the abduction target zone were 83.2%(I), 72.6%(II), and 79.8%(III) ($p=0.008$). Proportions of sockets in the anteversion target zone were 98.1%(I), 68.0%(II), and 85.4%(III) ($p< 0.001$). Proportions of sockets in both target zones were 82.1%(I), 57.3%(II), and 73.0%(III) ($p< 0.001$). Compared to group I, group II (OR 3.4, CI 2.2-5.2) and group III (OR 1.7, CI 1.1-2.5) were more likely to fall outside both target zones. Compared to group II, group III had a better chance of being in both target zones (OR 2.01, CI 1.5-2.7). Mean limb length discrepancies were 4.6±3.7mm(I), 4.6±3.9mm(II), and 4.6±4.0mm(III), respectively ($p=0.62$, with numbers available). The proportions of patients whose limb length discrepancy exceeded 10mm were 8.9±2.1%(I), 9.7±1.7%(II), and 9.7±1.3%(III) ($p=0.94$, with numbers available).

Conclusion: Accuracy of socket positioning was better with the anterior approach with fluoroscopy compared to both the lateral and posterior approaches. Socket position was more accurate with the posterior approach compared to the lateral approach. With the numbers available, surgical approach did not influence limb length discrepancy.

Paper #49

Adverse Reactions to Metal-on-metal are not Exclusive to Large Heads in Total Hip Arthroplasty

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Introduction: Large head metal-on-metal total hip arthroplasty (MoM-THA) is attractive for increased stability, but have exhibited high rates of loosening and adverse reactions to metal debris (ARMD). Some suggest smaller diameter MoM-THA may be immune to ARMD. The purpose of this study was to review our experience with small head MoM-THA (≤32mm) to determine if ARMD occurs with these devices.

Methods: Three hundred patients (348 hips) underwent MoM-THA at our center using a titanium modular acetabular component with chromium-cobalt tapered insert. Head size was 28mm in 71% and 32mm in 29%. Average age was 56 years and gender was male in 52%. Twenty-nine patients (34 hips) were lost prior to 2-year follow-up leaving 271 patients (314 hips) for review.

Results: Follow-up averaged 10.5 years (range, 2-18). Nineteen (6.1%) cups have been revised: 2 (0.6%) infection, 5 (1.6%) loosening, and 12 (3.8%) ARMD. ARMD had two general patterns: 1) 4 hips presented with pain, normal radiographs and elevated serum Co/Cr levels; 2) 6 hips presented with late gradual onset of groin pain, weakness, subluxation, and squeaking and/or grinding in their hips while radiographs and infection serology appeared normal. Revisions in cases with mechanical symptoms were associated with catastrophic pseudotumor and soft-tissue damage. Remaining ARMD revisions were for femoral loosening associated with soft-tissue changes in one and acetabular fracture after falling with metallosis and bone loss present in the other.

Conclusion: Unlike LDMOM, where aseptic loosening and early failure of ingrowth appear to be the main failure modes with ARMD appearing in the early to mid-term, MoM-THA with a titanium shell and metal insert had very low rate of aseptic loosening. ARMD incidence was low but represented 63% of revisions performed. The late onset and devastating nature of metal-related failures is concerning. Symptomatic patients require increased work-up and vigilant observation for ARMD.

Paper #50

Total Joint Arthroplasty in Patients with Chronic Renal Disease: Is It Worth the Risk?

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Introduction: Chronic Renal Disease (CRD) has been previously associated with high complications after Total Joint Arthroplasty (TJA). Thus, the purpose of this study is to quantify the impact of increasing renal impairment on short-term systemic morbidity following TJA.

Methods: A large, multi-center, prospectively collected clinical registry was queried for all adult patients undergoing Total Knee and Hip Arthroplasty from 2006 to 2012. Renal impairment was quantified using pre-operative serum creatinine to calculate the estimated glomerular filtration rate (eGFR) for each patient. Propensity scores were used to match patients based on comorbidities. The incidence of 30-day morbidity and mortality were then compared between patients with none or mild renal impairment, (Stage 1,2), against those with moderate or severe disease (Stage 3,4,5: eGFR< 60).

Results: In 74,300 patients undergoing TJA, the risk of morbidity increased dramatically with worsening CRD (eGFR: R2=0.77) (Figure 1). Complications were higher in patients with moderate to severe renal impairment (6.1% v. 7.6%, $p < 0.001$) (Table 2). In those with CRD (Stage 3-5), mortality was twice as high (0.26% vs 0.48%, $p < 0.001$). Major morbidity was also higher in patients with CRD: including pneumonia ($p=0.001$); unplanned intubation ($p< 0.001$); UTIs ($p< 0.001$); cardiac arrest ($p=0.005$); MI ($p=0.02$); blood transfusions ($p< 0.001$), sepsis ($p=0.01$) and septic shock ($p=0.3$). Compared with patient without CRD, patients with Stage 4 and 5 CRD had a 213% increased risk of any complication (OR 2.13, 95% CI: 1.73-2.62).

Conclusion: Our data has shown higher complication rates in those with severe renal disease. Surgeons may use these findings to discuss the risk-benefit ratio of operating on patients with significant CRD, particularly in elective cases. Policymakers should these findings to develop risk-adjustment models that incorporate the severity of disease.

Paper #51

A Heritable Predisposition for the Need to Undergo Total Hip Arthroplasty

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Introduction: A heritable predisposition to osteoarthritis of the hip has been reported in the literature. The predisposition of osteoarthritis of the hip may lead to the need for total hip arthroplasty (THA). The purpose of the present study was to define population-based familial clustering among individuals treated with THA.

Methods: The Utah Population Database allows analysis of combined health and genealogic data for over two million Utah residents. We used the Current Procedural Terminology (CPT) codes (27091, 27130, 27135, 27090, 27137, 27138, 27252) and the Internal Classification of Diseases, 9th edition, codes (715.35, 996.66, 996.46) entered in patient records to identify patients that have experienced THA and their genealogic data. The hypothesis of excess relatedness (familial clustering) was tested with use of the Genealogical Index of Familiality, which compares the average relatedness of affected individuals with expected population relatedness. Relative risks in relatives were estimated by comparing rates of disease in relatives with expected population rates (estimated from the population data).

Results: The Genealogical Index of Familiality test for 1829 patients that have undergone THA showed a significant excess relatedness ($p < 0.001$), even when close relationships were ignored (dGIF $p< 0.001$), second degree (RR 1.37; 95% CI 1.07 – 1.72; $p< 0.001$) and third degree relatives (relative risk, 1.20; 95% CI 1.03 – 1.39; $p< 0.001$).

Conclusion: Excess relatedness of affected individuals and elevated risks to both near and distant relatives were observed, strongly supporting a heritable contribution for the necessity to proceed with hip arthroplasty. We also identified high-risk pedigrees in the Utah population, which can be studied to identify genes responsible for the need to undergo total joint arthroplasty. Identification of these genes may help in future treatment strategies designed to prevent the need for THA.

Paper #52

Cobalt to Chromium Ratio is Not a Key Marker for Adverse Local Tissue Reaction in Metal on Metal Hips

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Introduction: Metal-on-metal (MoM) implants have been used extensively in the last decade with the hope of decreasing prosthetic instability and osteolysis in conventional metal-on-polyethylene (MoP) hips. Unfortunately, MoM bearings have performed inconsistently and some patients develop adverse local tissue reaction (ALTR). Attempts to diagnose ALTR have been difficult. Currently, there is no biomarker that is specific for ALTR. The presence of pain, elevated ion levels, and cross sectional imaging is used in concert to determine the need for revision. It has been suggested that the ratio of cobalt (Co) to chromium (Cr) ions may be predictive of bearing malfunction and ALTR. We asked whether the ratio of Co to Cr can be used as a predictor for periarticular ALTR in MoM hips.

Methods: 89 MoM patients underwent revision for bearing related problems. All patients had prerevision ion levels and clinical grading of ALTR, intraoperatively using the Griffin et al. tissue damage scale and the Co and Cr ratio was calculated. A Spearman correlation coefficient was utilized to determine the correlation between ALTR and the Co to Cr ratio.

Results: The average Co level was 23.28 (0 to 236) and the average Cr level was 9.02 (0 to 112). The average Co to Cr ratio was 2.96 (0 to 20). Tissue grades of the 89 patients were as follows: 23 grade 0, 38 grade 1, 19 grade 2 and 9 grade 3. There was no correlation ($r=.095$; $p=.41$) between ALTR and the Co to Cr ratio.

Conclusion: In this series, the Co to Cr ratio is not a predictive biomarker for MoM bearing malfunction or ALTR. A need continues for a predictive marker for necrosis in the evaluation of metal-on-metal bearings.

Paper #53

Accuracy of Fluoroscopic Guided Acetabular Component Positioning during Direct Anterior Total Hip Arthroplasty

Preetesh D. Patel, MD, Juan C. Suarez, MD, Caleb R. Szubski, BA, **Eric M. Slotkin, DO**

Introduction: Acetabular component malposition contributes to increased dislocation risk, impingement, accelerated wear, and early revision. Supine positioning during direct anterior (DA) total hip arthroplasty (THA) facilitates the use of intraoperative fluoroscopy, which may improve component position accuracy. The purpose of this study was to evaluate the accuracy of acetabular component orientation using intraoperative fluoroscopy in DA THA.

Methods: We retrospectively analyzed the acetabular component position in a consecutive series of 780 fluoroscopic guided DA THA performed by two surgeons in yearly intervals over a 3-year period, including their initial experiences. Component position was measured postoperatively using specialized software following the method described by Barrack, et. al. Target ranges for abduction and version angles were defined (30o to 50o and 5o to 25o, respectively) according to the "safe zone" established by Lewinnek et. al.

Results: Over the study period, 718 (92%) fell within the targeted abduction range (mean 37.6o; range 18.7o to 54.5o; std dev 5.46) , 723 (93%) fell within the targeted anteversion range (mean 18.7o, range 4o to 34.7o; std dev 5.30) , and 698 (88%) met both criteria. The accuracy of component positioning for combined inclination and anteversion improved yearly (79.2% in 2011, 90.9% in 2012, and 95.6% in 2013). Standard deviation for inclination and anteversion decreased for both surgeons yearly (Surgeon A: 2010, 6.65 and 7.59; 2011, 5.41 and 7.38; 2012, 5.39 and 4.25; 2013, 4.28 and 4.24, respectively) (Surgeon B: 2011, 8.09 and 6.20; 2012, 5.86 and 5.84; 2013, 4.02 and 4.02, respectively).

Conclusion: Fluoroscopy in DA THA is an accurate method to improve acetabular component orientation. There is a learning curve associated with the interpretation of intraoperative fluoroscopy. Compared to other available tools, fluoroscopy is readily available and cost-effective.

Paper #54

Bacterial Suture Adherence and Biofilm Formation in an in-Vivo Contaminated Wound Model

Michael R. Morris, MD, Christopher Bergum, BS, Nancy Jackson, **David C. Markel, MD**

Introduction: Bacterial wound infections continue to be problematic for the orthopaedic surgeon. The choice of suture material has drawn scrutiny as a way to possibly reduce wound infection. This study evaluates bacterial adherence to suture materials and tissue reactivity with a bioluminescent in vivo mouse model.

Methods: We utilized a mouse Air Pouch model to simulate a joint environment. Bioluminescent Staphylococcus aureus were utilized to create an in vivo contaminated wound model at two amounts (10^6 CFU & 10^8 CFU). Three types of commonly used absorbable suture were evaluated: braided, monofilament and barbed monofilament. Groups of 8 mice had two 1 cm strands of one of the suture types surgically placed into the Air Pouch followed by inoculation of either a high or low amount of the S. aureus. Bacterial suture adherence was evaluated with suture culture, a photon-capturing camera system, and scanning electron microscopy (SEM). Tissue reactivity was assessed through histology, RNA expression and protein expression.

Results: The braided suture group with the high amount of S. aureus exhibited frank purulence in all 8 mice. A significant difference between the optical density (OD) emitted per millimeter of suture was found between the suture groups with inoculation of high amounts of S. aureus ($p < 0.05$). More specifically the braided group demonstrated higher ODs/mm than both the monofilament ($p < 0.005$) and barbed monofilament groups ($p < 0.005$). No difference was appreciated between the monofilament and barbed monofilament groups. SEM demonstrated what appears to be biofilm in all high amount groups with the most robust in the braided suture group.

Conclusion: We believe that this is the first in vivo, contaminated wound model that provides information for the selection of suture material. Braided suture should be avoided when dealing with contaminated wounds. Interestingly, this model demonstrated no difference between the use of monofilament and barbed monofilament sutures in a contaminated wound.

Paper #55

Trends of Synovial Fluid Cytokines in Non-arthritic, Arthritic and Painful Hip and Knee Arthroplasty

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Introduction: Synovial fluid pro-inflammatory cytokines have shown potential for increased sensitivity in diagnosis of periprosthetic joint infection (PJI). However, it is unclear if some specific cytokines are markers for inflammation related with infection or other conditions such as osteoarthritis (OA). The purpose of this study was to evaluate the efficacy of broader synovial fluid cytokine panel in differentiating inflammation in the setting of OA and infection.

Methods: 151 consecutive patients that underwent either arthroscopic surgery for a non-arthritic condition (n=17), primary knee or hip arthroplasty for OA (n=34), and non-infected (n=70) or infected (n=30) revision of a primary knee or hip arthroplasty were prospectively included. Aseptic and septic samples were categorized using MSIS criteria for PJI. Synovial fluid levels of nine pro-inflammatory cytokines (IL-6, GM-CSF, IL-1□, IL-12, IL-2, IL-8, IFN-□, IL-10, TNF-□), were measured using a cytokine immunoassay. Elevations in each cytokine were evaluated across diagnostic categories, and associations between individual cytokines were determined.

Results: There was wide variation on all cytokines among compared groups. IL-6 was the most significantly elevated in the infection group (24766.1 pg/mL, 95% CI [11853.05, 33657.2 pg/mL]) compared to the non-infected group (204.35 pg/mL, 95% CI [67.38, 754.97 pg/mL], p< 0.001). Similarly, IL-1□ had significant elevation in the infection group (120.65 pg/mL, 95% CI [47.1, 276.6 pg/mL]) compared to the non-infected group (2.5 pg/mL, 95%CI [0.96, 6.98], p< 0.001). Other cytokines are nonspecific for inflammation related with either OA or other conditions. Also, they are not specific with inflammation related with infection of non-infection.

Conclusion: Cytokine profiles between non-osteoarthritis, OA and aseptic and septic joints vary considerably in the nine pro-inflammatory cytokines measured. IL-6 and IL-1□ are specific markers for infection. This study characterizes different inflammatory conditions within the joint and provides useful cytokine profiles that can be used to improve the diagnosis of infection after arthroplasty.

Paper #56

Antibacterial and Biocompatible Titanium-copper-oxide Nanofilm Coating

German A. Norambuena, MD, Cody C. Wyles, BS, Robin Patel, MD, FRCP, Rafael J. Sierra, MD

Introduction: Copper has been approved as a surface antibacterial material by the Environmental Protection Agency and has superior in vitro antibacterial and biocompatible performance compared with other metals.

Methods: Custom made Ti6Al4V Eli discs of 1.25 mm thickness and 12.5mm diameter were coated with TiCuO2 nanofilm loaded with 20% and 40% of copper using physical vapor deposition (PVD). For cell viability experiments, normal human osteoblast cells were seeded at a density of 1.8 x 104 cells per well. After 2 days, discs were incubated with cells under 2ml osteoblast cell media. At 72 hours, cell viability MTS assay was performed. For antibacterial analysis, discs were submerged in 2 ml of RMPI media and 10% fetal calf serum. Staphylococcus epidermidis inoculum of 3.1x10+5 CFU/ml was added to the discs. After 24 hours, discs were removed, rinsed, placed into 1 ml sterile saline, vortexed and sonicated. Biofilms and planktonic cells were quantitatively cultured. Copper release from the nanofilms was measured using an Inductively Coupled Plasma Mass Spectrometer (ICP-MS) at day 1, 2, 3 and 7.

Results: No cell viability detriment was shown at 72 hours of exposure to TiCuO2 coated discs at any copper concentration. Indeed, it was a slightly increase of cell viability after exposure to TiCuO2-coated discs. TiCuO2-coated discs loaded with 20% and 40% showed statistically significant 1.5 log10 and 2 log10 reduction of biofilm forming bacteria when compared with uncoated control discs, respectively (t-test, $p < 0.001$). Only TiCuO2-coated discs loaded with 40% of copper showed statistically significant 0.83 log10 reduction in planktonic bacteria (t-test, $p < 0.001$). Release of copper from TiCuO2 nanofilm containing 20% and 40% reached a maximum of 0.7 and 3.3µg/dL during first 24 hours, respectively. Later, the amount of copper released was low.

Conclusion: TiCuO2 nanofilm loaded with 20 and 40% of copper showed antibacterial effect while maintaining biocompatibility. This bioactive coating could be a promising approach for use in the field of implants-related infection.

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Jill Erickson (n)

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FUTURE AAHKS MEETINGS

25TH ANNUAL MEETING
November 5-8
2015

26TH ANNUAL MEETING
November 3-6
2016

27TH ANNUAL MEETING
November 2-5
2017

SPECIALTY DAY
AAHKS
Hip Society/Knee Society

MARCH 28
2015
Las Vegas, NV

MARCH 5
2016
Orlando, Florida

AAHKS
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